# 7 LAND, SOILS AND GEOLOGY

## 7.1 Introduction

### 7.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by Tom Phillip's and Associates (TPA) to carry out an assessment of the potential likely and significant effects of the proposed lateral expansion of Red Rock Quarry (i.e. the 'Proposed Development') at Clogrennane, Co. Carlow on the land, soil and geological environment.

This chapter of the Environmental Impact Assessment Report (EIAR) provides a baseline assessment of the environmental setting of the Proposed Development Site, as described in Chapter 3, in terms of land, soils and geology and discusses the potential likely significant effects that the operation and restoration phases of the Proposed Development will have. Where required, appropriate mitigation measures to avoid any identified significant effects to land, soils and geology are recommended and the residual effects of the Proposed Development post-mitigation are assessed. This chapter also identifies and assesses any potential likely significant cumulative effects which may result from the Proposed Development.

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

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

### 7.1.2 Scoping and Consultation

As detailed in Section 1.5 of the EIAR a non-statutory scoping exercise was completed by TPA for the EIAR.

A scoping request was also submitted to Carlow County Council but no response has been received.

### 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 EIAR 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.

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 4 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.

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 EIAR 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 EIAR 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 (2002) Geology in Environmental Impact Statements, A Guide;

- 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) Environmental Impact Assessment of National Road Schemes - A Practical Guide;
- 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 Proposed Development Site and surrounding area was carried out in November 2024 to collect all relevant geological data. The initial desk study was completed to supplement site walkover surveys and site investigations. The desk study information has been checked and updated, where necessary, in May 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 Proposed 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 exposures.

In summary, the site investigations (recent and historic) to address the land, soils and geology chapter of the EIAR included the following:

- HES completed walkover surveys of the Proposed 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 12th November 2025. The purpose of these site walkover surveys was to assess the ground conditions and layout of the Proposed 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;
- 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.<br>Degree or extent of soil contamination is significant on a national or regional scale.<br>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).<br>Large existing quarry or pit. Proven economically extractable mineral resource |
| **High** | Attribute has a high quality, significance or value on a local scale.<br>Degree or extent of soil contamination is significant on a local scale.<br>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.<br>Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site).<br>Well drained and/or highly fertility soils.<br>Moderately sized existing quarry or pit Marginally economic extractable mineral resource. |
| **Medium** | Attribute has a medium quality, significance or value on a local scale.<br>Degree or extent of soil contamination is moderate on a local scale.<br>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.<br>Small recent landfill site for mixed Wastes.<br>Moderately drained and/or moderate fertility soils. Small existing quarry or pit.<br>Sub-economic extractable mineral Resource. |
| **Low** | Attribute has a low quality, significance or value on a local scale. | Large historical and/or recent site for construction and demolition wastes. |

| Importance | Criteria | Typical Example |
|---|---|---|
| | Degree or extent of soil contamination is minor on a local scale.<br>Volume of peat and/or soft organic soil underlying site is small on a local scale | Small historical and/or recent landfill site for construction and demolition wastes.<br>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<br><br>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<br>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 EIAR Site Boundary. There is no potential for the Proposed Development to affect the land, soils and geological environment outside of the Proposed Development Site.

### 7.2.5 Limitation and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Land, Soils and Geology Chapter of this EIAR.

## 7.3 Receiving Environment

### 7.3.1 Site Description and Topography

The Proposed Development Site is located in the townland of Clongrenan, Co. Carlow, and lies immediately to the south of the Laois – Carlow county border. The Proposed Development Site is located ~1.5km east of the small village of Bilboa, Co. Laois which was historically a coal-mining settlement. The Proposed Development Site also lies ~5km southwest of Carlow town and ~7.5km northwest of the town of Leighlinbridge, Co. Carlow. The landholding covers a total area of 45.68 hectares with the Proposed Development Site covering an area of 41.86ha. It is proposed to extend the quarry to an extraction area covering 16.17ha (the existing extraction footprint is 8.66ha).

The Proposed 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.

The Proposed Development Site currently comprises of an existing quarry void which is surrounded by agricultural lands. Red Rock Quarry was previously used to extract sandstone bedrock, with the main extraction ceasing in 2014. The floor of the existing quarry stands at ~304mOD (metres above Ordnance Datum). The existing quarry contains several large stockpiles of spoil which have vegetated in places. An access track passes through the centre of the existing void. Some old plant, machinery and workshops are located to the east of the Proposed Development Site, adjacent to the L3896/L7134. Meanwhile, the lateral expansion lands are located predominantly to the south and southwest of the existing void. These lands comprise of rough agricultural pastures. Meanwhile, the lands to the east of the Proposed Development Site comprise of good agricultural pastures.

The Proposed 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 Proposed Development Site range from ~319mOD in the west to ~310mOD in the east. 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 existing topography in the east of the lateral extension lands slopes steeply to the east.

Meanwhile, the rough agricultural pastures to the southwest of the existing quarry void are relatively flat.

### 7.3.2 Land (Land-Take)

According to Corine landcover mapping (2018) (www.epa.ie), the majority of the Proposed Development Site area is mapped as agricultural pasture land with small area in the west of the Proposed Development Site mapped as land principally occupied by agriculture with significant areas of natural vegetation. The lands surrounding the Proposed Development Site are mapped largely as agricultural lands with an area of transitional woodland scrub located to the east of the Proposed 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 Proposed Development Site and across the surrounding lands. The Proposed Development Site is comprised of an existing quarry void which was associated with the previous extraction of bedrock from Red Rock Quarry. Meanwhile, the lateral expansion lands comprise of agricultural pastures. Mature hedgerows are present throughout these lands, delineating local field boundaries. 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.

### 7.3.3 Soils and Subsoils

#### *7.3.3.1 Desk Study*

The published Teagasc soil maps (www.gsi.ie) for the local area shows that the majority of the Proposed 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 Proposed 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 Proposed 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.

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

#### *7.3.3.2 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 (~20.7% of the total Proposed Development Site area).

Apex Geophysics completed a geophysical investigation at the Proposed Development Site between 11th and 15th March 2024 (Apex, 2024). The objective of these preliminary, non-intrusive, 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 Proposed 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 Proposed 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, the natural soils and subsoils at the Proposed Development Site are thin. The borehole logs show a range of soil and subsoil conditions, depending on their location within the Proposed 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 lateral extension area in the southwest of the Proposed 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 Proposed Development Site, has 0.3m of topsoil and 0.7m of firm silty gravelly CLAY over weathered shale.

Therefore, the subsoil profile across the Proposed 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**.

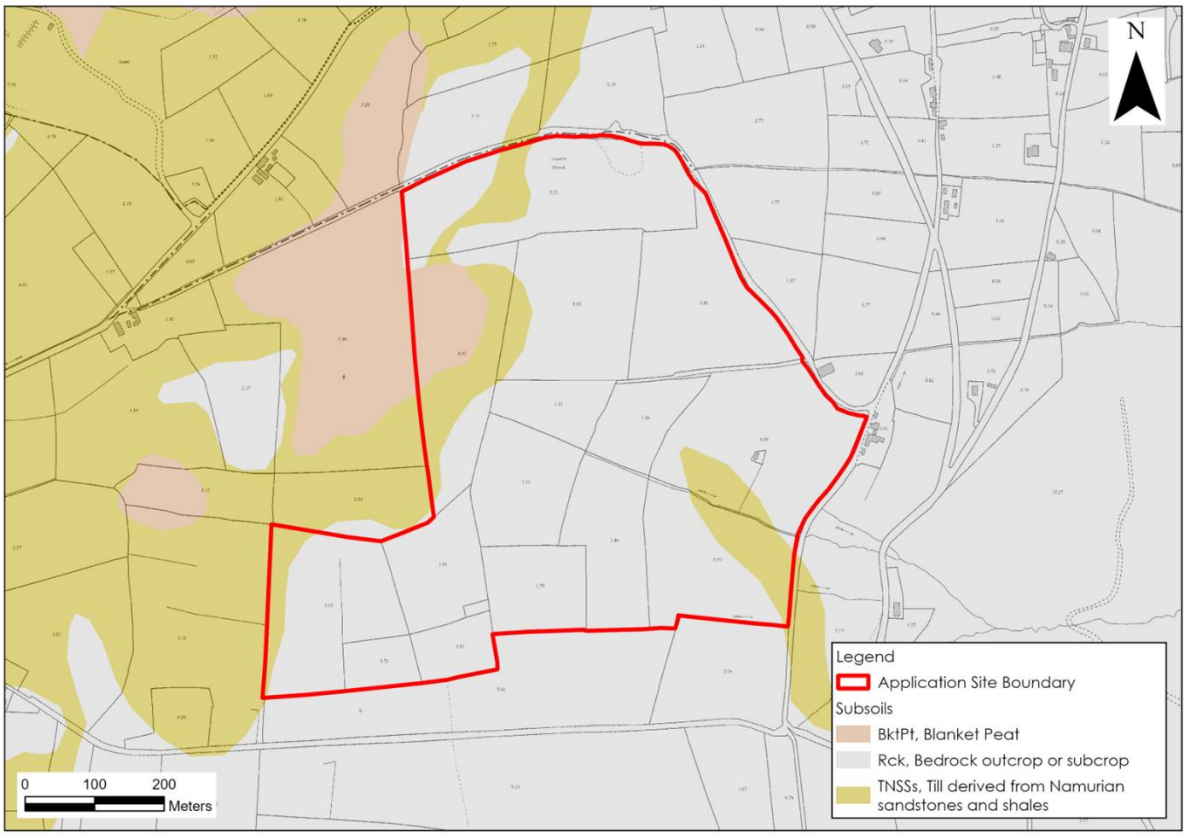


*Figure 7-1: Local Subsoils Map (www.gsi.ie)*

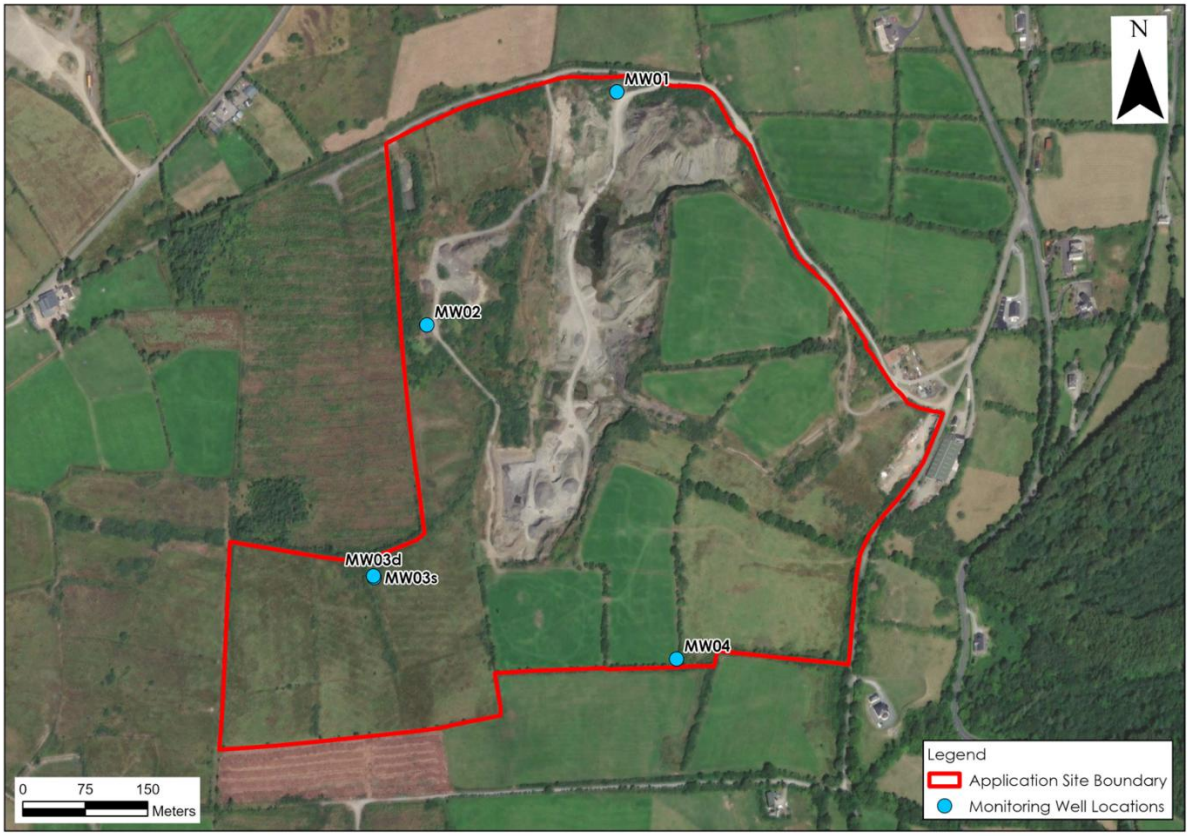


*Figure 7-2: Map of Site Investigation Points*

### 7.3.4 Bedrock Geology

#### *7.3.4.1 Desk Study*

The GSI's bedrock geology map for the local area (www.gsi.ie) shows that the majority of the Proposed Development Site is underlain by the Moyadd Coal Formation described as shale, siltstone and minor sandstone. Meanwhile, the southwest of the Proposed 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 Proposed Development Site. Another fault of similar orientation is mapped ~40m to the north of the Proposed Development Site.

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

There are no GSI mapped karst features within the vicinity of the Proposed 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.

#### *7.3.4.2 Site Investigations*

Initial site walkover surveys, comprehensive visual inspections and geological mapping of the existing exposed faces of bedrock at Red Rock 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 Proposed 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 existing quarry void is predominantly sandstone whilst other areas contain a higher proportion of shale.

As stated above in Section 7.3.3, the geophysical surveys completed at the Proposed 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 Proposed 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 Proposed 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 Proposed 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.

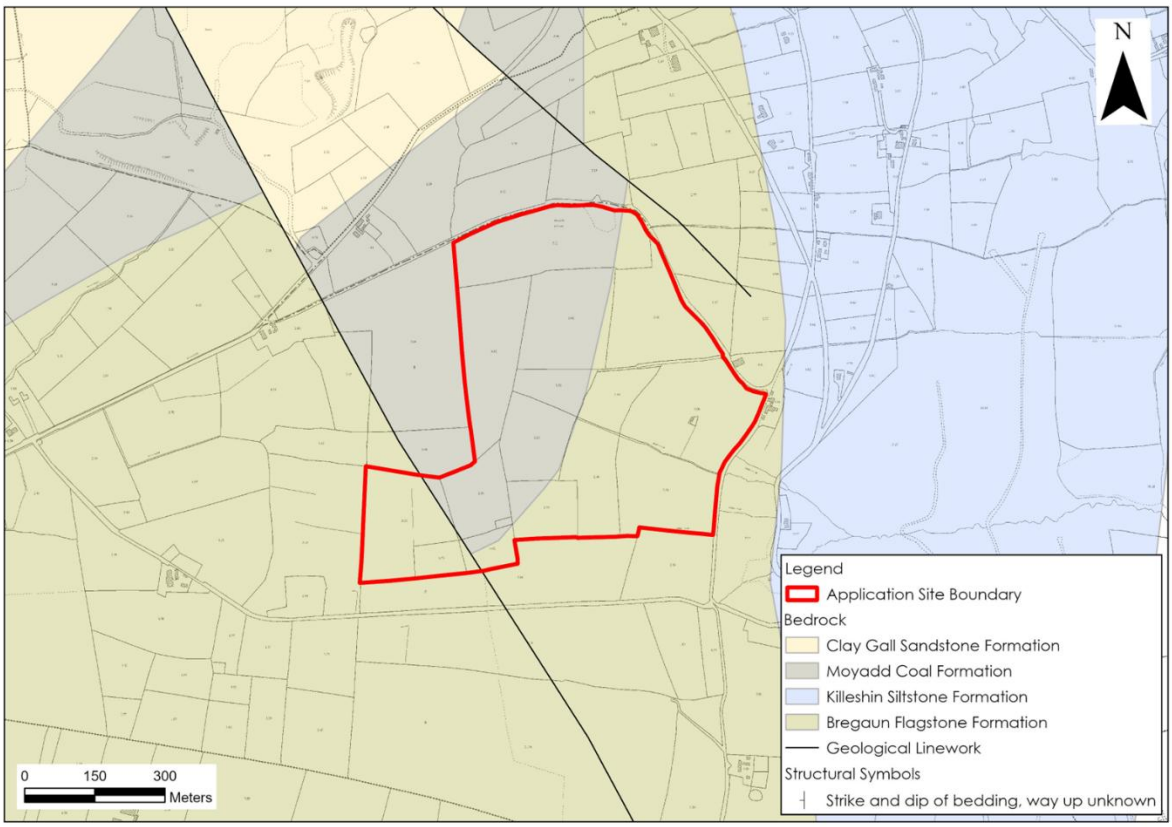


*Figure 7-3: Bedrock Geology Map (www.gsi.ie)*

### 7.3.5 Geological Resource Importance

The GSI database[1] (www.gsi.ie) shows that the majority of the Proposed 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 Proposed Development Site are mapped as having 'Moderate' crushed rock aggregate potential. The bedrock underlying the Proposed Development Site could be classified as being of 'High' importance as bedrock has previously been extracted at the Proposed Development Site and is has proven to be economically viable.

In terms of the local soils and subsoils, the Proposed Development Site is not mapped by the GSI (www.gsi.ie) as having granular aggregate potential. The overburden deposits at the Proposed Development Site, comprising predominantly of firm gravelly CLAY, can be classified as being of 'Low' Importance.

The GSI Online Minerals Database (www.gsi.ie) records the presence of an old quarry located ~1.1km west of the Proposed Development Site. This quarry was operational between 1975-1995 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 Proposed 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).

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

Additional information provided by the GSI state that this was an open cast mine, previously operated by Chesswell Ltd, which has now closed.

### 7.3.6 Geological Heritage and Designated Sites

#### *7.3.6.1 Geological Heritage*

The Proposed 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 Proposed 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 an NHA.

Other Geological heritage areas within 10km of the Proposed Development Site are listed in **Table 7-3** below.

Clogrenan Quarry CGS (Site Code: CW005) is located ~1.15km southeast of the Proposed 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.

*Table 7-3: 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 wackestones 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 |

#### *7.3.6.2 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 Proposed 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 EIAR.

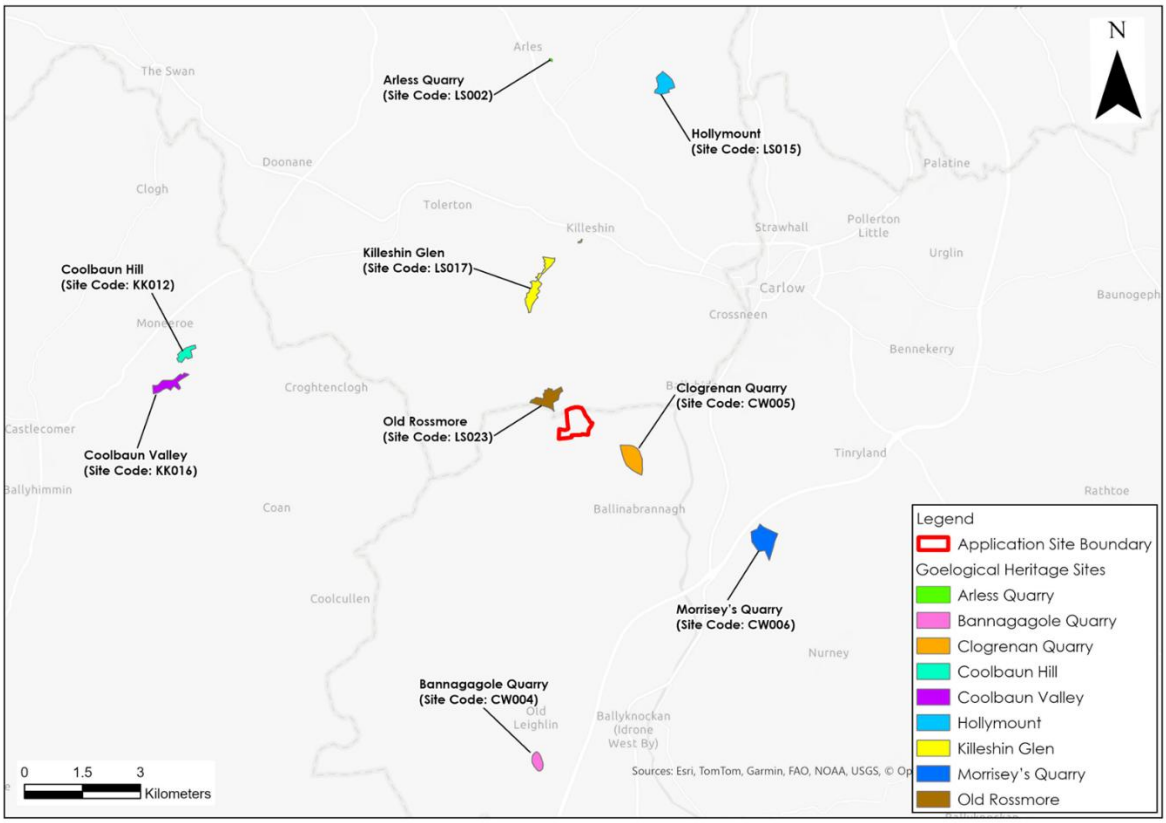


*Figure 7-4: Geological Heritage Areas (www.gsi.ie)*

### 7.3.7 Geohazards

The GSI Landslide database (www.gsi.ie) does not record any historic landslides in the vicinity of the Proposed Development Site or in the surrounding lands. The closest mapped landslide is at Maidenhead/Arless, Co. Laois, located ~10.8km north of the Proposed 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 Proposed Development Site is predominantly 'Low'. The GSI map the land to the east of the Proposed 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 are typically associated with peat soils/subsoils, however, there are no peat deposits in this area.

### 7.3.8 Soil Contamination

During site walkover surveys and site investigations, no evidence of soil contamination was recorded at the Proposed Development Site. Whilst previous quarrying operations were completed at the Proposed Development Site, there is no evidence of contaminated tailings. The spoil heaps comprise of shale and have begun to revegetate.

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 Proposed Development Site.

Furthermore, there are no Industrial Emissions (IE) licences/Integrated Pollution Control (IPC) Licence facilities in the immediate area of the Proposed Development Site. The closest mapped IEL licence is

located ~1km southeast of the Proposed 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 proposed lateral extension land which may have contaminated tailings.

### 7.3.9 Receptor Sensitivity

The land, soils and bedrock geological formations underlying the Proposed Development Site will be included in the impact assessment due to their proximal location to the Proposed Development and the potential effects that the Proposed Development may have on these receptors.

The poorly to moderately drained soils and subsoils in the proposed lateral extension lands 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 Proposed 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 impact assessment. There is no potential for the Proposed Development to affect the land, soils and geological environment outside of the Proposed Development Site boundary. There is no overlap between the Proposed Development Site any geological heritage site and/or designated site. Therefore, there is 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 Proposed Development

The Proposed Development is described in full in Chapter 3 of this EIAR.

The development site consists of an area of 41.86 ha within a total landholding of 45.68 ha, of which c. 41.86 ha is currently subject to an application for substitute consent under Section 177E of the Planning and Development Act 2000 (As amended) to regularise previous unauthorised development. The proposed development will consist of further quarry extraction over a total area of 16.17 ha to include the pre-existing quarry and additional agricultural lands with a projected lifespan of c. 20 years.

The proposed development will involve blasting, extraction and processing of rock using mobile primary crushing / screening and associated plant on the proposed quarry floor. The proposed quarry void will be extracted over 4 no. phases to a depth of 2 no. benches of c. 10m each to a quarry depth of c. 300m AOD with a proposed rate of extraction of c. 200K tonnes per annum. The proposed development will include for construction of earthen screening berms, soil storage areas and will utilise existing quarry entrance from the northern boundary linking to the L7130 local road to the east. Existing and proposed access tracks and existing settlement ponds will be utilised as part of the proposed development. The proposed development will be accompanied by a phased restoration plan.

## 7.5 Potential Likely Significant Effects of the Proposed Development

### 7.5.1 "Do Nothing" Scenario

If the Proposed Development were not to proceed, the Proposed Development Site will remain as an existing open pit surrounded by agricultural pastures. The proposed lateral extension areas would continue as poor agricultural land. The Proposed Development Site would remain largely unaltered as a result of the Do-Nothing Scenario.

### 7.5.2 Operational Phase

In the context of the Proposed Development, the operational phase is considered to be the extraction of sandstone, siltstone and shale bedrock to a final proposed depth of 300mOD. The extraction of bedrock in the existing greenfield areas will be proceeded by site preparation works comprising of vegetation removal and soil/subsoils stripping. This material will be used in the construction of boundary berms and in the phased restoration of the Proposed Development Site.

#### *7.5.2.1 Potential Effects on Land (Land-Take and Topographic Changes)*

The Proposed Development will result in the loss of ~7.51ha of greenfield land (agricultural pastures) associated with the phased lateral extension of Redrock Quarry.

Firstly, the clearing of the existing stockpiles and the removal of the overburden from the proposed extraction areas will result in local topographic changes. However, due to the relatively thin nature of the soil/subsoil deposits, proposed quarry extension areas will see a lowering of its surface topography by a maximum of ~1.2m during the site preparation works (note that the average subsoil depth from the site investigations in the proposed quarry extension areas is 1.2m).

The stripped/cleared material will be used to construct screening berms around the proposed extraction area which will also result in local topographic changes. Excess spoil will be stored in the proposed spoil storage area.

The greatest effect on topography will be associated with the removal of the bedrock to a depth of 300mOD. The existing quarry void at Red Rock will be expanded from ~8.66ha to ~16.17ha.

The effects on land, in terms of land-take, will also be localised to where the quarry is proposed to extend into greenfield areas (~7.51ha). This area comprises of ~17.9% of the total area of the Proposed Development Site. There will be no effects on land within the existing quarry void (~8.66ha) or in other areas of the Proposed Development Site.

There will be no effects on any lands adjoining the Proposed Development Site.

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

**Receptor**: Land and topography.

**Potential Pre-mitigation Effect**: Negative, moderate, direct, long-term, likely effect on land.

#### *7.5.2.2 Potential Effects from the Excavation of Soils and Subsoils*

The Proposed Development will involve the removal of ~145,000m$^3$ of overburden from the proposed extraction area in order to expose the underlying bedrock.

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

**Pathway:** Extraction.

**Receptor:** Soils and subsoils.

**Potential Pre-mitigation Effect:** Negative, direct, moderate, likely, permanent effect on soil and subsoils.

#### *7.5.2.3 Potential Effects due to Oil/Fuel Spillages and Leaks*

Plant and site vehicles will be present throughout the operational phase of the Proposed Development. Accidental spillage of fuels and hydraulic oils during operations can be a pollution risk to land, soils and associated ecosystems. Hydrocarbons have a high toxicity to humans, and all flora and fauna, and are persistent in the environment.

Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected.

**Receptor:** Soil, subsoil and bedrock.

**Pathway:** Soil, subsoil and bedrock pore space.

**Potential Pre-mitigation Effect:** Negative, slight, direct / indirect, reversible, unlikely, long-term effect on soil and bedrock.

#### *7.5.2.4 Potential Effects from the Erosion of Exposed Soils and Subsoils*

There is a 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.

**Potential Pre-Mitigation Effect:** Negative, slight, direct, short-term, likely effect on soil and subsoils by erosion and wind action.

#### *7.5.2.5 Potential Effects Associated with Bedrock Extraction*

The Proposed Development will involve the extraction of ~3.9 million tonnes of rock across a 20-year operational period down to a final floor level of 300mOD.

Bedrock will be extracted using blasting techniques which were previously utilised at the Proposed Development Site during the historic quarrying activities. The extracted rock will be processed on-site using mobile crushing and screening plant.

There will be no crushing or processing of bedrock off-site.

**Pathway:** Extraction.

**Receptor:** Bedrock.

**Potential Pre-mitigation Effect:** Negative, irreversible, direct, moderate, likely, permanent effect on bedrock.

### 7.5.3 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 planned development. Many MADS related to quarrying activities are preventable and can be readily addressed or prevented by good planning, design, emergency response planning and mitigation.

The primary risk of MADS associated with the Proposed Development is the accidental release of fuels or oils. The mitigation measures in relation to leakages/spills prescribed in Section 7.5.2.3 mean that there will be no significant effects on the land, soils and geology environment in the event of an accident.

In terms of the land, soils and geological environment, the impacts of any unplanned events are considered to be negligible.

### 7.5.4 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 is present at the Proposed Development Site. Furthermore, throughout all phases of the Proposed Development best practice measures and controls will be in place to ensure any potential sources of contamination will be managed appropriately. Also, the Proposed Development Site will not be 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 will be small and will be handled in accordance with best practice mitigation measures. The potential residual effects associated with land, soils and geology contamination and subsequent health effects are negligible.

### 7.5.5 Potential Cumulative Effects

The dominant land use activity in the local area is agriculture which is not expected to contribute to any cumulative effects on the land, soils and geological environment. There are several other mineral extraction sites and quarries located in the surrounding lands. This Proposed Development is for the operation and extension of the existing quarry void with the proposed extraction area at this site increasing to 15.6ha, with an additional 3.9 million tonne of rock to be extracted. There will therefore be a minor cumulative effect on land, with an increase in the land used for extractive industry. However, on a local and regional scale this effect is considered to be imperceptible.

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

## 7.6 Avoidance, Remedial & Mitigation Measures

### 7.6.1 Operational Phase

#### *7.6.1.1 Potential Effects on Land (Land-Take and Topographic Changes)*

In terms of potential effects within the Proposed Development Site, the effect on land and topography is considered to be significant as the landuse and topography within the proposed quarry extension area will be significantly altered from its current condition. However, the effects are considered to be an acceptable and unavoidable consequence of the Proposed Development.

On a more regional scale, the loss of ~7.51ha of agricultural land is minimal. The Proposed 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 is not considered to be significant.

Given the local undulating topography of the local area, any change to topography is likely to be minimal within the context of the overall landscape. The stripped overburden material and the material from the existing stockpiles, will be used in the construction of boundary berms surrounding the proposed extraction area, with excess spoil to be stored in the proposed spoil storage area. The construction of the boundary berms will assist in screening the Proposed Development and assimilating into the landscape.

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

#### *7.6.1.2 Potential Effects from the Excavation of Soils and Subsoils*

Site earthworks will result in a direct impact on local soils and subsoils. The effects is the removal and displacement of ~145,000$m^3$.

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

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

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

#### *7.6.1.3 Potential Effects due to Oil/Fuel Spillages and Leaks*

The highest standards of site management and utmost care and vigilance will be followed to prevent accidental contamination of soils/subsoils and/or bedrock during the operational phase of the Proposed Development.

The mitigation measures include:

- A dedicated fuelling area on concrete hardstanding will be used for all vehicle re-fuelling operations at the Proposed Development Site;
    - Fuel in this dedicated fuelling area will be stored in a double skinned, bunded, above ground oil tank;
    - A spill tray will be used during refuelling operations and a spill kit will be positioned beside the fuel tank in case of a spillage;
    - Drainage from the refuelling area will be routed through a full hydrocarbon interceptor and then a soakaway prior to discharge to ground;

- All plant and machinery will be serviced before being mobilised to site;
- Refuelling will be completed in a controlled manner using drip trays (bunded container trays) at all times;
- Fuel containers will be stored within existing secondary containment system, e.g. garage, bunds for static tanks or a drip tray for mobile stores;
- Containers and bunding for storage of hydrocarbons and chemicals will have a holding capacity of 110% of the volume to be stored;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage;
- Drip-trays will be used for fixed or mobile plant such as pumps and generators in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Procedures and contingency plans will be set up to deal with emergency accidents or spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on-site for use in the event of an accidental spill.

#### *7.6.1.4 Potential Effects from the Erosion of Exposed Soils and Subsoils*

The following mitigation measures are proposed:

- Soil removed from the proposed lateral extension area will be used to create a boundary berm around the extraction site, with excess spoil being stored in the proposed designated spoil storage area;
- Where possible the upper vegetative layer (where still present) will be 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; and,
- Re-seeding and spreading/planting will also be carried out in these areas.

#### *7.6.1.5 Potential Effects Associated with Bedrock Extraction*

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

The bedrock is considered to be of 'High' importance and has high potential for the development of a quarry. The Proposed Development is a lateral expansion of a historic quarry void. The presence of the historic quarry indicates the economic suitability of this area for the continuation and lateral expansion of the quarry.

The proposed bedrock extraction is considered to be an acceptable and unavoidable part of the Proposed Development. However, the effects will be localised within the proposed extraction area of ~15.52ha.

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

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

## 7.7 Residual Effects

### 7.7.1 Operational Phase

#### *7.7.1.1 Potential Effects on Land (Land-Take and Topographic Changes)*

**Post Mitigation Residual Effect:** Agricultural land used for grazing is the dominant landuse in the proposed extraction area. Due to the relatively small footprint of the Proposed Development on a

local scale, along with the implementation of the proposed restoration plan, the residual effect will be negative, direct, slight, likely, long-term effect on land.

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

#### *7.7.1.2 Potential Effects from the Excavation of Soils and Subsoils*

**Post Mitigation Residual Effects:** The soils and subsoils present at the Proposed Development Site will require removal in order to expose the underlying bedrock which will be extracted for economic purposes. This removal of overburden is considered an acceptable impact associated with the Proposed Development. The residual effect will be 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 will occur.

#### *7.7.1.3 Potential Effects due to Oil/Fuel Spillages and Leaks*

**Post-Mitigation 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 proposed above and will break the pathway between the potential source and the receptor. The residual effect is considered to be negative, direct / indirect, imperceptible, reversible, unlikely, long-term effect on soil and bedrock.

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

#### *7.7.1.4 Potential Effects from the Erosion of Exposed Soils and Subsoils*

**Post Mitigation Residual Effect:** Soils and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this all excavation works will be completed in accordance with a restoration plan, whereby material will be moved the least possible distance, and reseeding and planting will be completed. Following implementation of these measures the residual effect will be 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 will occur.

#### *7.7.1.5 Potential Effects Associated with Bedrock Extraction*

**Post Mitigation Residual Effects:** While the bedrock which will be removed are considered to be of 'High' importance, these bedrock formations are also present outside of the Proposed Development Site within the surrounding area. The residual effect is considered to be negative, irreversible, slight, direct, likely, permanent effect on bedrock.

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

### 7.8 Restoration Phase

Once the extraction of bedrock has ceased within the proposed extraction area, a thin layer of crushed rock will be spread 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 Proposed Development Site to reinstate the field boundaries.

Once quarrying operations have ceased, all site infrastructure and plant will be disassembled and removed off-site for disposal/recycling and/or resale.

Based on the above, the restoration of the Proposed 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 proposed extraction area back to its existing agricultural use.

### 7.9 Monitoring

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

### 7.10 Interactions

None.

## 7.11 References

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