7 LAND, SOILS AND GEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by Milford Quarries Limited to provide a description and an assessment of the residual direct and indirect significant effects of the quarrying activities at Red Rock Quarry, Clogrennane, Co. Carlow on the land, soil and geological environment from 1988 to the present day.

1995 is the baseline environment as this year is known to predate all works associated with the Development. Note that 1988 is the year in which the EIA Directive (Directive 85/337/EEC) was required to be transposed into Irish Law. The baseline land, soils and geological environment in the year 1995 is described in detail along with a description of quarrying activities from the 1995 baseline to the cessation of quarrying in 2023. and the management of the Development Site since the Applicant took ownership in 2023.

This chapter of the Remedial Environmental Impact Assessment Report (rEIAR) presents:

- An assessment of the effects on the quarrying activities on the land, soils and geological environment;
- The baseline sensitivity of the receiving land, soils and geological environment has been assessed based on the baseline conditions occurring in 1995;
- The effects on the receiving land, soils and geological environment have been assessed over several phases. These phases include the Extraction Phase (1995 Baseline to 2023), and the Current Phase (2023 to the present day);
- The monitoring and control measures that were being implemented; and,
- The residual effects along with any cumulative effects with other project in the vicinity of the Development Site.

Please note that for the purposes of this chapter, where:

- The 'Development' is referred to, this relates to all of the project components described in Chapter 3; and,
- The 'Development Site' is referred to, this relates to the primary study area for the rEIAR, as delineated by the rEIAR Site Boundary and corresponds to the overall landholding.

7.1.2 Scoping and Consultation

As detailed in Section 1.6 of the rEIAR a non-statutory scoping exercise was conducted by TPA to establish what format the rEIAR would take and the range and aspects of the environment to be considered.

A scoping response was issued to Carlow County Council and no response was received following this request.

7.1.3 Quality Assurance and Competence

Hydro-Environmental Services ("HES") are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This chapter of rEIAR was prepared by Michael Gill, Adam Keegan, Conor McGettigan and Nitesh Dalal.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is a Civil/Environmental Engineer, Hydrologist and Hydrogeologist with 22 years' environmental consultancy experience in Ireland. Michael has a degree in Civil and Environmental Engineering, a MSc in Engineering hydrology from TCD and a MSc in Applied Hydrogeology from Newcastle University. Michael has completed numerous (60+) hydrological and hydrogeological assessments relating to bedrock quarries and sand and gravel pits. Recent examples include Ardfert quarry in County Kerry, Middleton Quarry in County Cork, and Rathcore and Clonard Quarries in County Meath. Michael also has extensive experience in the preparation of remedial EIARs having worked on rEIARs for several bedrock quarries and peat extraction sites.

Adam Keegan PGeo (B.Sc., M.Sc.) is a hydrogeologist with 7 years environmental consultancy experience in Ireland. Adam has worked on numerous Environmental Impact Assessments for infrastructure projects, such as wind farms, strategic housing developments and quarries. Adam has experience in intrusive site investigation works within sand and gravel environments, primarily relating to quarry developments. Adam has worked on numerous quarry EIAR projects including Mallow quarry, Barrigone quarry, Kilmeague quarry, and Killarney East quarry.

Conor McGettigan (BSc, MSc) is an Environmental Scientist, with over 5 years' experience in the environmental sector in Ireland. Conor holds an MSc in Applied Environmental Science and a BSc in Geology from University College Dublin. Conor routinely completes hydrological and hydrogeological assessments for a wide range of developments including sand and gravel pits and bedrock quarries. Conor has also prepared several the land, soils and geology and water chapters of several rEIARs.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

7.1.4 Relevant Legislation

This rEIAR is prepared in accordance with the requirement of the European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The requirements of the following legislation are complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- S.I. No. 296/2018 European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018;
- European Communities (Environmental Impact Assessment) Regulations 1989 to 2017; and,
- S.I. No. 4/1995: The Heritage Act 1995, as amended.

7.1.5 Relevant Guidance

This Land, Soils and Geology section of the rEIAR has been prepared with regard to the following guidelines:

- Environmental Protection Agency (May, 2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry (Non-Scheduled Minerals);
- DoEHLG (2010) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities;
- Geological Survey of Ireland, Irish Concrete Federation (2008) Geological Heritage Guidelines for the Extractive Industry;
- Institute of Geologists of Ireland (2007) Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments;
- Institute of Geologists of Ireland (2013) Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology, and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

7.2 Study Methodology

7.2.1 Desk Study

A desk study of the Development Site and surrounding area was carried out in March 2024 to collect all relevant geological data. The initial desk study in advance of site walkover surveys and site investigations. The desk study information has been checked and updated, where necessary, in May/June 2025. The desk study included consultation with the following data sources:

- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland – Geological databases (www.gsi.ie);
- Geological Survey of Ireland – Geological Heritage Site mapping (www.gsi.ie):
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 19 - Geology of Carlow-Wexford (GSI, 1994);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- Aerial Photography; 1:5000 and 6" base mapping.

7.2.2 Baseline Monitoring and Site Investigations

Michael Gill of HES completed an initial visit and walkover survey of the Development Site on 09th May 2024. Site investigations comprising of borehole drilling were completed by Peterson Drilling Ltd, under the supervision of Adam Keegan of HES, on 26th, 27th and 28th June 2024. Additional walkover surveys and geological mapping were completed by Michael Gill and Conor McGettigan on 13th December 2024, 18th February, 25th March, 29th April, 29th May, 25th June, 23rd July, 14th August, 25th September and 12th November 2025. During these site visits observations were made on near surface geological features and accessible bedrock and subsoil exposures.

Available site investigation data (recent and historic) to address the land, soils and geology chapter of the rEIAR included the following:

- HES completed walkover surveys of the Development Site on 26th, 27th, 28th June and 13th December 2024, 18th February, 25th March, 29th April, 29th May, 25th June, 23rd July, 14th August, 25th September and 13th November 2025. The purpose of these site walkover surveys was to assess the ground conditions and layout of the Development including surveys of the adjacent lands and the existing quarry operations;
- During the site surveys HES completed detailed logging of exposed subsoil profiles and existing bedrock quarry side walls. There is ~1.5km of exposed bedrock side wall (~10m in height) in the quarry;
- Mineral soils, subsoils and bedrock were logged according to BS: 5930:2015 Code of Practice for Ground Investigations;
- 5 no. boreholes were drilled at the Proposed Development Site by Peterson Drilling Ltd, under the supervision of HES on 26th, 27th and 28th June 2024 up to a depth of 40mbgl (metres below ground level); and,
- Geophysical investigations were carried out by Apex Geophysics Limited from 11th to 15th March 2024.

7.2.3 Impact Assessment Methodology

The importance / sensitivity of the geological receptors was assessed on completion of the desk study and baseline assessment.

Using the NRA Guidance (NRA, 2008), an estimation of the importance / sensitivity of the geological environments within the Site is set out in Table 7-1 (NRA, 2008).

Table 7-1: Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
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 site 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 site 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.

Importance	Criteria	Typical Example
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 site 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.

Once the importance and sensitivity of the geological attribute is established, the conventional source-pathway-receptor model for was applied to assess impacts on the land, soils, and geology at the Site.

Where potential impacts are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the EPA's guidance document (EPA, 2022).

The description process clearly and consistently identifies the key aspects of any potential impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below, we have firstly presented below a summary guide that defines the steps (1 to 7) taken in each element of the impact assessment process in below. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Table 7-2: Estimation of Importance of Soil and Geology Criteria (NRA, 2008)

Attribute	Status / Occurrence	Importance
Step 1	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor.
Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. These measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by best practice engineering design.
Step 6	Post Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post mitigation effects of the identified potential impact source on the receiving environment.

7.2.4 Study Area

The study area for the land, soils and geological environment is limited to within the rEIAR Site Boundary. There was no potential for the Development (Extraction Phase or Current Phase) to affect the land, soils and geological environment outside of the Development Site.

7.2.5 Limitation and Difficulties Encountered

A complete timeline of the quarrying activities at the Development Site is not available. Similarly, a record of extraction volumes is not available. The timeline and volumes have been estimated based on the available data, predominantly historic aerial imagery.

7.3 Baseline Environment

7.3.1 Site Location

The Development Site is located in the townland of Clongrenan, Co. Carlow, and lies immediately to the south of the Laois – Carlow county border. The Development Site is located ~1.5km east of the small village of Bilboa, Co. Laois which was historically a coal-mining settlement. The Development Site also lies ~5km southwest of Carlow town and ~7.5km northwest of the town of Leighlinbridge, Co. Carlow. The landholding has a total area of 45.68hectares (ha). The application area for substitute consent application (Development Site) is 41.86Ha, of which 14.22Ha has been subject to historic extraction and associated activities.

The Development Site can be accessed via the L3896/L7134 which is located ~300m to the east. An existing access road branches off this local road to the east and runs along the northern boundary of the quarry, providing access to the existing quarry void.

7.3.2 Topography

7.3.2.1 1995 Baseline Topography

The Development Site is located on the eastern edge of the Castlecomer Plateau, an upland area in north Co. Kilkenny which also extends into Co. Laois and Co. Carlow at its northern edge. Locally, natural ground elevations within the Development Site range from ~319mOD in the west to ~265mOD in the east. Natural ground elevations within the existing quarry void would have ranged from ~319mOD to 310mOD, with topography sloping to the east.

7.3.2.2 Current Topography

Natural ground elevations have been altered in the existing quarry void due to the previous removal of overburden, extraction of bedrock and stockpiling of spoil material. The Development Site was previously used to extract siltstone/sandstone bedrock, with commercial extraction ceasing in c. 2014 following the outcome of the S. 261A proceedings. Some minor consolidation of the site occurred during the latter part of the Extraction Phase (2014-2023). The floor of the existing quarry void stands at ~304mOD (metres above Ordnance Datum). The Development Site contains several large stockpiles of spoil and crushed rock which have vegetated in places. An access track passes through the centre of the existing void.

7.3.3 Land (Land-Take)

7.3.3.1 Land – Historical Change Summary

The primary change to land at the Development Site associated occurred in c. 2005 when large scale quarrying activities commenced.

Land take and any land changes at the Development Site have been investigated using aerial imagery. Records from the applicant were also consulted to help develop the timeline of changes.

Maps for the local area, dating from 1913, indicate the presence of a small gravel pit at the Development Site (note: it was probably weathered bedrock or slip and not sand and gravel that was being quarried historically. There are no known deposits of sand and gravel locally). It is estimated that this borrow pit had an area of ~0.16ha. This borrow pit was soon abandoned with inspection of aerial imagery from 1973, 1995 and 2000 not showing any ground disturbance or quarrying works.

Aerial imagery indicates that extraction operations re-commenced at the Development Site in the early to mid-2000s (*i.e.* the early part of the Extraction Phase). The extraction area in 2005 is estimated to be ~3.61ha. Quarrying operations intensified at the Development Site between 2005 and 2010 with the extraction area estimated to have been ~6.29ha in 2010. Quarrying operations continued at the Development Site until c. 2014. During the later part of the Extraction Phase (2014-2023) there was some minor works completed in order to consolidate the site. The Applicant took ownership of the Development Site in 2023 and there have been no subsequent changes to the land environment. The existing quarry void covers an area of ~8.66ha. The estimated total extraction area though time is detailed in Table 7-3.

Table 7-3: Change in Extraction Area Through Time

Year	Estimated Extraction Area (ha)	Notes
1995 (Baseline)	N/A	0.16ha Abandoned borrow pit which pre-dates 1913
2005	3.61	Bedrock Quarry
2010	6.29	Bedrock Quarry
2012	7.28	Bedrock Quarry
2019	8.27	Bedrock Quarry
2023	8.66	Bedrock Quarry

7.3.3.2 Land – 1995 Baseline

The 1995 baseline environment at the Development Site comprised of a small, abandoned borrow pit (0.16ha) surrounded by agricultural lands. By this time the borrow pit had been abandoned for a significant period of time and had likely revegetated in places. The lands surrounding the borrow pit comprised of agricultural fields separated by hedgerows.

7.3.3.3 Land – Current Condition

According to Corine landcover mapping (2018) (www.epa.ie), the majority of the Development Site area is mapped as agricultural pasture land with small area in the west of the Development Site mapped as land which is principally occupied by agriculture with significant areas of natural vegetation. The lands surrounding the Development Site are mapped largely as agricultural lands with an area of transitional woodland scrub located to the east of the Development Site at the location of Clongrennan Woods. Corine land cover maps also record the presence of 2 no. mineral extraction sites in the local area. 1 no. mineral extraction site is mapped to the northwest in the townland of

Rossmore. According to GSI records this was an old coal mine (www.gsi.ie). Another mineral extraction site, known as Clongrennan limestone quarry, is mapped to the southeast in the townland of Raheendoran.

Inspection of aerial photographs and site walkover surveys completed by HES have provided greater detail regarding the landuse and landcover at the Development Site and across the surrounding lands. The Development Site is comprised of an existing quarry void (8.66ha) which was associated with the previous extraction of bedrock from the Development Site. Landuse on the surrounding lands is comprised of agricultural pastures, with an area of coniferous forestry to the west. Clongrenan Woods exist to the east of the L3896/L7134 with one-off housing also located along the local roads in the area.

7.3.4 Soils and Subsoils

7.3.4.1 Current Environment

7.3.4.1.1 Desk Study

The published Teagasc soil maps (www.gsi.ie) for the local area shows that the majority of the Development Site is overlain by shallow, rocky, peaty/non-peaty mineral complexes (mainly acidic) (AminSRPT) and shallow, peaty, poorly drained mineral soils (mainly acidic) (AminSPPT). A small portion in the northwest of the Proposed Development Site is overlain by blanket peat (BktPt). To the east of the Development Site Teagasc map the presence of shallow, well drained mineral soils (mainly acidic) (AminSW), with smaller areas mapped to be overlain by poorly drained mineral soils (mainly acidic) (AminPD) and shallow poorly drained mineral soils (mainly acidic) (AminSP).

The published GSI subsoil maps (www.gsi.ie) for the local area shows that the majority of the Development Site is underlain by bedrock outcrop or subcrop (Rck) with small pockets of till derived from Namurian sandstones and shales (TNSSs) and blanket peat (BktPt) to the west.

Topsoil has been removed from the majority of the Development Site and has been used for the construction of berms and/or stored in large stockpiles on the floor of the quarry. Between 1995 and 2025 soil and subsoil has been removed from an area of 8.66ha.

A local subsoils map is included below as **Figure 7-1**.

7.3.4.1.2 Site Investigations

Soils and subsoils in the existing quarry void have been stripped in the past to facilitate the previous quarrying operations. The footprint of the existing quarry area is ~8.66ha.

Apex Geophysics completed a geophysical investigation at the Development Site between 11th and 15th March 2024 (Apex, 2024). The objective of these site investigations was to provide information on overburden thickness, depth to rock and type of bedrock. Based on the geophysical surveys, the interpreted overburden thickness of the combined soils (interpreted to be sandy gravelly clay and completely weathered rock) varies from 0.4m in the centre to 18.1m in the northwest of the Development Site. The geophysical investigation report recommended the completion of intrusive site investigations to confirm the overburden thickness and rock type.

The nature and composition of the soils and subsoils present at the Development Site have been verified during intrusive site investigations. The intrusive site investigations comprised the drilling of 5 no. monitoring wells (MW1, MW2, MW3s, MW3d and MW4) from 26th June 2024 to 28th June 2024 under the supervision of HES. The locations of the monitoring wells are shown in **Figure 7-2** below.

Where still present in the lands adjacent to the existing quarry, the natural soils and subsoils at the Development Site are thin. The borehole logs show a range of soil and subsoil conditions, depending on their location within the Development Site:

- MW1, located on the floor of the existing quarry void, lacks a soil horizon, with sandstone bedrock encountered at the surface.
- MW2, is located on the western perimeter of the existing quarry void, and encountered 5.7m of MADE GROUND comprising of clayey shale fill, which is underlain by gravelly clay.
- MW3s is located in the southwest of the Development Site and encountered 0.3m of topsoil and ~0.9m of firm silty gravelly CLAY overlying weathered shale.
- MW3d, adjacent to MW23s, recorded 1.2m of brown silty CLAY overlying soft grey shale.
- MW4, located in the southeast of the Development Site, has 0.3m of topsoil and 0.7m of firm silty gravelly CLAY over weathered shale.

Therefore, the subsoil profile across the Development Site typically consists of firm gravelly CLAY over weak weathered shale. Soil/subsoil cover is generally shallow, transitioning quickly into bedrock or weathered rock. The complete geological logs for the 5 no. boreholes are attached as **Appendix 7.I**.

Based on the available site-specific data, a thin layer of soils/subsoils (approximately 1m in thickness) Assuming an average soil/subsoil depth of 1m across the extraction area, it can be estimated that a total of 86,600m^3 of soil/subsoil has been stripped from the extraction area (based on the existing quarry void being 86,600m^2).

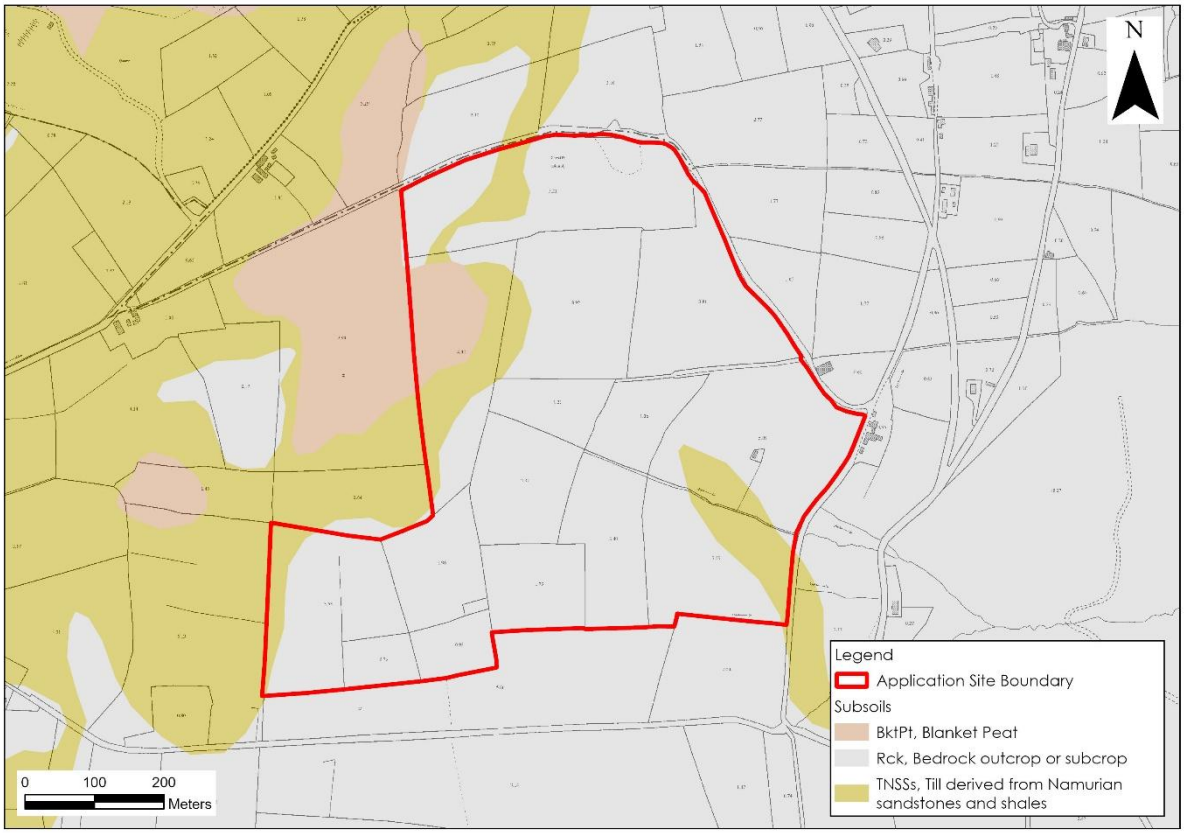

Figure 7-1: Local Subsoils Map (www.gsi.ie)

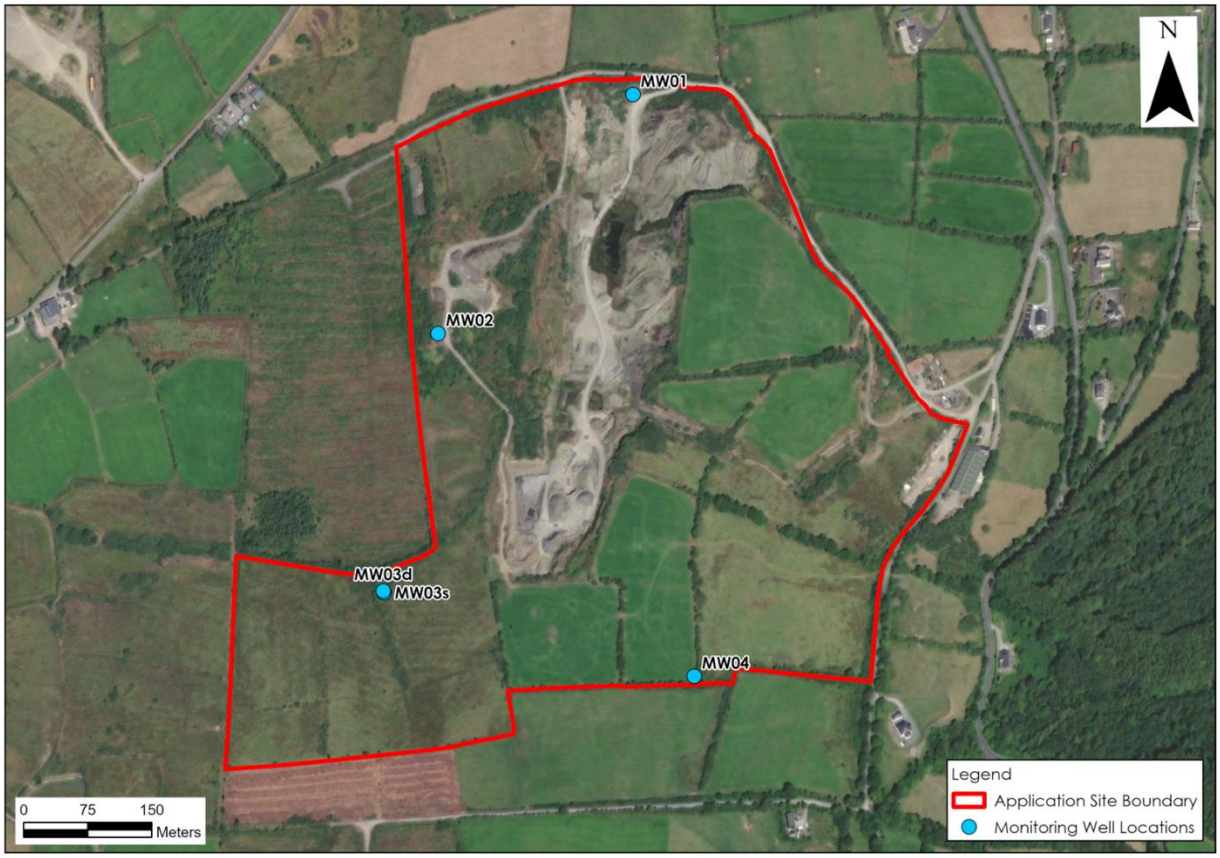

Figure 7-2: Map of Site Investigation Points

7.3.5 Bedrock Geology

7.3.5.1 Desk Study

The GSI's bedrock geology map for the local area (www.gsi.ie) shows that the majority of the Development Site is underlain by the Moyadd Coal Formation described as shale, siltstone and minor sandstone. Meanwhile, the southwest of the Development Site, and some small areas in the east, are mapped to be underlain by the Bregaun Flagstone Formation. The Bregaun Flagstone Formation is described by the GSI as being comprised of thick flaggy sandstone and siltstone.

The GSI map 1 no. northwest to southeast orientated fault to dissect the southwest of the Development Site. Another fault of similar orientation is mapped ~40m to the north of the Development Site.

The GSI also record the presence of bedrock outcrops within the Development Site and in the surrounding lands.

There are no GSI mapped karst features within the vicinity of the Development Site. Due to the siliclastic nature of the mapped bedrock, karst features would not be anticipated in this area as they are associated with the dissolution of limestone. No limestone bedrock is mapped in the local area.

A local bedrock geology map is included in **Figure 7-3** below.

7.3.5.2 Site Investigations

Initial site walkover surveys, comprehensive visual inspections and geological mapping of the existing exposed faces of bedrock at Development Site Quarry were completed by Michael Gill. Subsequent inspections completed during later site visits (refer to Section 7.2.2 for the dates of these site visits).

The existing exposures of bedrock at the Development Site comprise of ~1.5km of exposed quarry faces which are typically 10m in height. These exposures are extensive and provide a significant geological dataset. The exposed rock at was noted to comprise of sandstone and shale. The southwestern corner of the quarry void is predominantly sandstone whilst other areas contain a higher proportion of shale.

As stated above in Section 7.3.4, the geophysical surveys completed at the Development Site indicated a depth to rock ranging from 0.4 to 18.1m. The geophysical surveys indicated 3 no. rock types interpreted to be mudstone/shale, shale/siltstone with interbedded sandstone and sandstone/siltstone with interbedded shale. The geophysical investigation report recommended the completion of intrusive site investigations to confirm the overburden thickness and rock type.

The nature and composition of the bedrock geology at the Development Site has also been verified by intrusive site investigations. These works comprised the drilling of 5 no. boreholes in June 2024 under the supervision of HES. The locations of the site investigations are shown in **Figure 7-2** above.

Based on site-specific data, the bedrock geology at the Development Site across the boreholes primarily consists of interbedded sandstone, shale, and siltstone:

- MW1 encountered medium grained SANDSTONE at the surface. These sandstones were noted to contain occasional minor shale beds and extended to a depth of 27mbgl. These sandstones were underlain by a dark, grey-brown SHALE which extended to the base of the borehole (40mbgl).
- MW2 encountered overburden to 9.7mbgl. The bedrock was typically described as weak, laminated SHALE with SANDSTONE to a depth of 24mbgl. Medium strong, laminated SANDSTONE/SILSTONE with occasional SHALE was encountered from 24 to 40mbgl.
- MW3s extended to a depth of 9mbgl and encountered weak weathered SHALE from 1.2 to 4.5mbgl. The shale was underlain by medium strong SANDSTONE with occasional shale layers.
- MW3d extended to a depth of 40mbgl and encountered interbedded hard SANDSTONE, SHALE and SILTSTONE. Sandstone is dominant between 6.6 and 18.6mbgl with more shale and siltstone at depth.
- MW4 extended toa depth of 35mbgl and encountered shaley SILTSTONE with occasional sandstone layers.

Therefore, based on the site investigations, the bedrock geology at the Development Site is consistent with that mapped by the GSI (i.e. the shales, sandstones and siltstones of the Bregaun Flagstone Formation and the Moyadd Coal Formation.

7.3.5.3 Rock Extraction

Bedrock extraction commenced at the Development Site in the early to mid-2000s (note that prior to this there was a small historic borrow pit at the Development Site which forms part of the baseline environment). The volumes of rock extracted during the Extraction Phase have been estimated based on the delineated extraction areas (refer to Table 7-4). By c. 2005 it is estimated the total volume of rock extracted from the Development Site is estimated to have been ~62,000m^3. Quarry activities intensified between 2005 and 2010. By 2010 the total volume of rock removed from the Development Site is estimated to have been ~470,000m^3. The large scale quarrying activities ceased in c. 2014 with only minor works, associated with site consolidation, being completed at the Development Site during the later years of the Extraction Phase. The Applicant took ownership of the Development Site in 2023

and there has been no extraction of bedrock during the Current Phase (2023-Present). The total volume of rock removed from the Development Site estimated to be ~650,000m^3.

Table 7-4: Change in Extraction Area Through Time

Year	Estimated Extraction Area (m²)	Estimated Extraction Volume (m³)
1995 (Baseline)	N/A	N/A
2005	36,118	~62,000
2010	62,951	~470,000
2012	72,867	~550,000
2019	82,798	~620,000
2023	86,600	~650,000

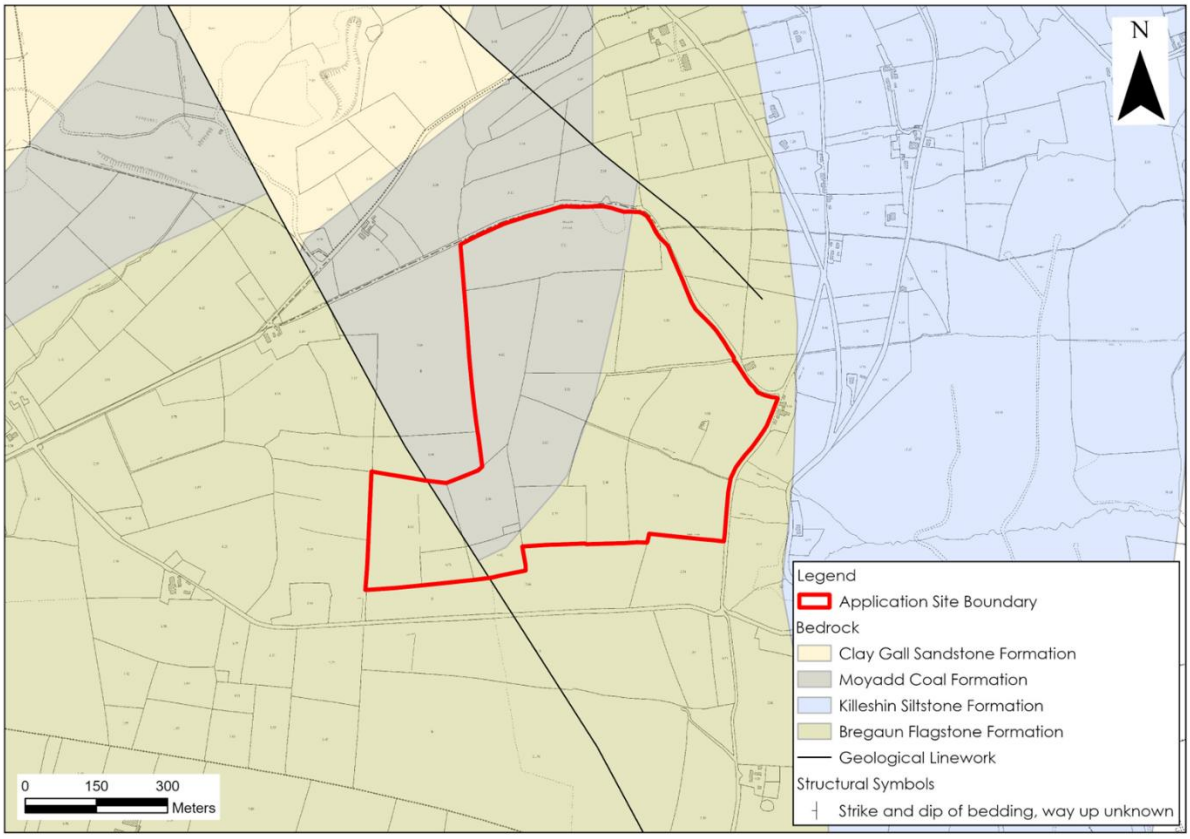

Figure 7-3: Bedrock Geology Map (www.gsi.ie)

7.3.6 Geological Resource Importance

The GSI database[1] (www.gsi.ie) shows that the majority of the Development Site is located in an area of 'High' potential for crushed rock aggregate (i.e. high potential for a bedrock quarry). A small area in the west of the Development Site is mapped as having 'Moderate' crushed rock aggregate potential. The bedrock underlying the Development Site could be classified as being of 'High' importance as bedrock has previously been extracted at the Development Site and has proven to be economically viable.

In terms of the local soils and subsoils, the Development Site is not mapped by the GSI (www.gsi.ie) as having granular aggregate potential. The overburden deposits at the Development Site, comprising predominantly of firm gravelly CLAY, can be classified as being of 'Low' Importance. It is noted that a small historic gravel pit pre-dated the extraction of bedrock at the Development Site.

The GSI Online Minerals Database (www.gsi.ie) records the presence of an old quarry located ~1.1km west of the Development Site. This quarry was operational between 1975 and 1995 and is mapped within the Clay-Gall Sandstone and Moyadd Coal formations. According to the GSI this was an old coal mine, known as Rossmore Colliery. Meanwhile, an active quarry, Clongrennan Quarry, is located ~1km southwest of the Development Site, and is underlain by the Clogrenan Formation and Luggacurren Shale Formation.

In terms of the recorded occurrence of minerals, a mineral locality is mapped by the GSI (www.gsi.ie) at the former Rossmore Colliery, where the key mineral is listed as coal (Mineral Location Ref: 3077). Additional information provided by the GSI state that this was an open cast mine, previously operated by Chesswell Ltd, which has now closed. There are no mineral localities mapped by the GSI within the Development Site.

7.3.7 Geological Heritage and Designated Sites

7.3.7.1 Geological Heritage

The Development Site is not located within any geological heritage site. The closest geological heritage site is the Old Rossmore County Geological Site (CGS) (Site Code: LS026). This CGS is located ~300m northwest of the Development Site. The Old Rossmore CGS is an abandoned coal mine and quarry with several large open pits, waste heaps, derelict plant and coal. The Old Rossmore CGS is significant as good exposures of coal and coal-bearing strata are uncommon in the Leinster Coalfield. This CGS is recommended for designation as a Natural Heritage Area (NHA).

Other geological heritage areas within 10km of the Development Site are listed in **Table 7-5** below.

Clogrenan Quarry CGS (Site Code: CW005) is located ~1.15km southeast of the Development Site. Clogrenan Quarry is a large and deep working quarry. This active quarry exposes the Lower Carboniferous Ballyadams Formation (thickly bedded wackestones and crinoid-rich calcarenites) at the base of the section and passes upwards into the Clogrenan Formation. This CGS is recommended for designation as an NHA.

A map of local geological heritage sites is presented as **Figure 7-4**.

[1] *Source: GSI online Aggregate Potential Mapping Database*

Table 7-5: Geological Heritage Sites (www.gsi.ie)

Site	Site Code	Designation	Distance from Site (km)	Description
Old Rossmore	LS023	CGS	~300m to the NW	The Old Rossmore CGS is an abandoned coal mine and quarry with several large open pits, waste heaps, derelict plant and coal.
Clogrenan Quarry	CW005	CGS	~1.15km to the SE	The Clogrenan Quarry is a large and deep working quarry. This active quarry exposes the Lower Carboniferous Ballyadams Formation (thickly bedded wackestone and crinoid-rich calcarenites) at the base of the section and passes upwards into the Clogrenan Formation.
Killeshin Glen	LS017	CGS	~2.7km to the N	A long section of rocks exposed in a deep gorge like valley. This is an important reference section for Namurian / Westphalian strata in the Leinster Coalfield.
Hollymount	LS015	CGS	~8.5km to the N/NE	A number of fields where a borehole was drilled in the early 1970s. This site is a deposit of Miocene-Pliocene (Neogene) age, which is exceedingly rare in the country.
Arless Quarry	LS002	CGS	~9km to the N	A small, disused quarry with a restricted area of bedrock outcrop. A good site for observing two rock types separated within the stratigraphic column.
Morrisey's Quarry	CW006	CGS	~5.1km to the SE	A large working quarry with extensive overburden of glacial till. Lower Carboniferous limestones of the Ballysteen Formation are well exposed at this quarry
Bannagagole Quarry	CW004	CGS	~8.2km to the S	Very large and deep working quarry. Limestones of the Ballyadams Formation are found in the Bannagagole quarry. It hosts many interesting fossils (corals and brachiopods)
Coolbaun Valley	KK016	CGS	~9.7km to the W	Disused coal mines within a small river valley. Exposures of shale and coal within old mine shafts and along a stream section
Coolbaun Hill	KK012	CGS	~9.8km to the W	A working open cast quarry. Exposed faces of shale and occasional anthracitic coal

7.3.7.2 Designated Sites

Within the Republic of Ireland designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

The Development Site is not located within a designated site. The closest designated site is the River Barrow and River Nore SAC (Site Code: 002162). This SAC is located ~2.2km to the east. The potential to impact downstream designated site is via hydrological connectivity and this is assessed in Chapter 8 of this rEIAR.

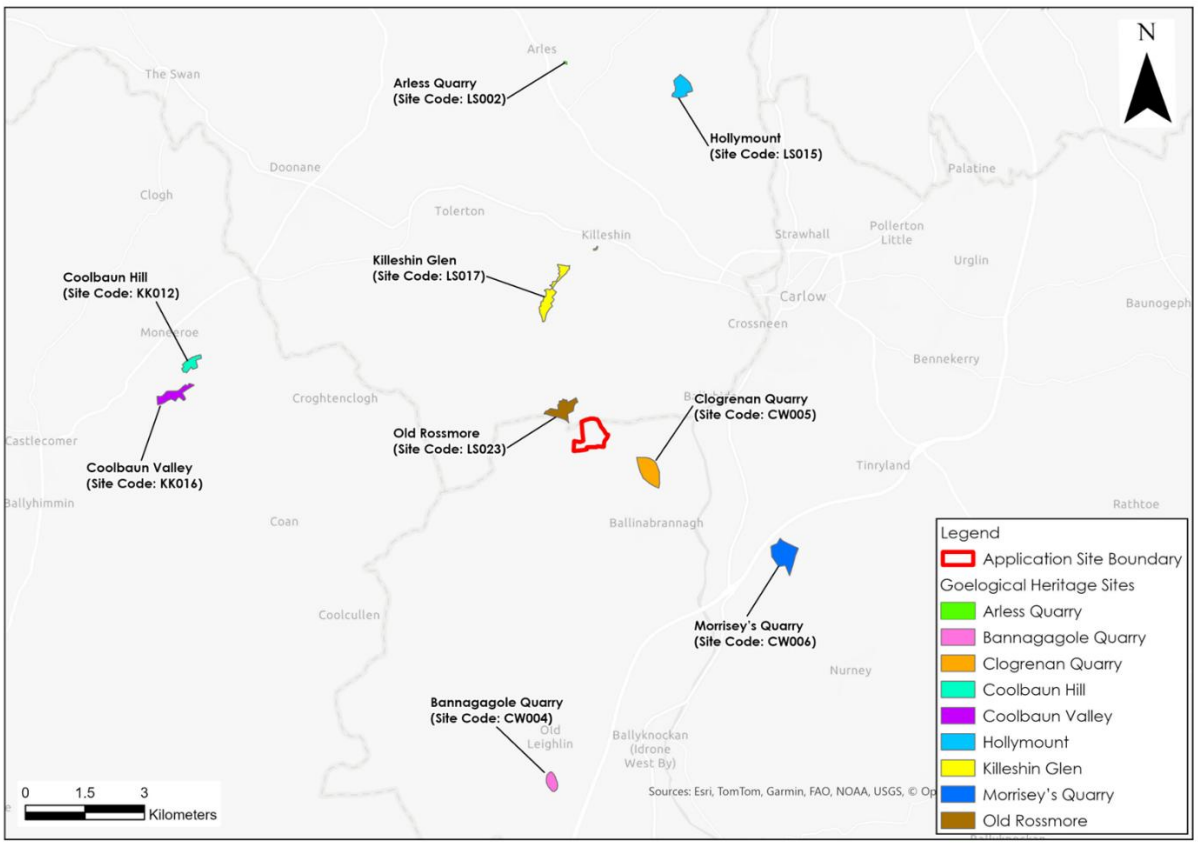

Figure 7-4: Geological Heritage Areas (www.gsi.ie)

7.3.8 Geohazards

The GSI Landslide database (www.gsi.ie) does not record any historic landslides in the vicinity of the Development Site or in the surrounding lands. The closest mapped landslide is at Maidenhead/Arless, Co. Laois, located ~10.8km north of the Development Site.

The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at a given location. The probability of a landslide occurring at the Development Site is predominantly 'Low'. The GSI map the land to the east of the Development Site as having 'Moderately High' susceptibility to a landslide. This is due to the steep slope of the land in this area which marks the eastern boundary of the Castlecomer Plateau. Landslides in Ireland are typically associated with peat soils/subsoils, however, there are no peat deposits in this area.

Furthermore, the Applicant's records do not document the occurrence of any historic landslides at the Development Site. No signs of instability were recorded during the site walkover surveys completed by HES.

7.3.9 Soil Contamination

During site walkover surveys and site investigations, no evidence of soil contamination was recorded at the Development Site. Whilst previous quarrying operations were completed at the Development Site, there is no evidence of contaminated tailings. The spoil heaps comprise of shale and have begun to revegetate. All quarrying operations at the Development Site were completed in accordance with tried and tested, best practice measures to prevent soil/subsoil and bedrock contamination. Similar mitigation measures have been implemented at numerous bedrock quarries and sand and gravel pits across the country.

According to the EPA online mapping database (www.epa.ie), there are no licenced waste facilities or dump sites within the Proposed Development Site or in the surrounding lands. The closest mapped waste facility is located in the townland of Cappanboe (Site Code: W0158), located ~7.5km to the north-northeast of the Development Site.

Furthermore, there are no Industrial Emissions (IE) licences/Integrated Pollution Control (IPC) Licence facilities in the immediate area of the Development Site. The closest mapped IEL licence is located ~1km southeast of the Development Site. This IEL site is operated by Clogrennane Lime Limited (Carlow) (P0400-03).

The GSI online database (www.gsi.ie) records the presence of several historic quarries in the Clogrennane area. These historic quarries typically date from the early to mid-20th century. No historic quarries are mapped within the Development Site land which may have contaminated tailings.

7.3.10 Receptor Sensitivity

The land, soils and bedrock geological formations underlying the Development Site will be included in the remedial impact assessment due to the direct effect that the Development had on these receptors. As stated in Section 7.3.5.3, the Development comprised the extraction of ~650,000m^3 of rock. The Development also included the stripping of soils and subsoils from the extraction area and resulted in a change in land-use from agricultural pastures to an active bedrock quarry.

The poorly to moderately drained soils and subsoils which exist at the Development Site can be considered as being of 'Low' to 'Medium' importance (refer to **Table 7-1**). Meanwhile, the bedrock can be considered as being of 'High' importance as the rock at the Development Site was previously extracted and was a proven extractable and economically viable resource.

All designated sites and geological heritage areas have been screened out of the remedial impact assessment. There was no potential for the Development to affect the land, soils and geological environment outside of the Development Site boundary. There is no overlap between the Development Site any geological heritage site and/or designated site. Therefore, there was no potential for effects to occur on land, soils and geological characteristics of any geological heritage site or designated site.

7.4 Characteristics of the Development

A full description of the Development and all works completed at the Development Site post-dating the 1995 baseline are described in full in Chapter 3 of this rEIAR.

7.4.1 Extraction Phase (1995 Baseline to 2023)

During the Extraction Phase quarrying, specifically the extraction of sandstone rock, occurred at the Development Site. The development consisted of quarrying including rock extraction by mechanical means including extraction areas, stockpiling areas, surface water management and ancillary works. The quarry included an extraction area of 8.66ha within a wider landholding of c.45.79 ha and involved extraction of c. 650,000 m^3 of material over this period. Rock extraction was completed by rock breaking and no blasting was completed at the Development Site. All rock was crushed and processed with mobile plant on-site and spoil was stored in large spoil heaps within and surrounding the quarry void.

The extraction of bedrock in the greenfield areas was proceeded by site preparation works comprising of vegetation removal and soil/subsoils stripping. This material was used in the construction of boundary berms and will be used in the phased restoration of the Development Site.

During this period ancillary infrastructure was also constructed at the Development Site. This took the form of site offices and welfare buildings and site access roads. All drainage infrastructure including settlement ponds.

It is noted that large-scale quarrying activities ceased in 2014. Between 2014 and 2023 there was minor consolidation works completed at the Development Site, with some minor extraction. The final extraction area in 2023 was noted to be 8.66ha (based on aerial imagery).

7.4.2 Current Phase (2023 to Present)

The Current Phase of the Development includes all activities carried out at the Development Site from the time that the Applicant took ownership of the Development Site in 2023 to the present day.

There was limited activity at the Development Site during this period, limited to environmental monitoring. The quarry has remained inactive throughout the duration of the Applicant's ownership. The drainage infrastructure, settlement pond, wet areas and discharge locations continue to be in operation.

7.4.3 Restoration Phase

The extraction area will be restored to agricultural grassland using material from an existing infill area in the west of the site. Revegetation will be allowed to occur naturally. The restoration plan also includes the planting of existing soil storage areas with woodland mosaic.

7.5 Assessment of Significant Effects and Mitigation Measures

7.5.1 "Do Nothing" Scenario

As outlined in the EPA Guidelines (May 2022), the description of the 'Do-Nothing Effects' related to the environment as it would be in the future should the project not be carried out. As discussed above, the baseline for this project is considered to be 1995, a time which predates any extraction of bedrock at the Development Site. The 'Do-Nothing' Scenario is defined as the quarrying at the Development Site never having taken place.

In the event that quarrying never took place at the Development Site, it is assumed that those lands would have continued as agricultural lands. Other land-use practices may also have taken place at the Development Site such as commercial forestry or other commercial or non-commercial uses.

The Do-Nothing Scenario also considers the current environment and the scenario whereby the proposed restoration plan will not be implemented. In this scenario, natural revegetation of the Development Site, predominantly the spoil heaps would continue over time. In this Do-Nothing Scenario, there would be no significant change to the land, soils and geological environment from its current condition. The positive effects associated with the proposed restoration plan, which is designed to offset some of the impacts associated with the previous quarrying activities, at the Development Site would be lost. The extraction area would remain as an abandoned quarry, surrounded by boundary berms, and the Development Site would not be restored to grassland/scrubland and the existing spoil storage areas would not be planted with native woodland.

7.5.2 Identification of Effects

7.5.2.1 Extraction Phase (1995 Baseline to 2023)

7.5.2.1.1 Effects on Land (Land-Take and Topographic Changes)

The Extraction Phase of the Development resulted in a change in the land environment from greenfield agricultural lands (agricultural pastures) to a bedrock quarry (rock extraction site) across the footprint of the expanded extraction area. Prior to rock extraction, vegetation was cleared and overburden removed from specific areas. The Development resulted in progressive, incremental changes to the land environment during the Extraction Phase as the extraction area expanded to the south. A rapid expansion of the extraction area occurred between 2005 and 2010 where the extraction area increased from 3.61 to 6.29ha. The final extraction area at the end of the Extraction Phase in 2023 was 8.66ha. Therefore, the Development resulted in a long-term effect on the land environment across this area.

The effects on land, in terms of land-take, were also localised to where the quarry activities took place. This area comprises of 8.66ha (60.9%) of the total area of the Development Site (14.22ha). There were no effects on the surrounding lands.

In terms of topographic changes, the removal of overburden would have lowered the surface topography in the extraction areas by ~1m due to the relatively thin soils/subsoils at the site. The overburden was stored in boundary berms which would also have resulted in local topographic changes. The greatest change to topography was associated with the extraction of bedrock. The floor level of the existing quarry void stands at ~304mOD. Pre-development topography across the extraction area ranged from ~319-315mOD. Therefore, the topography in the quarry void has been lowered by ~11-15m, a permanent effect on the land environment.

There were no effects on any lands adjoining the Development Site.

The effects on land and topography are considered to be moderate as whilst the effect altered the character of the environment, it was consistent with existing and emerging baseline trends. It is noted that there was a history of mineral extraction at the Development Site, with a historic gravel pit recorded at the Development Site. Furthermore, several extraction sites are present in the surrounding lands as detailed in Section 7.3.6.

Pathway: Excavation and relocation of soil and subsoils and excavation of bedrock.

Receptor: Land and topography.

Assessment of effects in the absence of mitigation: Due to the nature of the Development, which involved the extraction of bedrock and lowering of topography, there would have been effects to the land environment in terms of land-take and topography. Land use and topographic changes would have occurred throughout the Extraction Phase as the quarry expanded to the south. The effect in the absence of control measures could potentially have been similar to the residual effect described in Section 7.7.1.1 i.e. a negative, direct, moderate, permanent effect on land and topography at the

Development Site. The effect would have been moderate as there is a history of extraction in the local area (i.e. the Development was consistent with emerging and baseline trends).

7.5.2.1.2 Effects from the Excavation of Soils and Subsoils

The Extraction Phase of the Development involved the removal of ~86,600m^3 of soil/subsoil which was stripped from the extraction area (based on the existing quarry void being 86,600m^2 and an average overburden thickness of 1m).

The excavated material was used to construct screening berms around the extraction area.

Pathway: Extraction.

Receptor: Soils and subsoils.

Assessment of effects in the absence of mitigation: Due to the very nature of quarrying, which requires the removal of overburden to expose the underlying bedrock, a significant effect on soils and subsoils has occurred within the extraction area. However, the soils/subsoils in this area are shallow and are not designated, and some form of extraction had occurred historically (historic gravel pit) at the Development Site. Therefore, the effect in the absence of control measures could potentially have been similar to the residual effect described in Section 7.7.1.2 i.e. a negative, slight, direct, likely, and permanent effect on soils and subsoils.

7.5.2.1.3 Contamination of Soils/Bedrock due to Oil/Fuel Spillages and Leaks

Accidental spillage during refuelling of machinery and plant (static and mobile) with petroleum hydrocarbons was a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk over time. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e. contamination of soils, subsoils and pollution of the underlying aquifer) on the geological and water environment. Discharges from wastewater systems (septic tanks) at office buildings could potentially have caused contamination.

These potential effects (i.e. the potential for contamination of soils, subsoils and bedrock from the spillage of hydrocarbons or the release of untreated wastewater) existed at the Development Site during the Extraction Phase. However, there is no visible evidence of a significant pollution events/spills at the Development Site.

Pathway: Infiltration through pore space in soil, subsoil and bedrock.

Receptor: Soil, subsoil and bedrock.

Assessment of Effects in the absence of mitigation: In the absence of mitigation measures relating to refuelling and the storage of hydrocarbons and wastewater, the effect could potentially have been greater than the residual effect described in Section 7.7.1.3. However, to the best of our knowledge there was no evidence of significant contamination at the Development Site, and if there was a spill it would have been localised and would likely have been absorbed into the environment at a local scale. The effect could potentially have been a negative, moderate, direct, long-term, unlikely effect on soils, subsoils and bedrock.

7.5.2.1.4 Effects from the Erosion of Exposed Soils and Subsoils

There was high likelihood of erosion of soil and subsoil during the excavation of soils and subsoils and during the extraction works. The main impacts associated with this aspect is to the water environment, and therefore this aspect is further assessed in detail in Chapter 8 Water.

Pathway: Vehicle movement, surface water and wind action.

Receptor: Soil and subsoil.

Assessment of effects in the absence of mitigation: In the absence of mitigation measures the effect could potentially have been greater than the residual effect described in Section 7.7.1.4. The effect could potentially have been a negative, slight, direct, short-term, likely effect on soil and subsoils by erosion and wind action.

7.5.2.1.5 Effects Associated with Bedrock Extraction

Rock extraction was undertaken at different levels of intensity throughout the Extraction Phase. The Development involved the extraction of ~650,000m^3 of bedrock from the Development Site.

Bedrock was extracted using breaking techniques for quarrying activities. The extracted rock was processed on-site using mobile crushing and screening plant.

There was no crushing or processing of bedrock off-site.

Pathway: Extraction.

Receptor: Bedrock.

Assessment of effects in the absence of mitigation: Due to the very nature of quarrying, effects have occurred on bedrock at the Development Site. The effects result from the permanent removal of rock from the Development Site. The effect in the absence of mitigation measures could potentially have been the same as the residual effect described in Section 7.7.1.5 *i.e.* a negative, irreversible, moderate, direct, likely, permanent effect on bedrock. The effects are considered to be moderate due to the significant volume of rock remaining in the local area in comparison to the volumes extracted.

7.5.2.2 Current Phase (2023 to Present)

7.5.2.2.1 Effects on Land (Land-Take and Topographic Changes).

There has been no extraction of bedrock or change in landuse since the Applicant took ownership of the Development Site in 2023.

The cessation of all quarrying activities at the Development Site at the end of the Post-Extraction Phase resulted in a positive change to land, in terms of land-use, with a change from an active extraction site to a former extraction site available for natural revegetation. Surveys have revealed that spoil heaps throughout the extraction area are revegetating.

However, there has been no significant change in land to date, with the Development Site comprising of an abandoned quarry void with spoil heaps surrounded by agricultural pastures. Similarly there has been no significant changes to local topography during the Current Phase.

Pathway: Cessation of quarrying.

Receptors: Land and topography.

Assessment of effects in the absence of mitigation measures: The cessation of quarrying activities can be considered to be a positive effect, however, there has not been any significant change to the land environment (only revegetation of spoil heaps). The effect could potentially have been the same as the residual effect described in Section 7.7.2.1 i.e. a positive, direct, significant, effect on land at the Development Site. No significant effects have occurred since the cessation of quarrying in 2014.

7.5.2.2.2 Effects on Bedrock

No bedrock extraction has occurred since the Applicant took ownership of the Development Site in in 2023. Therefore, there has been no change in terms of rock volumes remaining at the Development Site during the Current Phase.

Pathway: Extraction.

Receptor: Bedrock.

Assessment of effects in the absence of mitigation: There would not have been any effects on bedrock and the could potentially have been the same as the residual effects described in Section 7.7.2.2 i.e. no residual effect.

7.5.2.2.3 Contamination by Leakages and Spillages

Since the Applicant tool ownership of the Development Site in 2023, there has been very limited activity at the Development Site. This activity has been limited to walkover surveys and environmental monitoring. The risks are of a significantly lesser extent than those which were present during the Extraction Phase.

Pathway: Infiltration through pore space in soil, subsoil and bedrock.

Receptor: Soil, subsoil and bedrock.

Assessment of effects in the absence of mitigation: To the best of our knowledge there was no evidence of significant contamination at the Development Site, and if there was a spill it would have been localised and would likely have been absorbed into the environment at a local scale. The effect could potentially have been a negative, slight, direct, long-term, unlikely effect on soils, subsoils and bedrock.

7.6 Avoidance, Remedial & Mitigation Measures

7.6.1 Extraction Phase (1995 Baseline to 2023)

7.6.1.1 Effects on Land (Land-Take and Topographic Changes)

In terms of effects within the Development Site, the effect on land and topography was considered to be significant as the landuse and topography within the extraction area was significantly altered from its 1995 baseline condition. However, these effects are considered to be an acceptable and unavoidable consequence of all quarry developments.

On a more regional scale, the loss of ~8.66ha of agricultural land is minimal. The Development Site is located in a rural area of County Carlow and is surrounded by agricultural lands. Therefore, the effects of actual agricultural land loss in the wider area was not considered to be significant.

Given the local undulating topography of the local area, and the location of the Development Site on a topographic high on the eastern edge of the Castlecomer Plateau changes to topography were minimal within the context of the overall landscape. The stripped overburden material and the material from the existing stockpiles, was used in the construction of boundary berms surrounding the extraction area, with excess spoil to be stored in the spoil storage area. The construction of the boundary berms assisted in screening the Development and assimilating into the landscape.

Mitigation includes a phased restoration plan which will return the extraction areas to agricultural land and scrubland.

7.6.1.2 Effects from the Excavation of Soils and Subsoils

Site earthworks resulted in a direct impact on local soils and subsoils

The impacts was localised (i.e. only within the extraction area) and was mostly mitigated through the adoption of a suitable landscape and restoration plan which will be undertaken as part of the restoration phase. The stripped topsoil was used to form berms around the extraction area, with any excess spoil being stored in the designated spoil storage areas.

The effects were considered to be an acceptable and unavoidable part of the Development as the soils and subsoils must be removed in order to expose the underlying bedrock which was extracted for economic purposes.

The excavated soils/subsoils are not notable from a geological heritage point of view.

7.6.1.3 Effects due to Oil/Fuel Spillages and Leaks

Whilst there is no record of the mitigation measures implemented at the site with respect to hydrocarbons there is no evidence of pollution or spillages at the site. The highest standards of site management were likely maintained and utmost care and vigilance followed to prevent accidental contamination or unnecessary disturbance to the site during the operation of the quarry. These measures would have been tried and tested, best practice measures and would have been the same as those which are implemented at quarries across the country. No additional mitigation measures with respect to hydrocarbons would have been required.

The Section 261 Registration Notification from 2007 included a condition which restricted the construction of ancillary buildings. There is no evidence of wastewater disposal from the site and all wastewater was likely removed from the site by a licenced contractor.

7.6.1.4 Effects from the Erosion of Exposed Soils and Subsoils

The following mitigation measures were adopted during the Extraction Phase to prevent the erosion of soils and subsoils:

- Soils and subsoils removed from the quarry area were used to create boundary berms around the extraction site, with excess spoil being stored in the designated spoil storage areas;
- Where possible the upper vegetative layer (where still present) was stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored soil within the restored areas;
- The berms and spoil storage areas were sealed with a digger bucket; and,
- Re-seeding and spreading/planting were also carried out in these areas.

7.6.1.5 Effects Associated with Bedrock Extraction

Bedrock extraction resulted in a direct impact on the local geological environment.

The bedrock was considered to be of 'High' importance and had high potential for the development of a quarry. The bedrock extraction was considered to be an acceptable and unavoidable part of the Development. However, the effects were localised within the extraction area.

Therefore, no specific mitigation measures in relation to the excavation of bedrock were required.

The rock to be quarried at the Development Site was not notable from a geological heritage point of view.

7.6.2 Current Phase (2023 to Present)

7.6.2.1 Effects on Land (Land-Take and Topographic Changes)

The area of land owner by the Applicant remained the same. There was no effects on land or topography since the change in land use from an active quarry to a former extraction site.

No specific mitigation measures were required.

7.6.2.2 Effects on Bedrock

No mitigation measures were required as no rock was extracted during the Current Phase.

7.6.2.3 Contamination by Leakages and Spillages

There was very little activity at the Development Site during the Current Phase. The mitigation measures detailed in Section 7.6.1.3 were also implemented during the Current Phase for any site-going vehicles.

7.7 Residual Effects

7.7.1 Extraction Phase (1995 Baseline to 2023)

7.7.1.1 Effects on Land (Land-Take and Topographic Changes)

Residual Effects: The baseline environment at the Development Site was characterised by agricultural pastures. The Development resulted in a permanent change to the land environment associated with the removal of bedrock and the lowering of local topography within the extraction area. The residual effect was a negative, direct, moderate, permanent effect on land and topography at the Development Site.

Significance of Effects: For the reasons outlined above, and with the implementation of the listed mitigation measures, no significant effects on land occurred.

7.7.1.2 Effects from the Excavation of Soils and Subsoils

Residual Effects: The soils and subsoils present at the Development Site required removal in order to expose the underlying bedrock which was extracted for economic purposes. This removal of overburden was considered an acceptable impact associated with the Development. The residual effect was a negative, slight, direct, likely, and permanent effect on soils and subsoils.

Significance of Effects: For the reasons outlined above, no significant effects on soils and subsoils occurred.

7.7.1.3 Effects due to Oil/Fuel Spillages and Leaks

Residual Effects: The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all quarry sites. Proven and effective measures to mitigate the risk of spills and leaks have been implemented at the Development Site. Similar measures are being implemented at quarry sites across the country. It is understood that no significant fuel spills or wastewater discharges have occurred during the Extraction Phase. The residual effect was a negative, direct / indirect, imperceptible, long-term, unlikely, effect on soils, subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on soil, subsoil and bedrock occurred.

7.7.1.4 Effects from the Erosion of Exposed Soils and Subsoils

Residual Effects: Soils and spoil may have been eroded by vehicle movements, wind action and by water movement during the Extraction Phase. To prevent this material was moved the least possible distance, and reseeding and planting was completed. These are tried and tested, best practice mitigation measures which are implemented at quarry sites across the country. Following implementation of the mitigation measures the residual effects was a negative, slight, direct, short-term, likely effect on soils and subsoils by erosion and wind action.

Significance of Effects: No significant effects on soils or subsoils occurred.

7.7.1.5 Effects Associated with Bedrock Extraction

Residual Effects: While the bedrock which was removed was considered to be of 'High' importance, these bedrock formations are also present outside of the Development Site within the surrounding

area. The residual effect is considered to be negative, irreversible, moderate, direct, likely, permanent effect on bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on the local bedrock occurred.

7.7.2 Current Phase (2023 to Present)

7.7.2.1 Effects on Land (Land-Take and Topographic Changes)

Residual Effects: A significant change to the land environment occurred with the cessation of all quarrying activities in 2023. No quarrying activities have been undertaken since the Applicant took ownership of the site in 2023. This land-use change results in a positive, direct, significant, long-term, effect on land. There has not been any subsequent changes to land since the cessation of quarrying.

Significance of Effects: For the reasons outlined above, no significant effects have occurred.

7.7.2.2 Effects on Bedrock

Residual Effects: There was no residual effect on bedrock during the Current Phase.

Significance of Effects: For the reasons outlined above, no significant effects on the local bedrock occurred.

7.7.2.3 Contamination by Leakages and Spillages

Residual Effects: No adverse effects have occurred. There was very limited activity at the Development Site during the Current Phase. The residual effects was a negative, imperceptible, direct, long-term, unlikely effect on soils, subsoils and bedrock.

Significance of Effects: For the reasons outlined above, no significant effects on soils, subsoils and bedrock occurred.

7.8 Restoration Phase

It is proposed to restore the extraction area. This restoration will be completed by spreading a thin layer of crushed rock over the floor of the extraction area followed by the spoil material stored in the spoil storage area and in the boundary berm. The restored areas will revert to grassland/scrubland via natural regeneration. In addition, hedgerows will be planted and stonewalls inserted across the Development Site to reinstate the field boundaries. The soil storage areas at the northwest and northeast of the site will be planted with native woodland species.

The restoration of the Development Site will have a positive effect with respect to the land, soils and geological environment.

No negative effects on the land, soil and geological environments are expected during the restoration phase or post restoration. The restoration will have a positive effect in terms of returning the extraction area back to its existing agricultural use. Tried and tested, best practice mitigation measures will be implemented during all restoration work which will ensure that there is no potential for contamination of soils, subsoils and/or bedrock.

7.9 Risk of Major Accidents and Disasters

Major Accidents and Disasters (MADS) refer to events that are not part of any activity or normal operation for a development. Many MADS related to quarrying activities were preventable and readily addressed or prevented by good planning, design, emergency response planning and mitigation.

The primary risk of MADS associated with the Development was the accidental release of fuels or oils. However, there are no records of significant spills or leaks of hydrocarbons at the Development Site. Furthermore, tried and tested, best practice mitigation measures in relation to hydrocarbons were implemented during the quarrying activities. These mitigation measures in relation to leakages/spills are detailed in Section 7.5.2.1.3 and are the same as those which are implemented at similar quarry sites across the country.

In terms of the land, soils and geological environment, no MADS occurred and there no effects were associated with unplanned events.

7.10 Assessment of Human Health Effects

Potential health effects in relation to soils and geology mainly occur due to direct and indirect (dust) contact with contaminated soil. However, no contaminated soil was present at the Development Site. Furthermore, throughout all phases of the Development best practice measures and controls were in place to ensure any potential sources of contamination managed appropriately. Also, the Development Site was not open to the public and therefore, direct contact is unlikely.

Hydrocarbons, in the form of fuels and oils, will be used on-site during extraction works. However, the volumes were small and handled in accordance with best practice mitigation measures. The potential residual effects associated with land, soils and geology contamination and subsequent health effects were negligible.

7.11 Potential Cumulative Effects

The dominant land use activity in the local area is agriculture which was not expected to contribute to any cumulative effects on the land, soils and geological environment. There were several other mineral extraction sites and quarries located in the surrounding lands. The Development resulted in the extraction of 650,000m^3 of bedrock from an extraction area of 8.66ha. The Development therefore resulted in a minor cumulative effect on land, with an increase in the local land being used for the extractive industry. However, on a local and regional scale this effect was considered to be imperceptible.

Due to the lack of any significant residual effects from the Development that would have affected the wider geological environment, there was no significant cumulative effects on land, soils and geology resulting from the Development, and other local existing developments, projects and plans. All effects on the land, soils and geological environment relating to the Development were localised and contained within the Development Site.

7.12 Monitoring

No monitoring was required in terms of the land, soils and geological environment.

7.13 Interactions

None.

7.14 References

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