Castlepollard Quarry, Deerpark, Castlepollard, Co. Westmeath

Castlepollard Quarry

Environmental Impact Assessment Report

Section 6

Land, Soils & Geology

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6.1 INTRODUCTION

This section of the EIAR describes the geological setting, in both a local and regional context, of the proposed development at the quarry at Deerpark, Castlepollard, Co. Westmeath, with respect to the land, soil, subsoil and geological bedrock environment. The proposed development will consist of the continued use and operation of the existing quarry (permitted under P.A. Ref. 01/525), including deepening of the quarry, along with minor amendments to the permitted quarry layout comprising an extraction area of c. 4 ha within an overall application area of c. 11.4 ha. The development will include provision of new site infrastructure, including water management system, wheelwash and other ancillaries (Refer to EIAR Figure 1.3).

The potential impact on the geological environment resulting from the proposed continuance of quarry operations is assessed and possible mitigation measures proposed to reduce any significant impacts. It also provides an assessment of the impact of the quarry on the geological features of the site itself.

An assessment of the hydrological and hydrogeological impacts relating to the quarry is detailed in *Section 7* of the EIAR.

6.2 REGULATORY BACKGROUND

6.2.1 Introduction

There are two acts or regulations that are specific to this chapter, and these are:

- Mines and Quarries Act, 1965, (S.I. 7 of 1965); and
- The Safety, Health and Welfare at Work (Quarries) Regulations, 2008, (S.I. 28 of 2008), as amended 2013, 2019.

Policies and plans that have a direct bearing on this chapter include the following:

- EMRA (2019). *Regional Spatial & Economic Strategy 2019-2031*. Eastern & Midland Regional Assembly (EMRA); and
- Westmeath County Council (2021). Westmeath County Development Plan 2021-2027.

Refer to Appendix 1 of this EIAR.

6.2.2 Guidance

This chapter of the EIAR has been prepared with regard to the following guidance:

- DoEHLG (2004). Quarries and Ancillary Activities – Guidelines for Planning Authorities. Department of the Environment, Heritage and Local Government (DoEHLG);
- EPA (1992). BATNEEC Guidance Notes for the Extraction of Minerals. Environmental Protection Agency (EPA);

- EPA (2006). Environmental Management in the Extractive Industry (Non-scheduled minerals). Environmental Protection Agency (EPA);
- EPA (2015). Draft Advice Notes for Preparing an Environmental Impact Statement. Environmental Protection Agency (EPA);
- EPA (2017). Guidelines on the Information to be contained in an Environmental Impact Assessment Report, Draft, Environmental Protection Agency (EPA);
- GSI/ICF (2008). Geological Heritage Guidelines for the Extractive Industry. Geological Survey of Ireland (GSI) and Irish Concrete Federation (ICF);
- IGI (2007). Recommended Collection, Presentation and Interpretation of Geological and Hydrogeological Information for Quarry Development. Institute of Geologists of Ireland (IGI);
- Institute of Geologists of Ireland (2013). Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements. Institute of Geologists of Ireland (IGI);
- National Roads Authority (2008). Environmental Impact Assessment of National Road Schemes - A Practical Guide; and
- National Roads Authority (2009). Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

6.2.3 TECHNICAL STANDARDS

This following technical standard was used in the field during the site visit:

- British Standards (2015). Code of Practice for Site Investigations BS5930:2015.

6.3 METHODOLOGY

The section essentially describes the geological and soil environment at the site and wider vicinity and assesses the potential impacts on these of the proposed development. The scope of works for the assessment undertaken comprised the following:

- Consultations;
- Desk Study;
  - Collation of existing regional information regarding the geology, soil and land use of the site and surrounding area;
  - Review of other available site information.
- Field Work;
  - Site walkover on 7th April 2021 and 31st May 2021.
- Reporting.

6.3.1 CONSULTATIONS

A response was received from Clare Glanville, Senior Geologist, GSI with respect to a request for pre-application consultation in relation to the proposed development (Refer to EIAR Section 6.6.2 below and Appendix 4 for details).

6.3.2 DESK STUDY

The desk study was undertaken to compile, review and interpret available information, data and literature pertaining principally to the geological and soil environment of the site, its immediate environs and regional setting.

All available regional and site-specific information was compiled, assessed and interpreted during the preparation of this geological assessment. The geological assessment of the site is considered sufficiently detailed to adequately characterise the geological setting of the site.

The evaluation consisted of an examination of relevant geological data from the Geological Survey of Ireland, the Irish Geological Heritage (IGH) Programme, and other geological references for the area, as well as data on soil and land use from the Environmental Protection Agency (McConnell et al. 2001; Meehan et al. 2019; Fealy & Green 2009). Available geological maps, surveys, literature and reports relating to the site and the locality were examined as part of the baseline desk study. Site specific geophysical data were acquired from report by Apex (2018).

6.3.2.1 Sources of information

The assessment was carried out in general accordance with the above guidance documents. Also, data was sourced online from the following websites:

- http://gis.epa.ie/Envision Envision Geoportal, Environmental Protection Agency (EPA); and

- http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 Public Data Viewer, Geological Survey of Ireland (GSI).

Refer also to References (EIAR Section 6.7 below).

6.3.2.2 Designations

The proposed site is not within any European Site, including Special Protection Area (SAC) and Special Protection Areas (SPA). Appropriate Assessment Screening has been carried out with respect to the proposed development (See Appendix 8).

The Irish Geological Heritage (IGH) Programme identifies a wide range of sites that represent Ireland's geological heritage. The programme is a partnership between the Geological Survey of Ireland (GSI) and the National Parks and Wildlife Service (NPWS), and sites identified as important for conservation are designated as Natural Heritage Areas (NHA).

In its 2021-2027 County Development Plan (CPD), Westmeath County Council (2021) recognises sites of geological interest, which include twenty five County Geological Sites (CGS). The site of the quarry is identified by the GSI as the Deerpark Quarry and is designated as a CGS (Meehan et al. 2019).

6.3.2.3 Impact Assessment Methodology

The impact assessment methodology used in this EIAR is based on the criteria given in the EPA's Guidance EPA (2015; 2017) (Refer Appendix 3). The effects on land, soils and geology are assessed in terms of type (e.g., direct), quality (e.g., negative), significance (e.g., moderate), extent or context (e.g., area, conformance to baseline), probability (e.g., likely), and duration or frequency (e.g., short-term, momentary) of the impacts. The NRA (2008) provide an additional criterion for assessing soil and geology features that is based on its Importance from Very high to Low, which is also adopted in the EIAR (Refer Table 6.1). Thus, for example, the Importance of a designated County Geological Site (CGS) would be assessed as Very High, whereas that of an uneconomically extractable mineral resource would be assessed as Low.

6.3.3 FIELD STUDY

The field survey consisted of a site walkover on 7th April 2021 and 31st May 2021 to assess the geology of the site and record all significant geological features. The exposed limestone deposits in the quarry were examined during the site walkover and are described below. Aspects of the desk-based assessment were verified, and geological descriptions and photographs of the geological features were recorded. The site walkover included a visual examination of the quarry faces as part of this geological assessment.

Table 6.1 Criteria for Estimation of Importance of Soil and Geology Attributes

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality, significance or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale*	Geological feature rare on a regional or national scale (NHA) Large existing quarry or pit Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale*	Contaminated soil on site with previous heavy industrial usage Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site) Well drained and/or highly fertility soils Moderately sized existing quarry or pit Marginally economic extractable mineral resource
Medium	Attribute has a medium quality, significance or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale*	Contaminated soil on site with previous light industrial usage Small recent landfill site for mixed wastes Moderately drained and/or moderate fertility soils Small existing quarry or pit Sub-economic extractable mineral resource
Low	Attribute has a low quality, significance or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale*	Large historical and/or recent site for construction and demolition wastes Small historical and/or recent landfill site for construction and demolition wastes Poorly drained and/or low fertility soils Uneconomically extractable mineral resource

* Relative to the total volume of inert soil disposed of and/or recovered. NRA (2008).

6.4 BASELINE DESCRIPTION OF RECEIVING ENVIRONMENT

6.4.1 LAND

Both the soils and bedrock geology have an important role in determining the environmental characteristics of the land. The underlying bedrock has a major influence on the landform that develops, and the constituent rocks provide the parent material from which the soils are derived. The natural characteristics of the rock help determine the nature of the derived soil, as well as the rate at which it forms, whilst the soil strongly affects both the natural vegetation that emerges, and the type of agriculture that can be sustained. The topography of the area is a reflection of the underlying geology, which is described in the succeeding subsections.

6.4.1.1 Site Location

Castlepollard Quarry is located within the Townland of Deerpark, at ITM Grid Ref. E647650, N768320, c. 2 km southeast of Castlepollard, c. 5 km northwest of Collinstown, c. 8.5 km southeast of Multyfarnham, c. 13.5 km northwest of Delvin, c. 13.5 km southwest of Oldcastle, and c. 15.5 km southwest of Mullingar (See EIAR Figure 1.1). The quarry is located on the west side of Regional Road R395, which connects the town of Edgeworthstown in the northwest to Delvin in the southeast, via Castlepollard and Collinstown. The site is situated adjacent to, and with direct access onto, the R395.

6.4.1.2 Topography

The topography of the region is that of rolling hilly landscape, typically varying from 80 to 150 m Above Ordnance Datum (AOD), with more prominent hills reaching as high as 295 m (i.e., Hill of Mael). The site is situated near the northern margin of the Irish Midlands, where the limestone terrain gives way to clastic sediments of the Cavan-Down Massif and the southern limit of the Drumlin Belt.

At Deerpark, a limestone, known as the Derravaragh Cherts, occurs as a NW-SE oriented ridge. There are two remnant areas of mixed broad leaved woodland located on the verges of the main quarry area. The dominant species are Ash and Hazel, with hawthorn, blackthorn, holly, willow, ivy, bramble and gorse. The copse of trees covering the eastern flank of the hill, into which the quarry has been excavated, screens the quarry workings from most views along the R395. The base of the ridge is at roughly 86 m AOD, and while the eastern and western flanks are steep, the southern flank slopes gradually up to the peak at c. 128 m AOD. The extraction area has been excavated into the northern flank of the ridge and progressed southwards such that the backface of the quarry has reached the peak and thus its maximum elevation. The quarry roughly follows the longitudinal axis of the ridge, such that the copses on the flanks have been preserved. The surrounding lands are largely agricultural and held in pasture, while there is significant afforestation on cutaway bogs to the west and northwest of the site.

The site or permitted area for quarrying under P.A. Ref. 01/525, PL 25.128072 covers c. 11.4 ha. To date, extraction has taken place in the northern and central sections of the quarry, where the floor is at c. 88 m Above Ordnance Datum (AOD).

It is proposed to develop an additional extractive bench below the current quarry floor to 70 m AOD. In order to maintain a dry working environment on the floor of the quarry, some rainfall-runoff and groundwater will need to be discharged from site. The development will include upgrading of the Water Management System. Development of the quarry at depth below the current floor will require dewatering and discharge to surface water. The proposed discharge to surface water will be subject to a licence to discharge to surface water as required under Section 4 of the Local Government (Water Pollution) Act, 1977.

The lands are located in an area between Lough Lene and Lough Derravaragh that is characterised by NW-SE oriented ridges and a resulting parallel drainage system. The application site is situated in the Inny (Shannon) Sub-Catchment (SC_030), part of the Upper Shannon Catchment (Hydrometric Area 26F). The site is a hill sitting on the landscape and the topography falls on all sides from the hilltop. The site position and surrounding topography is such that the site appears to straddle the catchments of two streams (see EIAR Figure 7.8). Each of the streams that drain these small catchment areas flow southwest towards the Yellow (Castlepollard) River, which rises in Collinstown and outfalls into the northern end of Lough Derravaragh. The site and immediate surrounds, the Yellow (Castlepollard) River and Lough Derravaragh are all within WFD Catchment & Hydrometric Area 26: Upper Shannon. No part of the site is hydrologically connected to Lough Lene. The nearest part of the catchment that drains to Lough Lene is 570 m to the northeast of the site under consideration here.

The quarry is currently being worked dry with infiltration of rainfall to ground on the quarry floor.

To date, extraction has taken place in the northern and central sections of the quarry lands. The quarry comprises disturbed ground in a large, level processing area located in the northern section of the site and a central horseshoe-shaped extraction area developed into the northern end of the limestone ridge. The extraction area is bordered by copses of trees on the flanks of the ridge, which has been stripped of overburden within the area proposed for extraction. A perimeter earthen berm has been constructed and seeded on the boundaries of the extraction area at the southern end of the site. The former processing area, which contained the asphalt plant (now removed) is located in the northern section of the site and crushing and screening is carried out using mobile plant within the extraction area.

There are stockpiles of sorted/sized aggregate present on-site. The current floor quarry floor is c. 88 m AOD.

The Site access is directly onto the Regional Road R395.

Residential development in the area consists of dispersed farmsteads and diffuse or sporadic ribbon development along roadsides and around towns and villages. The closest large residential settlement to the site is Castlepollard, which is located c. 2 km to the northwest. There are 10 residences within 250 m, 16 within 500 m and 42 within 1 km of the site planning application boundary (Refer Figure 4.1). There are several clusters of residential dwellings located near the site. A cluster of 6 residences are located within 250 m on the east side of the R395 across from the site entrance and north along the L5743 (i.e., nos. 5-10), while another cluster of 4 residences are located within 250 m west of the site adjacent to the drainage ditch into which it is proposed to discharge surface waters (i.e., nos. 1-4).

There are no occupied residences within the application site or landholding, and the closest is located c. 270 m northeast of the quarry extraction area.

6.4.1.3 Land Use & Land Cover

There are two remnant areas of mixed broad leaved woodland located on the verges of the main quarry area. The dominant species are Ash and Hazel, with hawthorn, blackthorn, holly, willow, ivy, bramble and gorse. The copse of trees covering the eastern flank of the hill, into which the quarry has been excavated, screens the quarry workings from most views along the R395.

The site access is directly onto the Regional Road R395. The land in the wider area surrounding the quarry is typically agricultural land, and consists of a patchwork of generally medium to small agricultural fields, with variably managed hedgerows. The Corine (CORINE: Co-ORdinated INformation on the Environment) land-use map (2018) shows that the land is predominantly held in pasture (231), but also with significant swathes of land principally occupied by agriculture (243), non-irrigated arable land (211), coniferous forests (312), mixed forest (313), transitional woodland shrub (324), and peat bogs (412) (Refer Figure 11-8).

The quarry has been a feature of the land since the early 1900s. The quarry in more recent times (since 2001) was operated by P. Clarke & Sons Ltd under the current planning permission P.A. Ref. 01/525. The current operators, Lagan Materials Ltd. acquired the leasehold interest in the quarry in 2017.

The site or permitted area for quarrying under P.A. Ref. 01/525, PL 25.128072 covers c. 11.4 ha. To date, extraction has taken place in the northern and central sections of the quarry, where the floor is at c. 88 m AOD. The overburden has been stripped from the southern section of the area permitted under P.A. Ref. 01/525, and it is proposed to extend extraction in this area and to depth.

The area has a long history of quarrying, such that these activities have co-existed with other, predominantly agricultural, land uses in the area. The proposed land use on-site will continue the tradition of quarrying activities and associated operations. There are a few active and disused quarries in the wider area, such as at Ankerland c. 1.5 km southeast of Fore, Murrens c. 6km south of Oldcastle and at Blackmiles and Baronstown c. 2.5 km east of Crookedwood.

Outside of the immediate environs of the urban areas of Castlepollard, Delvin, Oldcastle and Mullingar, and the nearby villages of Collinstown, Multyfarnham, Coole and Crookedwood, the settlement pattern in the area can be described as low intensity rural settlement. Residential development in the surrounding countryside consists of isolated farmsteads and owner-occupied, detached bungalow/houses along public roads and to a minor extent, along and at the end of lanes off the public roads. There is significant ribbon development on the approach roads to Castlepollard and other large settlements.

There has been a long historical association with quarrying at this location and consideration has been given to screening of the development, phasing and direction of working with respect to receptors to reduce visual impact, while impacts due to noise and dust are substantially attenuated.

Ultimately, Castlepollard Quarry will be decommissioned and reinstated in accordance with the approved quarry restoration scheme. Any topsoil stored in the screening berms can be reinstated. Thus, the quarry site will undergo a change of land use from mineral extraction to a wildlife amenity and will be integrated back into the surrounding landscape.

6.4.1.4 Land Take

The proposed development will consist of the continued use and operation of the existing quarry (permitted under P.A. Ref. 01/525), including deepening of the quarry, along with minor amendments to the permitted quarry layout comprising an extraction area of c. 4 ha within an overall application area of c. 11.4 ha. These lands are operated under a lease agreement with the landowner. The quarry lands are accessed via a Wayleave to the Regional R395 (Refer to EIAR Figures 1.2 & 1.3).

The site is roughly rectangle in shape, with the following approximate dimensions: axial length of c. 425 m and perpendicular width of c. 250 m (Refer to Figures 1.2 and 1.3). The orientation of the rectangle's main axis is NNW-SSE. The proposed extraction area is irregular in shape and runs axially to the southern boundary occupying the central and southern sections of the site. It does not encompass the tree covered slopes on the flank of the ridge nor the former processing area in the northern section of the site. The overburden has already been stripped from the proposed extraction area and a screening berm has been constructed along its western, southern and eastern boundaries.

The existing workings comprise partly excavated or disturbed ground, with upstanding areas of undisturbed ground covered in copses of trees on the flanks of the ridge, which form the eastern and western margins of the site and provide screening of development apart from a narrow section which is open to view to the north. It is proposed that the extraction area will progress to the southern boundary of the site, but there will be no additional land take due to the development.

6.4.2 SOILS

Soil is an essential natural resource and is intrinsically valuable to the environment, and all life within it. Soil is the surface layer of the Earth's surface that is capable of supporting life, and encompasses topsoil and the upper, weathered portion of the subsoil. Soil varies from place to place, and may be mineral or organic, acid or alkaline, deep or shallow, and well drained or poorly drained. Soil generally derives from parent geological material and includes organic matter under the influence of numerous processes, unlike subsoil which has no organic matter within.

Soil provides for several important functions, including:

- Contributes to the hydrological cycle in the filtration/recharge, storage and discharge of rainwater;
- Supports all terrestrial ecology, including all flora and fauna; and
- Protects and enhances biodiversity;

Topsoil and subsoil may derive from parent geological material and organic matter under the influence of numerous processes, including weathering and erosion. In terms of subsoil, the profound influence of glaciation in Ireland is seen in the glacial till, which blankets much of the underlying rocks.

Visual assessment of the soils within the quarry site suggests that the soils are shallow and naturally well drained.

6.4.2.1 Topsoil

The topsoil in the study area is typical of dry mineral soils found in rolling lowlands (Gardiner & Radford 1980). The 2nd Edition of the General Soil Map of Ireland, with accompanying Soil Survey Bulletin No. 36, was published by Gardiner and Radford (1980). The map has a publication scale of 1:575,000, which results in generalised soil regions that provide poor geographic resolution and reference to allow useful spatial data on the range of soil types to be expected at the scale of the property. Nonetheless, the topsoil is designated as Soil Association No. 31, consisting of Minimal Grey Brown Podzolics (80%) with lesser associated Gleys (10%), Brown Earths (5%) and Basin Peats (5%), which are derived from parent materials of limestone glacial till.

The soil types occurring at the site and in the wider area were primarily assessed by reference to the Teagasc/EPA soil map (EPA 2018; Refer Figure 6.1).

The dominant soils occurring in the wider around Deerpark are Acid Brown Earths & Brown Podzolics (AminDW), although the site was largely covered by Rendzinas & Lithosols (BminSW), which are derived from calcareous parent materials, and minor Lacustrine-type soils in the north of the site. Large swathes of Cutaway Peat (Cut) and Fen Peat (FenPt) occur in the area, while ribbons of Alluvmin (Mineral Alluvium) are developed along river and stream courses.

Rendzinas and Regosols are mineral soils that are developed mostly from shallow stony deposits, and from the alluvial deposits of rivers, respectively (Gardiner & Radford 1980). Rendzinas are shallow soils, usually not more than 50 cm deep, derived from parent material containing over 40% carbonates. The surface horizon is very dark in colour, with a strong structure and with a neutral or alkaline reaction. A calcareous B horizon may be present, but the A horizon may directly overly the calcareous parent material. The profiles of Regosols show no distinct horizon development, and usually have a light-coloured A1 horizon directly overlying the C horizon. The texture of regosols varies between sands and clays, depending on the parent material. It is considered that the identification of Rendzinas and Regosols in the Teasgasc/EPA maps is consistent with underlying calcareous parent material of the Derravaragh Limestones (See Subsoil).

Grey Brown Podzolics dominate the surrounding area and these soils are also usually formed from a calcareous parent material, which counteracts the effects of leaching. The dominance of Podzolics and lesser Brown Earths in the wider landscape indicate that the soil types in the Deerpark locality are poorly drained.

6.4.2.2 Subsoil – Quaternary Geology

In terms of subsoil, the profound influence of glaciation in Ireland is seen in the deposits of glacial till and glaciofluvial sand and gravel that blanket much of the underlying rocks of the country. Geologically recent Quaternary sediments cover the rocks in most of Westmeath, and many are of glacial or glaciofluvial origin that were deposited within the last 2.6 million years (2.6 Ma).

The Quaternary Period itself spans from 2.6 Ma to present, and the sediments and features formed during glaciation, which is characteristic of the Period, are commonly treated under the general term Quaternary Geology. The last Ice Age, known as the Late Midlandian or Devensian, peaked at approximately 20-25,000 years before present (BP) in Ireland, with total deglaciation of Ireland by around 13,000 years BP. Soils would have begun to develop after deglaciation, around the beginning of Holocene epoch at 12,000 years BP. Thus, the origin of the subsoil is associated with deposition related to ice movement during glaciation, particularly during the glacial maxima, and later glacial retreat and melting during deglaciation. Ice sheets grind and pulverise the underlying bedrock, reducing it to fragments ranging from boulders to clay particles. Sediments and features formed during the glaciation are commonly treated under the general term Quaternary Geology. The two main types of Quaternary subsoils in Ireland are; (1) glacial till, largely deposited at the base of ice sheets; and (2) sand and gravel deposits associated with the melting of the ice sheets, and generally termed 'glaciofluvial sands and gravels'.

The area of County Westmeath was overlain by a thick ice sheet at the glacial maxima, which moved in a general southeasterly direction. The powerful erosive force of the ice sheet is considered to have sculpted the landscape in the region, as evidenced by many preserved glacial features. Glacial till represents the most common and areally extensive glacial deposits, and is comprised of poorly sorted boulder clay dumped in the zone of wastage beneath the glacier or ice sheet, which can be associated with one or more of the advancing ice sheets prior to the final Midlandian retreat. As ice sheets melt, the meltwaters sort and deposit fluvioglacial sands and gravels in the form of characteristic glacial features, such as eskers and moraines.

The distribution of the subsoil types at the site at Deerpark and in the wider area is also assessed by reference to the Teagasc/EPA Soil/Subsoil Maps (EPA 2018; Refer to Figure 6.2), with supplementary interpretation based on the General Soil of Map of Ireland (Gardiner & Radford 1980).

From groundwater data (GSI 2020), it is apparent that most of the hills and ridges in the wider area, which are composed of Derravaragh limestones, are covered by relatively thin overburden thicknesses with vulnerability ratings of X and to a lesser extent E, corresponding to overburden thicknesses of <1 m and <3 m, respectively. In the Deerpark area, the vulnerability rating is predominantly X and E on the hills and ridges with the surrounding lands given a rating of H, except for bogs which are given a rating of L. The application site is almost entirely rated as X with a minor tract of E and H in the old processing area at the north of the site. The proposed extraction area is rated X, but the overburden has already been stripped to access the underlying bedrock.

In the Deerpark area, the overburden consists dominantly of glacial Till derived from Cherts (TCh), with lesser amounts of subcropping rock (Rck), Cutaway Bog (Cut), Fen (FenPt) and minor lacustrine sediments (Refer to Figure 6.2). It is apparent from Figure 6.1 and Figure 6.2 that the topsoil on-site is underlain by subcropping bedrock with negligible glacial overburden. Towards Castlepollard, the Till derived from Chert passes into Till derived from Limestones (TLs), as the underlying limestones pass from the Derravaragh Cherts to those of the Lucan Formation.

6.4.3 BEDROCK GEOLOGY

6.4.3.1 Regional Bedrock Geology

The application site at Deerpark lies on the extreme western margin of Sheet 13, the Geology of Meath (McConnell et al. 2001). This subsection is based largely on, but without explicit individual references in the text, the Geological Description to Accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 13, Meath (McConnell et al. 1994) and Sevastopulo (2009). The bedrock geology map available on the GSI online map viewer (GSI 2021) also confirms that all of the units within c. 5 km of the site are Carboniferous rocks of Mississippian (i.e., formerly the Lower Carboniferous) age. These are shown in chronological order in Table 6.2 below.

Table 6.2 Bedrock Units of the Wider Deerpark Area

Bedrock Unit	Epoch	Stage	Thickness
Derravaragh Cherts Formation	Lr. Carboniferous (Mississippian)	Holkerian-Brigantian	c. 200 m
Lucan Formation	Lr. Carboniferous (Mississippian)	Late Chadian-Asbian	c. 300-800 m
Waulsortian Limestones	Lr. Carboniferous (Mississippian)	Courceyan-Chadian	<100-225 m

During the Ordovician and Silurian Periods (c. 490-415 Ma), the Iapetus Ocean closed bringing Laurentia (including northwest Ireland) and Avalonia (including southwest Ireland) into collision and culminating in the Caledonian Orogeny c. 425-395 Ma. During the Devonian Period (c. 417-354 Ma) Ireland was part of the Laurasian super continent, also known as the Old Red Sandstone continent. The latter underwent extensive subaerial erosion, whilst laying in arid southern subtropical latitudes, giving rise to the characteristic red coloured, continental facies sandstones. During the early Carboniferous (c. 359–331 Ma), a marine transgression advanced northward across the eroded and flat-lying continent (i.e., peneplained), and deposited a sequence of carbonate rocks that cover much of the Irish Midlands. During the early Carboniferous, the transgression advanced northwards, and a thick succession of progressively deeper water limestones were deposited in slowly subsiding basins. The Waulsortian limestones, highly fossiliferous carbonate mud mounds, are a prominent feature at this stage.

The rocks of the wider Deerpark area belong to the Mississippian (Lower Carboniferous) marine sequence, spanning the Courceyan and Visean stages, formerly known as the Dinantian, with ages between 359 and 331 Ma. At that time, Ireland lay south of the equator in tropical waters. The thickness of the succession is in the Deerpark area is unknown.

The following descriptions are based on those from the Dublin Basin, and particularly the Navan-Meath sub-basin, which covers the greater part of the Dublin Basin in Sheet 13. The bedrock of the Deerpark area, including the site, is shown in Figure 6.3. The Derravaragh Cherts Formation is enclosed by limestones of the Lucan Formation ("The Calp") with minor areas of mudbank limestone to the northwest. The Calp lies c. 2 km to the northwest at its nearest to the site. The base of the Mississippian sequence in the wider Deerpark area is marked by the Waulsortian Limestone.

Waulsortian Limestones (WA)

The Waulsortian consists of pale grey, massive, poorly bedded, pure limestone with distinctive cavity-filling stromatactis structures, and with thin shale interbeds locally. The lithology formed steep (<400) carbonate mudmounds or "banks", with topography on a scale varying from a few metres to greater than 100 m. These are commonly separated by an "off-bank" facies of dark-grey, argillaceous, shelve limestones, although the banks can also coalesce into continuous sheets. The Waulsortian are not defined as a formation, are Courceyan to earliest Chadian in age, and are up to c. 225 m thick.

Lucan Formation (LU)

The next youngest unit is the Lucan Formation, also known as the "Calp", which is widespread in Westmeath, Meath and north County Dublin, and underlies much of the surrounding area (i.e., within c. 5 km). The unit is Chadian-Asbian in age, and consists of dark grey, well-bedded, cherty, graded limestones and calcareous shales, which originated as calciturbidites. The formation varies widely in grains size and shale content, as well as in thickness (i.e., up to 300-800 m). The lower part of the formation is composed of commonly conglomeratic calciturbidites, whilst the upper part is largely composed of a fining-upwards sequence of distal calciturbidites.

Derravaragh Chert Formation (DV)

The youngest preserved formation in the Navan-Meath sub-basin is the Derravaragh Cherts Formation. Apex (2018) describe the formation as consisting of unfossiliferous, dark grey, gently dipping, thinly-bedded calcsilicates and wackestones with thin shales. It is composed mainly of chert with thin calcareous siltstones, limestones and rare shale interbeds. The chert variably occurs as beds, laminae and nodules, and locally comprises 75% of succession. Fossils are rare and the age is uncertain, although it is at least as old as Holkerian. The formation is differentiated from the underlying Lucan Formation on the basis of the greater amount of chert. The limestones are notably prone to karstification.

Although no faults are identified as occurring in the site, three faults have been identified within 3-5 km of the site according to GSI (2001; 2021). Two of the faults have a NW-SE trend, while a third follows a Caledonian trend (i.e., SW-NE orientation). This fault may have been reactivated by crustal compression during the Variscan Orogeny around the end of the Carboniferous (c. 299 Ma).

The spatial distribution of aquifers in the vicinity of the site is shown in Figure 6.4 The Derravaragh Cherts cover 147 km^2, is estimated to be 200 m thick, and is defined as a Locally Important Aquifer – Karstified (Lk). In respect of public and private water supply schemes, there are no Source Protection Zones within c. 6.5 km of the site (i.e., nearest source protection zone is Multifarnham GWS). The limestones belong to the Derravaragh Groundwater Body (GWB), which was assigned a "Good" status in 2013-2018, but was also assigned an "At Risk" status. Because the Derravaragh Cherts underly the entire site, and is a locally important aquifer, the sensitivity of the geological and groundwater interest of the site is determined to be high.

6.4.3.2 Site Bedrock Geology

The following is a synopsis of the findings of Apex Geoservices' geophysical investigation of the Castlepollard Quarry (Apex 2018). For further details on the hydrogeology of the quarry, the reader is referred to the comprehensive analysis presented in Section 7, Water, of this EIAR.

There are approximately 30 to 35 m of limestone beds exposed in the quarry, with each bed ranging in thickness from 30 to 50 cm (ABP 2002). The ridge into which the quarry has been developed had a soil cover of 10-30 cm, while the slope of the ridge conforms with the dips of the beds in the quarry, i.e., to the southeast. Apex carried out a geophysical assessment in December 2018 to determine the potential for additional resources below and around the Castlepollard Quarry. As stated above, the Geological Survey of Ireland (GSI) 1:100,000 Bedrock Geology map indicates that the quarry and the survey area is underlain by cherty limestone and minor shale of the Derravaragh Cherts Formation.

The geophysics identified moderately to highly weathered limestone with clay infill in open joints. Exposed rock in the quarry face shows minimal occurrence of shale, although clay infilling of open joints and possible clay wayboards were observed. The weathering and infill decrease with depth below original ground level. Limestone with high resistivity is interpreted as slightly weathered to fresh cherty limestone with tight joints, and several profiles located along the quarry floor indicate that unweathered limestone extends to at least 30 m below ground level (bgl).

Apex outlined a resource area leaving a boundary rim at c.120 m OD around the working area using the geophysical and topographic data. The resource area was divided into two zones based on the geophysical results:

Zone A – thin overburden over slightly weathered to fresh cherty limestone, with minimal clay infill and an upper 2-5 m weathered zone. The rock in this zone should be similar quality to that which is currently being extracted.

Zone B – thin overburden over moderately to highly weathered cherty limestone, with clay infill in open joints throughout, and occasional highly to completely weathered zones with clay infill. The rock in this zone may require further processing due to the higher clay content, and clay zones may be encountered in the face.

Apex recommended rotary coring to confirm the geophysical interpretation. Zone B extends to the south outside the area permitted under P.A. Ref. 01/525, but there are no plans for any extension beyond the permitted area.

The saleable aggregate reserves within the proposed extraction area have been calculated following a geophysical survey by Apex Geophysics (Refer to Appendix 6.1), well drilling programme (Refer to EIAR Section 7.5.4) and geological mapping of the quarry faces to refine the geological model for the site.

An aerial drone survey of the site was used to produce orthorectified images and a centimetre accurate Point Cloud for existing topography of the site. Digital terrain modelling (DTM) software was then used to produce 3D models of the existing topography, geological formations, and quarry design.

The following design constraints were incorporated into the calculations (i.e., standard criteria were adopted with regard to face heights, bench widths, haul road design, etc.):

- 1:2 Side slopes for soils and construction of screening berms;
- 1:10 Longitudinal gradient for internal haul road ramps within the quarry;
- Provision for construction of 1.5 m high safety berms along quarry ramps;
- Quarry working face at 80°;
- 3 m Residual benches between subsequent benches;
- The site will be worked from the existing quarry area in a southerly direction in a series of c. 15m benches between 128 and 70 m AOD (Refer to Figure 3.1 & 3.3).
- The final quarry bench 85m to 70m AOD will be developed below the groundwater table with discharge to surface water subject to a licence to discharge to surface water as required under Section 4 of the Local Government (Water Pollution) Act, 1977.
- For the purpose of calculations, an average rock density of 2.5 tonnes / m^3 was assumed.
- Allow 15% for wastage, void space and clay infill.

The average annual output will be in the order of 100,000 tonnes giving an anticipated duration for the extraction of c. 24 years.

Table 6.3 Details of Quarry Reserves

Bench m OD	Cu.m	tonnes	Duration
128 to 114	122,092	259,446	3
114 to 99	234,812	498,976	5
99 to 85	263,927	560,844	6
85 to 70	333,581	708,861	7
Totals	**956,719**	2,028,126	20

6.4.4 GEOLOGICAL HERITAGE

The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under sixteen themes ranging from Karst features to Hydrogeology. The IGH Programme is operated by a partnership between the GSI and the National Parks and Wildlife Service (NPWS), and sites identified as important for conservation are designated as Natural Heritage Areas (NHA). Datasets are now available online detailing sites of geological heritage.

An audit of the Geological Heritage of County Westmeath was carried out in 2019, which identified 28 County Geological Sites (CGS) in the county. In its 2021-2027 County Development Plan (CPD), the Council recognizes these areas of conservation value, which include a number of geological and geomorphological sites (Refer Table 12.3 Westmeath County Council 2021).

A search of the GSI Geological Heritage Database reveals that there are several sites of geological interest in the wider area (Refer Table 6.4 and Figure 6-5), including the Castlepollard Quarry itself, which the GSI referred to as the Deerpark Quarry and which they designated a County Geological Site (CGS) (Meehan et al. 2019a, b). The site is designated under two IGH themes, primarily IGH8 (Lower Carboniferous) and secondarily IGH15 (Economic Geology) and may be recommended for Geological NHA. The site was designated because "the rock is tough and hard compared to many of the 'softer' limestones elsewhere in the Midlands". CGSs do not receive statutory protection like Natural Heritage Areas (NHA) but receive an effective protection from their inclusion in the planning system, which should ensure that they are not inadvertently damaged or destroyed through lack of awareness.

There are seven such sites of geological interest near the application site (<7.5 km). There are no pathways by which the quarry at Castlepollard Quarry can impact the other sites, other than possibly by water, as discharge of waters to the tributary of the Yellow River will result in its flow into the Lough Derravaragh CGS. The sites of geoheritage are given in Table 6.4.

The relevant Geological Heritage Policy Objectives of Westmeath County Council set out in the County Development Plan 2021- 2027 are as follows:

CPO 12.30	Contribute towards the appropriate protection and maintenance of the character, integrity and conservation value of features or areas of geological interest listed in Table 12.3.
CPO 12.31	Support the implementation of recommendations made in the County Westmeath Geological Audit.
CPO 12.32	Consult with the Geological Survey of Ireland when undertaking, approving or authorising developments which are likely to impact on County Geological Sites or involve significant ground excavations.
CPO 12.33	Protect geological NHA's as they become designated during the lifetime of the Plan.
CPO 12.34	Encourage and promote, where appropriate, public access to geological and geomorphological sites and avoid inappropriate development through consultation with the Geological Survey of Ireland, subject to environmental and habitats assessment.

Table 6.4 Geological Heritage Sites in the Wider Castlepollard Area

Site	IGH Themes	Site Name	ITM Coordinates	Standoff Distance	Description	Designation	Geological
WH005	IGH8 & IGH15	Deerpark Quarry	647717.54E, 768353.27N	0 km	A deep, impressive, working quarry, set into a high ridge 2 km southeast of Castlepollard	CGS, may be recommended for Geological NHA	The rock is hard compared to many of the 'softer' limestones of the Midlands
WH007	IGH7	Finnea-Murrens Esker	645507.09E, 778457.10N	7.5 km, N	A long, linear series of esker sand and gravel segments deposited under the ice sheet	CGS	This esker and the associated gravels form a deglacial, meltwater-deposited complex
WH008	IGH1, IGH7 & IGH16	Fore Hills	651894.65E, 770382.81N	2 km, NE	A landscape of hills, valleys and lakes, with surface and underground water flow systems	CGS, recomm-ended for Geological NHA	Worthy of the title of "fossil landscape" the site hosts several interesting features
WH014	IGH7 & IGH14	Lough Bane and Lough Glass	654742.05E, 771046.65N	6.5 km, NE	Two lakes set within a deep glacial valley, impounded by high bedrock cliffs and glacial moraines	CGS	The lakes occur at the headwaters of the River Deel; the main outflow is southeast of Lough Bane
WH015	IGH7, IGH8 & IGH14	Lough Derravaragh	642026.76E, 766866.62N	4 km, W-SW	A long, narrow lake between steep-sided hills, as well as the flanks of a number of these hills	CGS	A combination of geological influences around Lough Derravaragh make this a site a worthy CGS
WH023	IGH12	Rock of Curry and Hill of Mael	645045.18E, 776426.54N	7.5 km, NNW	It is believed that these ridges represent an erosional landform from Tertiary times	CGS	A good example of suspected remnant tower karst
MH014	IGH7	Murrens	652404.00E, 774886.19N	6 km, NNE	Wooded ridge - esker and hummocky ground including gravel pit	CGS, recomm-ended for Geological NHA	Glacial deposits including a linear ridge composed of sand and gravel called an esker

The Geological Heritage of County Westmeath *(An audit of County Geological Sites in County Westmeath 2019*) notes that working quarries (including Deerpark Quarry) are often listed because they represent the best available sections in areas with otherwise poor exposure, and that no restriction is sought on the legitimate operation of the quarries. However, maintenance of exposure after quarry closure is generally sought in agreement with the operator and planning authority in such a case.

The CGS Site report for Deerpark quarry notes that the *"geological heritage interest relies on continued working of the quarry as a place to see the strata that is exposes. Access to geologists is important but it is not suitable for promotion to the public as it is a company business and a hazardous working environment. Should the quarry cease to operate in the future, then some negotiated access to the site should be sought"* (Refer to Appendix 6.2).

Because the limestone itself is the feature of interest, and not any particular feature or location in the quarry), continued extraction will not destroy the feature of interest but rather increase exposure.

Details with respect to appropriate guidelines/mitigation measures with respect to Geological Heritage are provided in EIAR Section 6.6.2 below.

6.4.5 SENSITIVE RECEPTORS

The site is located in a sparsely populated rural area. The surrounding lands are largely agricultural, although copses of hazel and ash trees cover the flanks of the hill into which the quarry was developed. The Site access is directly onto the Regional Road R395. In respect of Land, Soils and Geology, the land, soils and geological heritage in the area potentially represent sensitive receptors. No additional land take is envisaged as part of the proposed development, and thus no further lands will be directly impacted. The soils on-site have been stripped to gain access to the underlying limestone and have been used for perimeter screening berms for subsequent use in restoration. Soil stripping was carried out in accordance with the principles of good soil handling, and will be reinstated when quarrying operation cease. The storage areas have been vegetated to reduce both visual impact and erosion.

The geological bedrock exposures within the existing quarry were considered of sufficient interest to warrant designation as a County Geological Site (CGS) that may be recommended for designation as a Geological NHA. The next nearest geological site of interest or proposed Geological National Heritage sites is the Fore Hills, c. 2 km northeast of the site on the opposite side of Lough Lene (Meehan et al. 2019). It is described as a "fossil landscape" and hosts several interesting features.

The impact of the development on the identified geological heritage of the site was assessed with reference to the GSI consultation and to the “Geological Heritage Guidelines for the Extractive Industry” developed by the GSI and the Irish Concrete Federation (GSI/ICF 2008). These guidelines are intended for Irish Concrete Federation (ICF) members so that they may follow best practice and receive clear information concerning geological heritage in relation to any proposed quarry or related development or land purchase. Mitigation measures are proposed to allow the preservation of any important rock exposures of geological and scientific significance. Further extraction will involve consultation with the GSI to ensure that any future exposures can be recorded and catalogued as the quarry extends into the hill and more and more cherty limestone is exposed (Refer to EIAR Section 6.6.2 below and Appendix 4).

6.5 ASSESSMENT OF IMPACTS

The following Impact Assessment matrix provides an indication of the significance of potential effects arising during the life cycle of the development not accounting for any mitigation measures (Table 6.5). The quarry is a well-established operation such that there will be minimal additional construction works. As such, the impacts during the construction phase are not dealt with here.

Table 6.5 Land, Soil & Geology - Impact Matrix

Factors	Construction	Operation	Decommissioning
'Do Nothing' Impacts	Slight (green)		
Direct Impacts		Moderate (amber)	X
Indirect Impacts		X	X
Cumulative Impacts		X	X
Residual Impacts		Moderate (amber)	Slight (green)
`Worst Case' Impacts		Significant (red)	Significant (red)

None/imperceptible: **X**; Slight: ●(green); Moderate: ●(amber); Significant/Very significant: ●(red).
Refer to Appendix 3 for definition of Significance

6.5.1 'DO NOTHING' IMPACTS

If the development did not proceed, the aggregate resource would remain unused in situ, and the local supply of quality aggregates would be more restricted. The existing site permitted under P.A. Ref. 01/525, PL 25.128072 comprises a moderate-sized (i.e., c. 11.4 ha) quarry that has been extensively worked, such that the lands represent a disturbed and degraded landscape with some remaining infrastructure and stockpiles on the quarry floor. Under the 'Do Nothing' scenario, all quarrying activities would cease. The site would be restored to beneficial after-use as per the requirements of the existing planning permission (P.A. Ref. 01/525, PL 25.128072). However, the resources of the quarry would remain in situ and thus unutilised, and would possibly result in the requirement to develop a more remote greenfield site.

6.5.2 DIRECT IMPACTS

Quarrying has occurred within the application site, and as such, there has been an impact on the bedrock geology as a result of this prior development.

As described, the site is an existing quarry in which much of the development works and site infrastructure is in place. The extraction area has been stripped of soils for use in the construction of perimeter screening berms and for restoration of the upper quarry faces. In general, bedrock is close to or at surface with less than 0.5 m of soils to be removed.

The site will be worked from the existing quarry area in a southerly direction in a series of c. 15m benches between 128 and 70 m AOD (Refer to Figure 3.1 & 3.3). It is proposed to develop an additional extractive bench below the current quarry floor to 70 m AOD. In order to maintain a dry working environment on the floor of the quarry, some rainfall-runoff and groundwater will need to be discharged from site. The development will include upgrading of the Water Management System. Development of the quarry at depth below the current floor will require dewatering and discharge to surface water. The proposed discharge to surface water will be subject to a licence to discharge to surface water as required under Section 4 of the Local Government (Water Pollution) Act, 1977.

Table 6.6 Direct Impacts by Stage of Development

Direct Impact	Construction Stage	Operational Stage	Decommissioning Stage
Land Use	None—no new land take.	None—no new land take	Moderate, long-term, positive due to return to beneficial after-use.
Soils	None—soil already stripped from proposed extraction area.	None—soil already stripped from proposed extraction area.	Significant, long-term, positive due to restoration of site to wildlife amenity through promotion of natural colonisation of restored quarry faces.
Geological Bedrock	None.	Moderate, long-term, negative impact due to removal of mineral resources.	Significant, long-term, positive impacts if site restoration includes provision for preservation, promotion and access to designated geoheritage features.
Sensitive Receptors: Geological Heritage	None.	Potentially significant, long-term, positive impact if fresh exposures due to excavation are of additional geological/ scientific interest and of high to very high importance.	

A total of 2 million tonnes of workable reserves are still available within the proposed extraction area. The average annual output will be in the order of 100,000 tonnes giving an anticipated duration for the extraction of c. 20 years. By its nature, quarrying of the underlying rock would involve removal of an identified geological resource and therefore some impact upon land, soils and geology must be expected (Table 6.6). It is considered that the continued operation and restoration would provide much needed raw material to help meet the needs of a growing population.

There is a moderate, but controlled impact due to the removal of raw material during the operation. Excavations in bedrock to date involved excavations in a delineated benched area. The impact of excavations to date at the quarry would be considered as negative with moderate significance and of long-term duration.

The proposed development will not involve stripping or removal of any soils or subsoils. The impact upon the existing soil is considered imperceptible during the operational phase, and moderate, positive following decommissioning, as the soil will remain on-site for reinstatement within the worked-out areas as a fundamental part of the site rehabilitation.

The decommissioning phase will provide a safer environment than is currently the case, with the removal of all plant and infrastructure, and creation of stable slopes in the interest of health & safety and long-term sustainability.

The restoration of the site to beneficial after-use will result in a long-term significant positive effect in the long-term.

6.5.3 INDIRECT IMPACTS

There is a considerable history of quarrying on-site, which began in the early 1900s, and which has had no identifiable indirect impact on the geology of the area. The development will have no indirect impact on the local or regional geology, as no contaminants will be released onto the lands, and dust emissions will be tightly controlled.

6.5.4 CUMULATIVE IMPACTS

There are no other projects, quarries, commercial or industrial facilities in close proximity to the site. As such it is considered there is no significant cumulative impact with respect to the operation of the quarry.

6.5.5 TRANSBOUNDARY IMPACTS

The EIA Directive 2014-52-EU invokes the Espoo Convention on Environmental Impact Assessment in a Transboundary Context, 1991, and applies its definition of transboundary impacts. Given the location (c. 50 km from the border with N. Ireland), nature, size and scale of the proposed development, it is expected that the impacts of the development would not have any significant transboundary effects on land, soils or geology.

6.5.6 RESIDUAL IMPACTS

As a result of the proposed mitigation and enhancement measures incorporated in the design, no significant, long-term, adverse residual impacts are predicted in terms of Land, Soils and Geology during the operational phase.

It is considered that following full restoration and closure of the site that there will be no significant, long-term, adverse impacts in terms of Land, Soils and Geology, other than the development of the in-situ mineral resource. The restored quarry will provide a more manageable environment, than is currently the case, but with a change in land-use from the original agricultural use to the future beneficial future land-use as wildlife amenity.

6.5.7 'WORST CASE' IMPACTS

The worst case impact would be the removal of identified geological heritage features without IGH consent and proper supervision by a consulting geologist. As stated previously extensive consultation has been carried out with the GSI, in particular, Clare Glanville, Senior Geologist.

It is proposed to facilitate access by appropriate scientists during quarrying to record any new stratigraphies / relationships as they might become exposed and to establish if the quarry site is worthy of recognition post extraction and through aftercare/restoration planning. If deemed appropriate a representative section of the quarry face shall be left at the end of the quarry life or inclusion of information panels to promote the geology to the public or develop tourism or educational resources if appropriate depending on the future use of the site. (Refer to EIAR Section 6.6.2 below).

6.6 MITIGATION & MONITORING

The removal of the in-situ mineral resources represents a moderate long-term, negative impact on the bedrock geology, albeit an inevitable outcome of extractive operations. The development is not expected to have any significant negative impact on the surficial geology of the site or surrounding area, and thus it is proposed that only standard soil handling measures will be implemented as mitigation measures with respect to the surficial geology. Ultimately, after final land reclamation of the enclosing quarry site, with the land restored to a wildlife amenity, there will be no adverse residual impact on the surrounding environment from the development.

Environmental monitoring, including local groundwater and surface water monitoring will be implement during the operational, closure and decommissioning phases of the development.

6.6.1 SOILS

Historically, the site has been agricultural land with copse of trees on the flanks of the hill. Although there was minor historical quarrying near the northeast corner of the site, the soils are assumed to have been largely undisturbed and/or contaminated, and are characteristic of a greenfield site.

The soils have already been stripped and used in the construction of perimeter screening berms or stored in stockpiles, and will be reused to restore the site on closure. Bulk fuel storage does not occur on-site, while refueling is done on an appropriately engineered hard standing with drainage to a hydrocarbon interceptor. Thus, the soils have been effectively separated from the activities in the extraction and processing areas, such that there has not been, and nor will there be, opportunities for contamination of soils with hydrocarbons. Further details are given in Section 3.3.3.6 Management of Topsoil and Overburden Soils, Section 3.3.3.14 Fuel & Oil Storage, and Section 3.3.5.1 Accident Prevention and Emergency Response.

Consideration has been given to soil and subsoil management. Importantly, the EPA/Teagasc subsoil map clearly shows the dominance of subcropping bedrock and the almost complete lack of subsoil deposits underlying the topsoil across the site. Topsoil and subsoil stripped to obtain access to the underlying limestone resource has been used directly for construction of peripheral screening berms to aid attenuation and visual impact, or has been stored for later restoration. The storage areas are vegetated as soon as possible, to reduce both visual impact and erosion.

Stripping was carried out in accordance with the principles of good soil handling. These principles are aimed at reducing possible adverse effects such as smearing and compaction of the soil. Measures which are to be incorporated to achieve this aim include:

- Storage of soils within perimeter security / screening embankment of the site. This is to allow the vegetation of these screening embankments as soon as possible;
- Placement of soils directly on completed sections of the quarry as part of the final quarry restoration;

- Soils will not be handled in wet conditions or when the moisture content of the soils is too high. This will ensure that smearing of the soils does not take place and that the soil retains its structure;
- Soils will not be stripped or placed when the moisture content is high, i.e., after heavy rainfall;
- No soils will be moved when they are too dry or when there are unusually windy weather conditions. This will help to prevent erosion and any consequential creation of dust;
- All temporary storage mounds will have slope angles not greater than 1:1.5 and will be re-vegetated as quickly as possible to avoid soil erosion by air and water; and
- Topsoil shall be stored to a height not exceeding 3 metres to preserve organic constituents.

Further details with respect to the management of topsoil and overburden soils are outlined in EIAR Section 3.3.3.6.

6.6.2 BEDROCK GEOLOGY

The removal of the in-situ mineral resources represents a moderate, long-term, negative impact on the bedrock geology, albeit an inevitable outcome of extractive operations.

The impact of the development on the geological heritage of the site was assessed with reference to the consultation with the GSI and to the "Geological Heritage Guidelines for the Extractive Industry" developed by the GSI and the Irish Concrete Federation (GSI/ICF 2008). These guidelines are intended for Irish Concrete Federation (ICF) members so that they may follow best practice and receive clear information concerning geological heritage in relation to any proposed quarry or related development or land purchase.

In response to a request for pre-application consultation (Refer Appendix 4), the GSI noted that "*as a working quarry, the listing as a County Geological Site has no implications for the normal operation of the quarry, subject to standard permissions and conditions under planning and environmental legislation. It would be desirable to consider retaining representative faces for geological purposes during aftercare and restoration plans instead of straight forward infill to original pre-quarrying topography.*

The GSI have requested that the operator might assist our geological heritage goals with the following (and ideally this would be written into the restoration / closure plan) and be included as a condition of planning as deemed appropriate by the planning authority:

1. Allowing access to quarry faces by appropriate scientists (upon request and with due regards to Health and Safety requirements) during quarrying to record any new stratigraphies / relationships as they might become exposed and to establish if the quarry site is worthy of recognition post extraction and through aftercare/restoration planning.
2. If deemed appropriate in (1) above, leaving a representative section of the quarry face at the end of the quarry life or inclusion of information panels to promote the geology to the public or develop tourism or educational resources if appropriate depending on the future use of the site. Natural exposures are few, or deeply weathered; this measure would permit on-going improvement of geological knowledge of the subsurface.

The Geoheritage Programme tries to promote a partnership between geological heritage and active quarrying, with such measures as those outlined in the 'Geological Heritage Guidelines for the Extractive Industry'.

As part of the Irish Geological Heritage (IGH) Programme, consultees are requested to assist with developing work on Irish geological heritage by following the guidelines/mitigation measures below:

Quarry Operation Stage

- Facilitate periodic visits from IGH during the quarry operation, to advise on future geo-conservation issues, e.g., preserving a representative section of the geology; Permit access for research by bona fide geologists, which may include recording new data and sample collecting, and for educational purposes - health and safety considerations permitting. Off-track parking areas would be ideal for examination of sections;
- Notify IGH about any significant new section or feature, temporary or permanent, that may become exposed by quarrying, e.g., after blasting (or send a digital photograph that can be quickly assessed). New faces can be examined by IGH or other relevant expert, with minimal interruption to the quarrying operation, and may facilitate optimum extraction as well as enhance geological understanding of the area. Discuss with IGH how new features can be accommodated in closure plans; and
- Monitor and, ideally, maintain a digital photographic record of the extraction process, so that new faces are documented, as well as any new or significant feature flagged to IGH. These can be examined if needed, adding to GSI's knowledge base and facilitating a smooth quarrying operation; IGH can advise on ideal monitoring and photographic methods. Forward any annual reporting groundwater monitoring data digitally to the GSI Groundwater Programme (as submitted to the EPA and local authorities as per the EU Water Framework Directive or planning condition).

End operation stage

- Finalise restoration plans in consultation with IGH, ideally having designed the operation of the quarry to consider end use. Plan for maximum geodiversity on closure, if appropriate. In particular, leave rock faces visible as exposure rather than covered with soil, vegetation or rock debris); make rock faces safely available to geologists, and to the public if possible, by creating public pathways and viewing areas with furniture and information panels (IGH can advise on interpretative materials); and
- Maintaining access to the geological heritage interest promotes geoconservation in the community. There are more imaginative, and economical, end uses for quarries than the backfilling method that obliterates existing and newly created geodiversity and biodiversity, such as their modification as open-air amphitheatres or rock-climbing facilities. Even if converted to light industrial use, the quarry walls can be retained for geodiversity interest.

As statutory consultees a copy of this EIAR, including a site specific geophysical report by Apex (2018), will be made available to the GSI (Refer to Appendix 6.1).

Lagan recognises the importance of the Geological Survey of Ireland as Irelands public earth science knowledge centre. In order to facilitate the aims of the GSI to provide free, open and accurate data and maps on Irelands subsurface to landowners, the public, industry and all other stakeholders within Ireland and internationally Lagan will work with the GSI wherever possible following any request made by the GSI to Lagan. Lagan is also amenable to working with the GSI with a view to providing a copy of any future reports detailing any site investigations carried out together with a digital photographic record of significant new excavations. Furthermore, should Lagan receive a request from the GSI to visit site to collect any geological data or personally document exposures for example, arrangements will be made to facilitate a mutually convenient time. The data would be added to Geological Survey of Ireland's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. This information would facilitate the GSI to further our understanding of the underlying geology and the geological history of this part of Ireland.

To this end Lagan recently hosted GSI personnel on-site who were present filming for a television series called 'The Island' at the quarry - a three-part series which airs on RTE. One episode of the series produced in association with the GSI tells the story of Ireland from a geological perspective.

Should any significant bedrock exposures of importance be identified, Lagan will work with the GSI to find a mutually beneficial arrangement on how best they can be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints. This measure would permit on-going improvement of geological knowledge of the subsurface and could be included as additional sites of the geoheritage dataset, if appropriate.

The final land restoration scheme will ultimately allow the site to be returned to a condition whereby there will be negligible residual impact on the geological heritage of the site and surrounding environment due to the excavation and removal of bedrock underlying the site. It is planned to minimise, eliminate or decrease long-term ecological and visual impacts on the environment through the implementation of the final restoration scheme.

It is anticipated that final restoration will be achieved within 2 years of completion of extraction operations. Final restoration will be to a beneficial after-use as a secure wildlife amenity with water feature. The intention is to create a habitat suitable for aquatic life and birds, such that the disused workings will eventually become of considerable amenity value. A detailed Restoration and landscaping plan has been prepared as part of the application (Refer to Figure 3.2).

A well-coordinated restoration process (in consultation with the IGH) will ensure that representative areas of quarry faces are left unvegetated. Parts of the upper benches will also be seeded with suitable species of shrubs and climbers to create vegetated ledges. Vegetation and natural colonisation on these benches will encourage growth on the faces and will subsequently break up the natural harshness of the exposed rock face.

Site restoration allows vegetation to become established during the course of the development, thereby reducing the overall impact of the development (i.e., visual impact, dust impact, flora and fauna impact, etc.). It also has the added benefit to the operator of spreading out the cost of restoration over the life of the development.

Grading and planting on completed sections of the upper quarry face will be carried out as shown in Figures 3.1 to 3.3. The upper benches will be seeded with suitable species of shrubs and climbers to create vegetated ledges. Vegetation and natural colonisation on these benches will encourage growth on the faces and will subsequently break up the natural harshness of the exposed rock face. This will occur in a progressive manner as quarrying progresses.

A detailed working scheme/ restoration plan has been prepared (Refer to Figures 3.1 to 3.3). In preparing the design, standard criteria were adopted with regard to face slopes, standoffs to site boundaries, etc. The final quarry face angles have been assessed by a geotechnical engineer to ensure long-term stability after completion of extraction operations. The stability of restored faces observed in the existing quarry indicates that the long-term stability of the final quarry faces will be satisfactory in this geological environment.

The client will ensure that there is a periodic examination of new faces and any new features revealed, by a visiting GSI geologist or consultant.

The final land restoration scheme will ultimately allow the site to be returned to a condition whereby there will be negligible residual impact on the surrounding environment due to the extraction and removal of the limestone bedrock underlying the site. It is planned to minimise, eliminate or decrease long-term ecological and visual impacts on the environment through the implementation of the landscaping & restoration scheme.

It is considered that the exact detail with respect to final treatment of quarry should be left to at least 6 months prior to final restoration to facilitate future beneficial end use. A typical planning condition to this effect could be *"The developer shall confirm in writing with the planning authority within 6 months of the cessation of operations, the details of, and programme for, implementation of the restoration scheme upon permanent cessation of quarrying activity at the site*". Further information on the restoration scheme is given in Section 3.4 – Site Restoration and Section 11 – Landscape.

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6.8 FIGURES

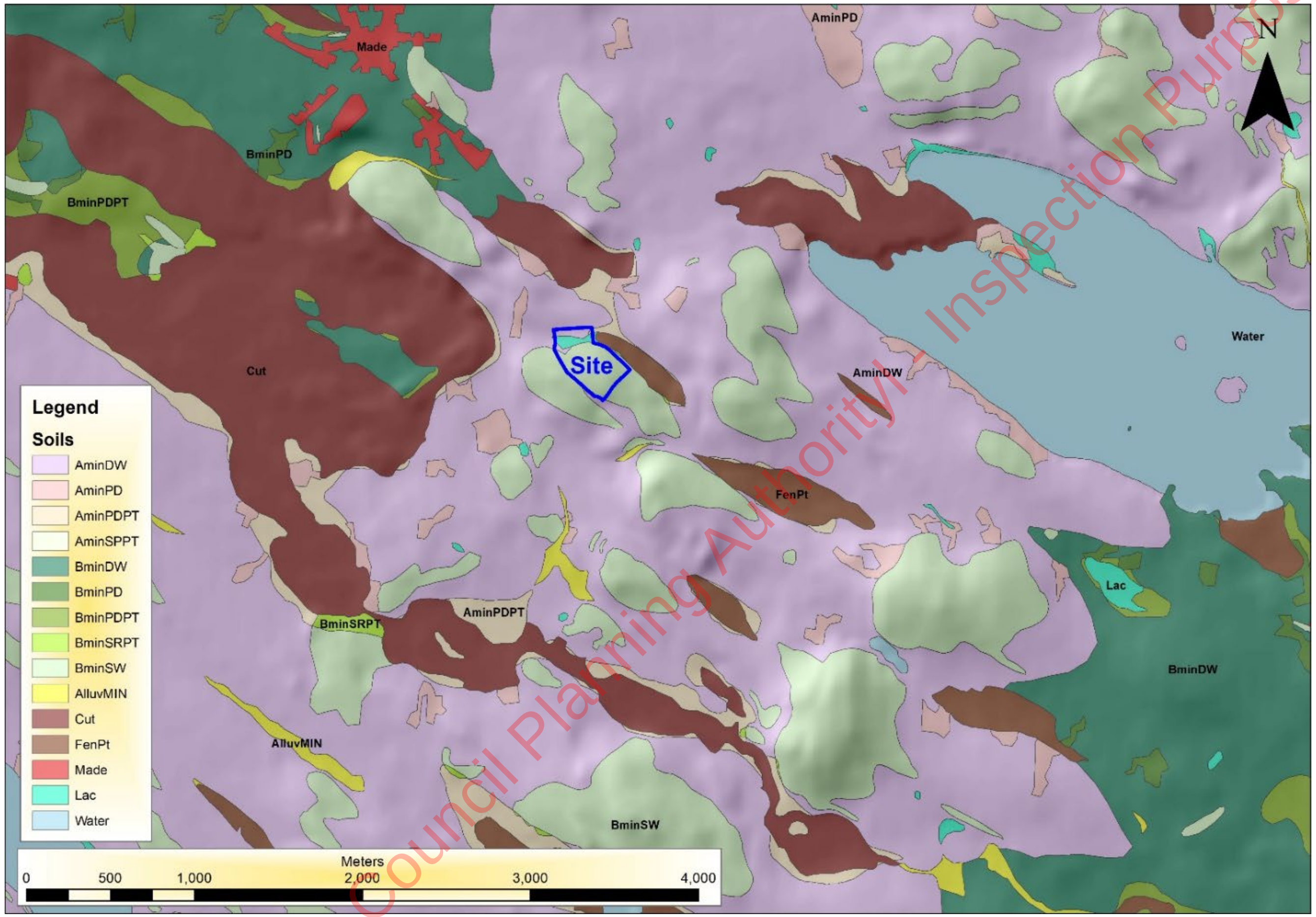

Figure 6.1 Map showing topsoil of wider area around Deerpark

Note dominance of large swathes of AminDW (Acid Brown Earths & Brown Pozolics): fuschia) in the wider area. BminSW (Renzina & Lithosols: light green) occurs in large patches and dominates the site. There are lesser amounts of Cutaway Peat and Fen (Cut and FenPt: dark brown), BminDW (Grey Brown Podzolics & Brown Earths: dark green), and other minor soil types. Lacustrine-type soils (turquoise) are identified in the northern section of the site. Rendered with ArcGIS 10.3.1 using data from EPA (2006).

JSPE

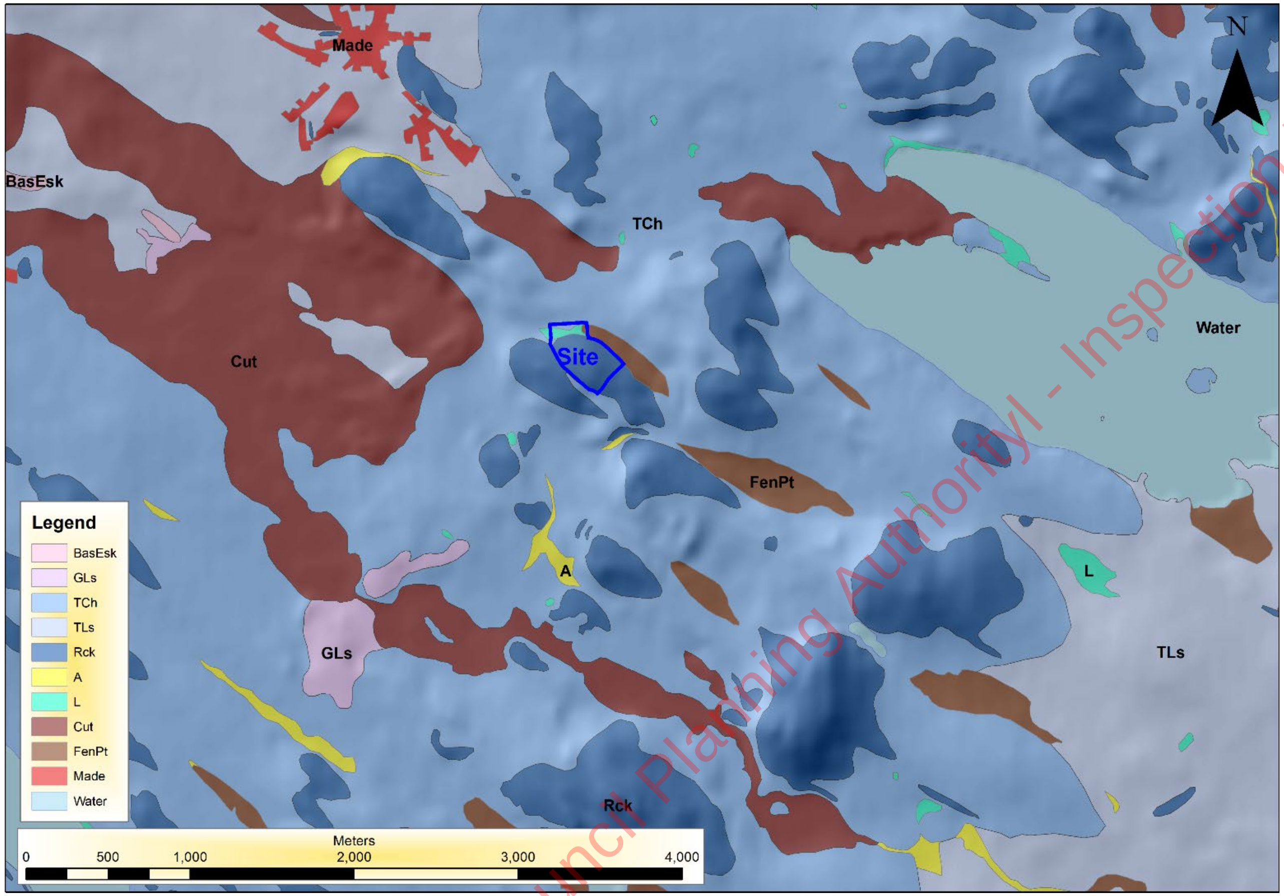

Figure 6.2 Map showing subsoil of wider area around Deerpark

Note dominance of large swathes of TCh (Chert till: light blue). The quarry site is dominated by Rck (subcropping bedrock: dark blue) with minor L (Lake sediments, undifferentiated (turquoise). Note large swathes of Cutaway Peat and Fen (Cut and FenPt: dark brown) and Limestone till (Carboniferous) (TLs). Rendered with ArcGIS 10.3.1 using data from EPA (20).

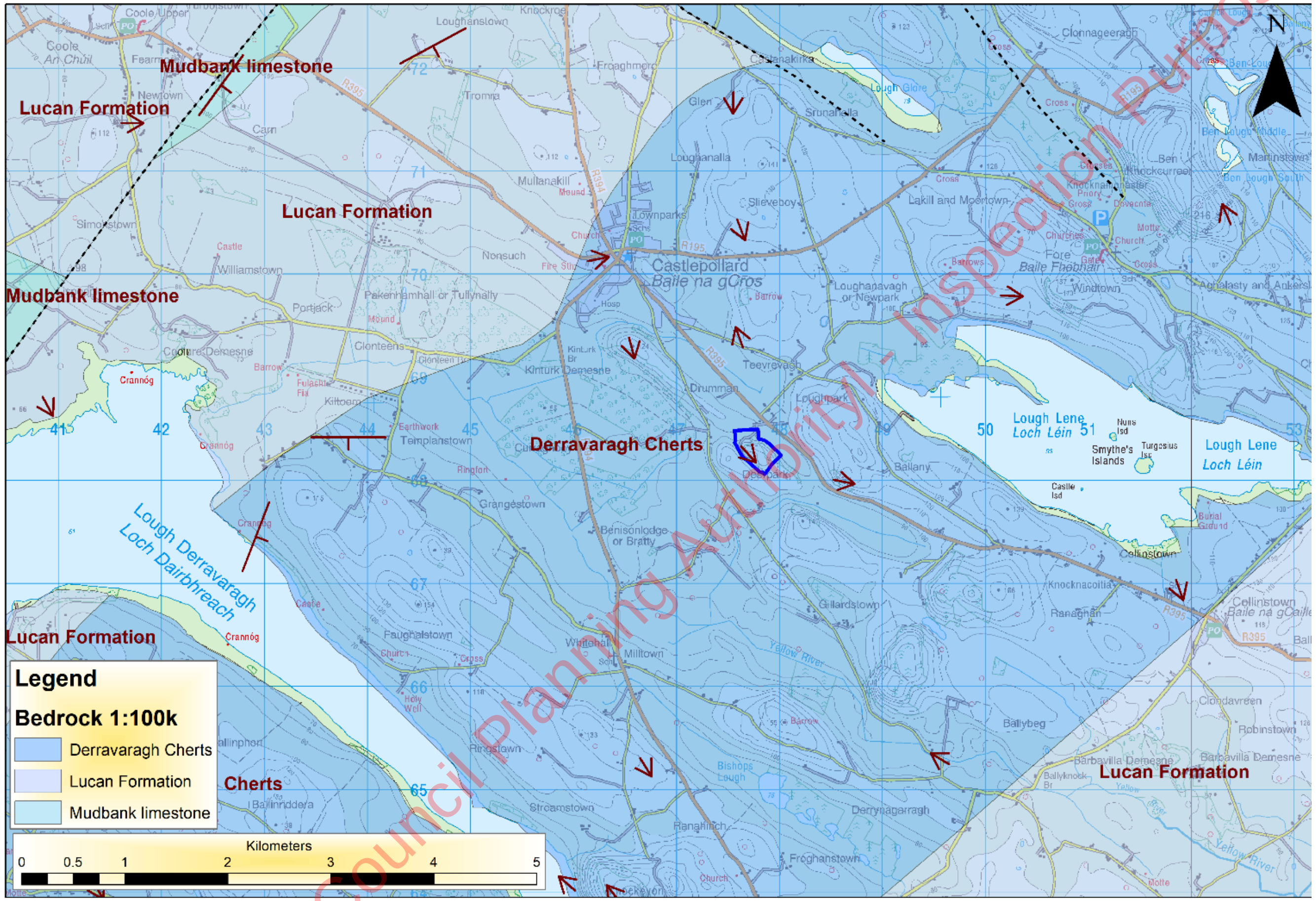

Figure 6.3 Geology map overlain on the OSi road map of the area around Castlepollard Quarry

Blue line denotes boundary of application site. Geological map overlain as transparent layer. Site is located in NE-SW oriented tract of Derravaragh Cherts Fm. enclosed in Lucan Fm. ("Calp") with minor areas of mudbank limestone to the northwest. Rendered in ArcGIS 10.3.1 with data from the GSI and OSi.

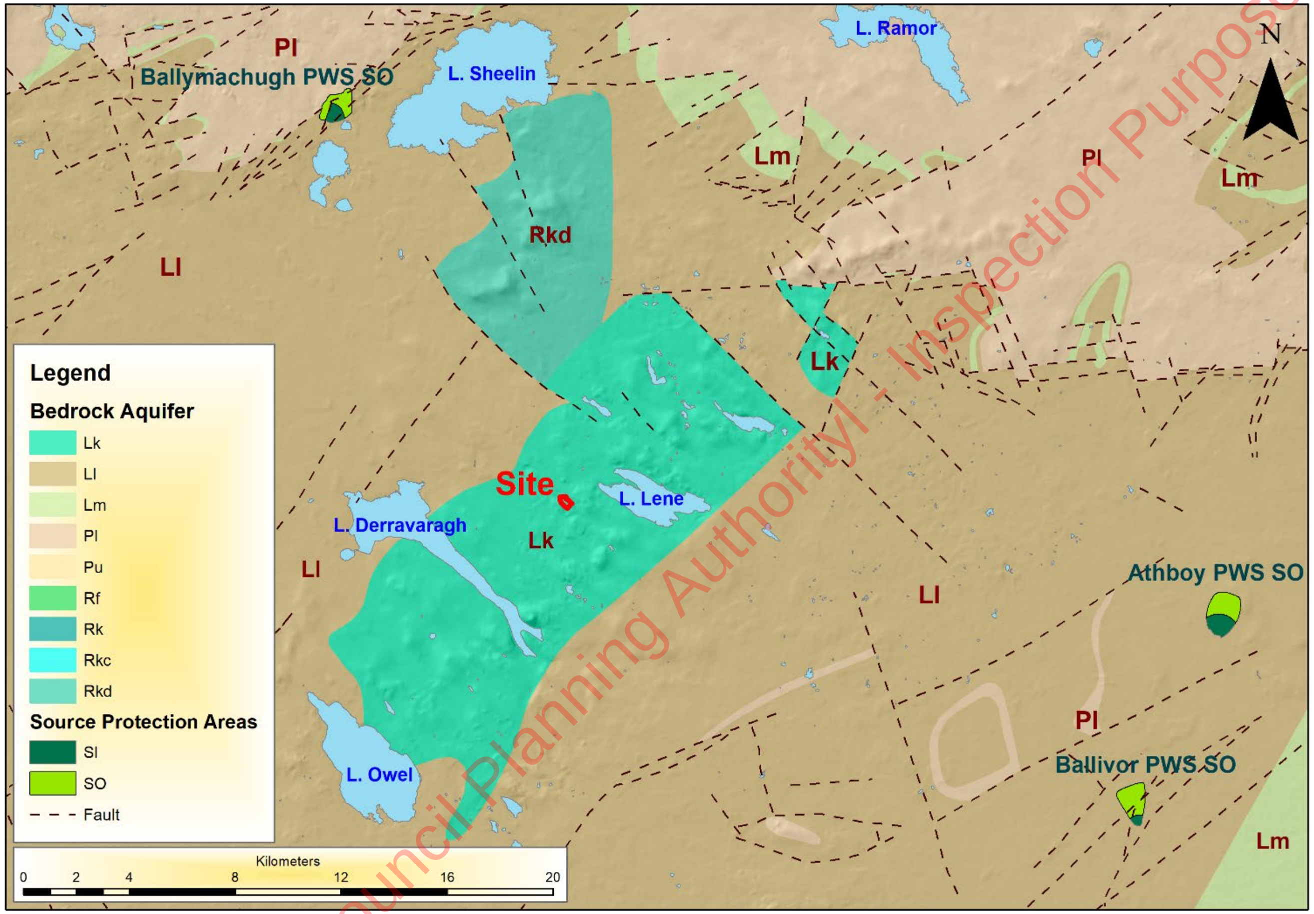

Figure 6.4 Aquifer map of wider area around Castlepollard Quarry

Bedrock underlying the site is classified as Lk (Locally Karstified Bedrock Aquifer), and is largely enclosed in bedrock classified as Ll (Locally Important Aquifer, which is Moderately productive only in Local Zones). Other Aquifers are Rkd (Regionally Important Aquifer - Karstified (diffuse)), Lm (Locally Important Aquifer - Bedrock which is Generally Moderately Productive) and Pl (Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones). Rendered with ArcGIS 10.3.1 using data from GSI (2021).

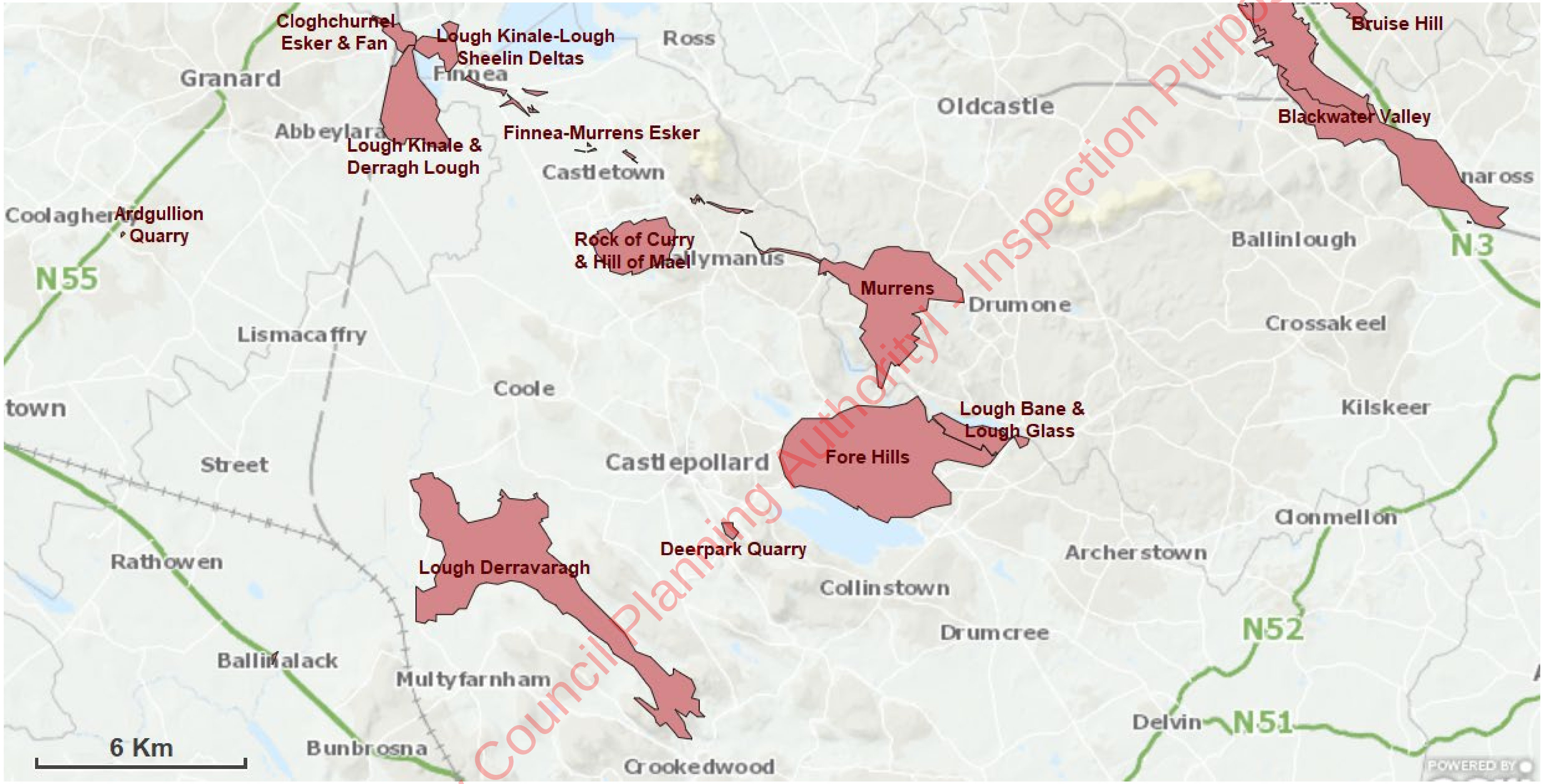

Figure 6.5 Geoheritage Map of wider area around Castlepollard Quarry

Topographic map of wider Castlepollard area, showing several designated geological heritage sites, seven of which are within 7 km of the site. The Castlepollard Quarry is designated a geological heritage site, known to the GSI as Deerpark Quarry. Redrawn from GSI (2021).

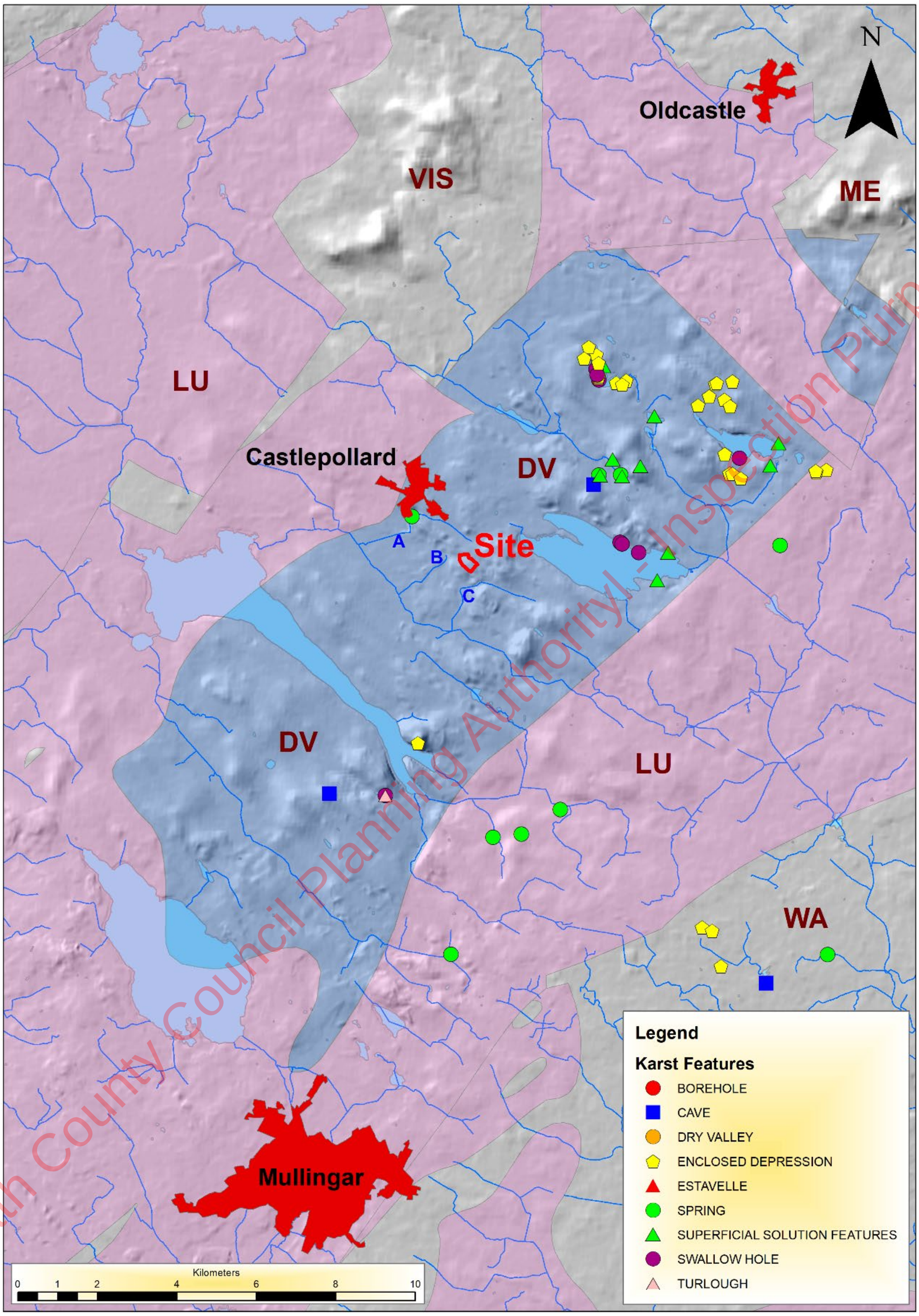

Figure 6.6 Map of wider area around Castlepollard Quarry

Hill-shaded relief map of Castlepollard Quarry and wider area, showing numerous karst features within the Derravaragh Fm and Derravaragh GWB, but none in the vicinity of the site - nearest being in Castlepollard. Rendered in ArcGIS 10.3.1 using aerial image from Esri World Imagery and data from the GSI (2021).