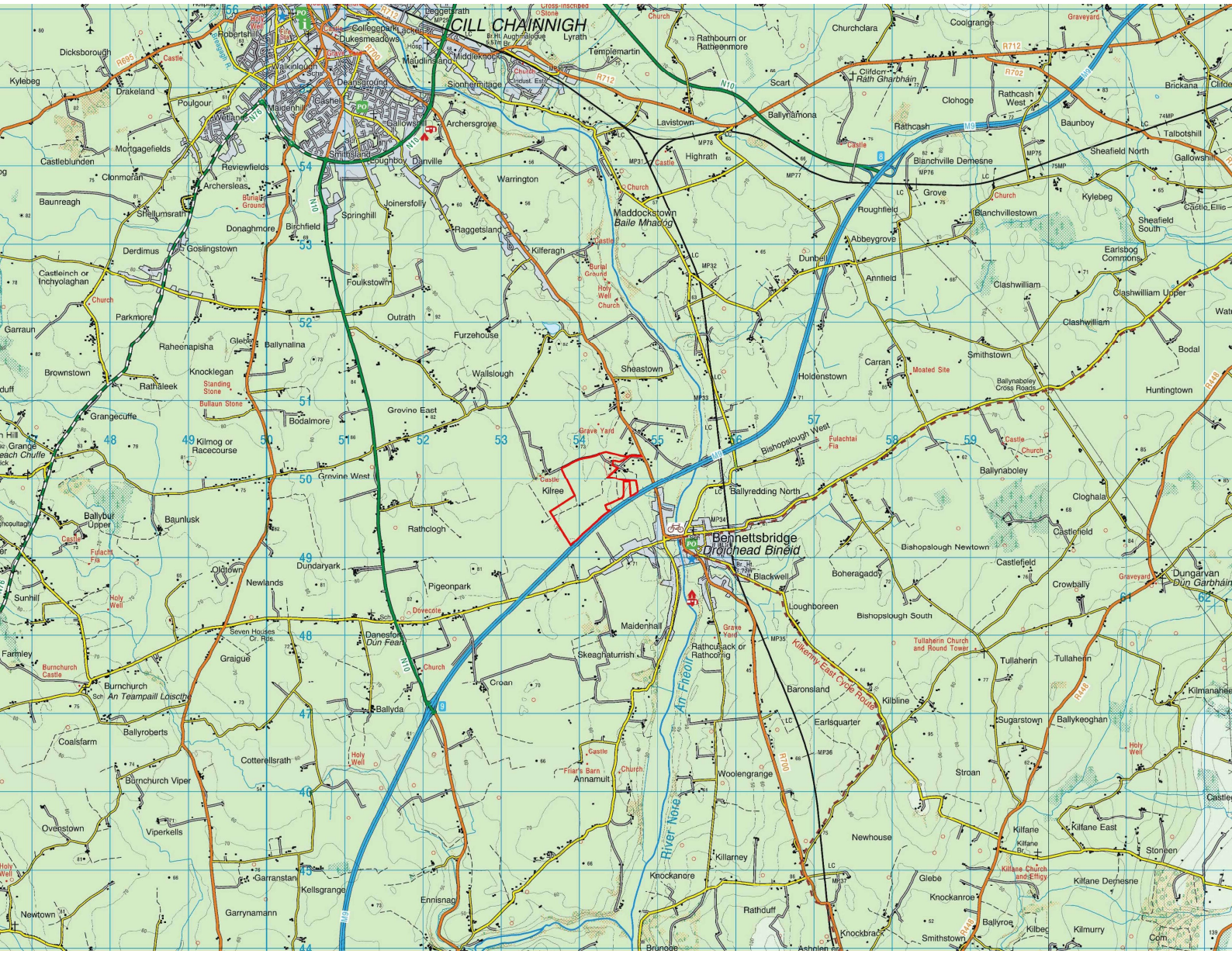
# CHAPTER 7

# LAND, SOILS AND GEOLOGY



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QUARRY CONSULTING

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# CHAPTER 7: Land, Soils and Geology

## Introduction

7.1 This 'Land, Soils and Geology' (LSG) chapter of the Environmental Impact Assessment Report (EIAR) has been prepared for a lateral extension to an existing limestone quarry at Kilree, Bennettsbridge, Co. Kilkenny.

7.2 The proposed total footprint of the site (i.e., the existing quarry site and the proposed site extension) will be referred to as "the site" for ease of reference throughout this chapter.

7.3 Bennettsbridge Limestone owns the site where the proposed development will take place.

7.4 The area under consideration is in the ownership of the quarry and the proposal is to bring the lands to the west of the permitted (PL 18/858) void deeper, but to the same elevation as is already excavated within the established quarry's second bench elevation, which is 25 to 30m OD.

7.5 The coordinates central to the overall quarry site are ITM 654,034E, 649,785N.

7.6 The pre-quarrying natural land surface elevation of the entire quarry landholding is 72m OD in the west and 42m OD in the east, approximately.

7.7 The site is licensed to discharge treated waters arising on the floors under Section 4 licence ENV/W/78 (2017). The licensed discharge point to the River Nore, *via* the Dunbell_Little stream, is in the eastern part of the site. Refer to Appendix 8.2 for a copy of the Site's Discharge Licence. Refer to Figure 8.1 for the Site Layout and Discharge Location.

7.8 The site lies within the Nore Catchment (HA15) and the River Nore has multiple designations as a European Site (River Barrow and River Nore SAC 002162, River Nore SPA 004233). The proposed development's potentials for impact and interaction with the River Nore are addressed in Chapter 8. This Lands, Soils & Geology Chapter focusses on the geological environment.

7.9 This Lands, Soils & Geology (LSG) assessment and chapter of the EIAR has been completed by Dr. Pamela Bartley (Hydro-G), who was also the field assessor and author of the Water Chapter of this EIAR for the quarry. The potential risk of groundwater interception in the areas of land surrounding the application site led to a strong Water Chapter focus for the Environmental Impact Assessment for the proposal. This LSG Chapter focusses on the information for the lands, soils and geological environment.

7.10 The application area comprises an operational working quarry and a greenfield extension to the west. Details of the site layout are shown on the Application's Drawing Series as EIAR Figure 3A and the associated Cross Sections.

7.11 The operational quarry is consented by Kilkenny County Council's permission PL18/858. The operational quarry is permitted to excavate bedrock to 2 Benches (30m OD) over a significant portion of its area and to a 3rd Bench (12m OD) in the south eastern portion of the overall site. Refer to Planning Drawing 3A. West of the 3rd Bench area permitted to 12m OD is a greenfield spur that was permitted to 30m OD in the PL18/858 permission. It is now proposed to continue into the greenfield to the west and north of the 2018's permitted greenfield lands that are currently being worked. Overall, it is proposed to take 2 Benches from ground level in the greenfield application area and no further depth in the operational quarry: that is included in the application area because its infrastructure will service the continued extraction of bedrock.

7.12 The applicant is seeking a 25-year permission for extraction and associated activities, with an additional 2 years for final site restoration. The entire detailed Development Description is presented in Chapter 1 of this EIAR. Hydro-G has used the Project Description to develop this Impact Assessment for the Lands, Soils & Geological environment.

7.13 The overall application area consists of the established Bennettsbridge Quarry (permitted under Plan File Ref. 18/858) together with adjoining greenfield lands immediately to the west. Under the 2018 permission the quarry was authorised to expand east-west into c. 8.5 ha of previously unworked ground. Excavation of that consented area is now under way. The present application seeks to continue that westerly progression into the next block of greenfield land, thereby forming a logical lateral extension of the existing extraction void while retaining the same finished floor level (25–30 m OD) and drainage regime. The works will be carried out within an overall red-line area of c. 61 ha. This comprises:

- **c. 36 ha** – the existing permitted quarry (Plan Ref. 18/858), and
- **c. 25 ha** – a lateral extension on the western and north-western flanks of the quarry.

7.14 Of the extension lands:

- **c. 18.2 ha are new, green-field extraction blocks, and**
- **c. 3.3 ha are areas inside the present quarry boundary (an existing haul-ramp and an un-constructed berm) that will now be worked through to gain access to the extension.**

7.15 Accordingly, the total additional rock-extraction footprint amounts to c. 21.5 ha. The balance of the extension area – c. 6.3 ha – will accommodate overburden storage, new landscaped screening berms, haul-road tie-ins and the mandatory safety/set-back standoffs from boundaries.

7.16 The quarry is located to the north of the M9 Motorway connecting Waterford to Dublin: the M9 merges with the M7 to Dublin in the vicinity of Newbridge, Co. Kildare, at a distance of 70km to the north east of the quarry. The site is located between Junctions 9 and 8 on the M9. Kilkenny city is c. 7km to the north west and the village of Bennettsbridge is 1.5km to the south east. Carlow town is c. 32km to the north east and Waterford is c. 38km to the south. Refer to Figure 1.1 of the EIAR DWG Series.

7.17 The current permission (Plan Ref. 18/858) allows the part of the existing quarry floor to be worked down to 12 m OD. No further deepening of that permitted void is now sought. Instead, the proposal is to develop the adjoining green-field extension in two benches, bringing the new extraction area down to match the second-bench level already established in the quarry – c. 25–30 m OD.

7.18 Access to the site is from a minor road (L26322) that branches from the R700 regional road that links Bennettsbridge Village with Kilkenny City. To the east of the existing quarry there is an office building, weighbridge and wheelwash located near the entrance to the quarry. The M9 motorway forms the southernmost boundary.

7.19 The western boundary of the permitted working quarry presents exposed walls of limestone bedrock that extend from Bench 2's floor elevation to natural ground level of the area proposed for lateral extension into the southwest. Therefore the exposed bedrock walls of the established quarry, and its rock and water potential, are open to visual examination.

7.20 The proposed development seeks to laterally extend the extraction area further to the west and north to an elevation of only two 19m deep benches so that there is a floor elevation of

25 to 30m OD, integrating additional lands into the overall extraction footprint. These lateral extensions will maintain the same extraction methods and depth as the central portion of the quarry, without introducing any new buildings, plant, or processes.



7.21 Within the lateral extension area, there is a 6.8 ha (c.7 ha) area of woodland that will be felled as per Department Licence conditions and there is a farmyard that will be demolished. All elements of the proposed development, including the continued use of explosives in the breaking of bedrock, are assessed here.

7.22 This chapter of the EIAR presents the baseline land, soils and geological environment and then assesses potential impacts, assigns mitigation measures and then reassesses the potential residual impacts. Potential cumulative impacts are also addressed.

7.23 As stated throughout this EIAR, the assessments have been completed in accordance with the EU EIA Directive 2011/92/EU, as amended by EIA Directive 2014/52/EU and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018, in order to inform the consideration of the Application and provide the planning authority with the environmental information that must be considered when determining the Application.

7.24 The overall site subject of this application is within the administrative boundary of Kilkenny County Council (KCC) and the EIAR is being provided to KCC as part of a planning application seeking planning permission.

7.25 The applicant, Bennettsbridge Limestone Quarry , the application site, contributors to this EIAR and other pertinent details were previously presented in Chapter 1 and Chapter 3 of this chapter.

7.26 The EIA and this EIAR Chapter have been informed by historical site investigation drilling and geophysics completed by Apex in 2018 across the greenfield area, drilling supervised in 2024 by Dr. Pamela Bartley of Hydro-G and bedrock permeability testing completed and reported by Envirologic (2025).

7.27 This LSG Impact Assessment has applied the most recent guidance from the EPA (2022) in the presentation of information in an EIAR and application of Impact Assessment.

## Study Methodology

7.28 The objectives of this assessment, as per the EIA Directive (2014/52/EU) and EPA Guidance (2022), include as follows:

(i) Use publicly available resources and historical site-specific literature to characterise the baseline land, soils and geological conditions for the site.

(ii) Update this information using additional site investigation work (*e.g.,* drilling, geophysics and bedrock response tests) and analysis.

(iii) Assess the potential impact of the proposed development on the LSG environment.

(iv) Specify appropriate mitigation measures for any identified potential impacts, as deemed necessary. The proposed development works, impacts and mitigation measures will then be reassessed, and residual impacts defined.

## Statement of Expertise

7.29 The evaluation of the Lands, Soils and Geological environment and the Assessment of Effects and Potential Impacts, with Mitigation Measures and Remedial Impacts, was completed by Dr. Pamela Bartley (Hydro-G) who is considered a karst groundwater specialist with quarry, Section 4 Discharge Licencing and Public Water Supply expertise. She holds a degree in Civil Engineering, an M.Sc in Environmental Engineering with Geotechnical competency and a Ph.D in hydrogeology that had a strong focus on how soils and subsoils affect groundwater responses. Pamela Bartley's Statement of Expertise is presented as **Appendix 8.1.**

7.30 This EIA for the Lands, Soils & Geology and Water environments, and associated EIAR Chapters, were created by the same person.

7.31 In the assessment of the geology particular to the Bennettsbridge Limestone Quarry site, Dr. Bartley's EIA was supported by Eurogeologist Peter O'Connor PGeo., M. Sc. (Geophysics), DIP EIA MGT and the site's Geotechnical Engineer Dr. Jonathan Talbot of Advanced Mining Solutions Ltd.

7.32 Hydro-G holds the required Professional Indemnity Insurances, Employers and Public Liability Insurances.

## Legislative Instruments & Planning Guidance

7.33 This Lands, Soils and Geology assessment was prepared with consideration of European legislation, Irish Regulations and Guidance, listed as follows:

(i) Mines and Quarries Act (S.I. No. 7 of 1965).

(ii) S.I. No. 349 of 1989, European Communities (Environmental Impact Assessment) Regulations, and subsequent amendments (S.I. No. 84 of 1994, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001).

(iii) The Planning and Development Acts, 2000, as amended.

(iv) The Planning and Development (Amendment) Act 2010, S.I. 600 of 2001 Planning and Development Regulations and subsequent amendments, including S.I. No. 364 of 2005 and S.I. No. 685 of 2006.

(v) EIA Directive (2014/52/EU) of the European Parliament and of the Council of 16 April 2014, amending Directive 2011/92/EU, on the assessment of the effects of certain public and private projects on the environment.

(vi) S.I. No. 473 of 2011, European Union (Environmental Impact Assessment and Habitats) Regulations 2011 and S.I. No. 584 of 2011, European Union (Environmental Impact Assessment and Habitats) (No. 2) Regulations 2011.

(vii) Geology in Environmental Impact Statements. Institute of Geologists of Ireland (2002) & Guidelines for the Preparation of Soils, Geology & Hydrogeology Chapters of Environmental Impact Statements. Institute of Geologists of Ireland (2013).

(viii) Quarries and Ancillary Activities: Guidelines for Planning Authorities. Department of Environment, Heritage and Local Government (2004) & Environmental Management Guidelines for the Extractive Industry (Non-Scheduled Minerals). Environmental Protection Agency (2006).

(ix) Reclamation Planning in Hard Rock Quarries. Department of Civil & Structural Engineering, University of Sheffield and Edge Consultants, Mineral Industry Research Organisation (2004) & A Quarry Design Handbook. GWP Consultants and David Jarvis Associates Limited, UK (2014).

(x) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes. Transport Infrastructure Ireland (undated, c. 2009). https://www.tii.ie/technical-services/environment/planning/Guidelines-on-Procedures-for-Assessment-and-Treatment-of-Geology-Hydrology-and-Hydrogeology-for-National-Road-Schemes.pdf

(xi) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU, as amended by 2014/52/EU. European Union (2017).

(xii) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment. Department of Housing, Planning and Local Government (2018).

(xiii) Guidelines on the Information to be contained in Environmental Impact Assessment Reports. Environmental Protection Agency (2022).

(xiv) Kilkenny's County Development Plan (2021 – 2027).

## Statutory Consultations

7.34 Quarry Consulting managed the development proposal.

7.35 With respect to National Agency responses to consultation communication, the responses from the GSI and TII contain elements relevant to this LSG assessment. A full copy of the GSI's and TII's Responses to Scoping are presented as **Appendix 7-1**. Hydro-G provides high level overview responses on the first page of **Appendix 7-1** and details the assessments completed in the main body of this Chapter**.**

7.36 Hydro-G hereby confirms that all data, maps and report resources listed in the GSI scoping response have been included in the assessment.

7.37 TII's requested Geotechnical Assessment is presented in the Report by AMS (2025) for the site, which is discussed later and also included as the final of three AMS Reports in Appendix 7-3.

## Impact Assessment Methodology (EPA, 2022)

7.38 In addition to adhering to "Guidelines on the Information to be contained in Environmental Impact Statement Reports" (EPA, 2022), the Lands, Soils and Geology assessment was completed in accordance with "Geology in Environmental Impact Statements, a Guide" (IGI, 2002), and "Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements" (IGI, 2013). In addition, "Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes" (NRA, 2009) is referenced where the methodology for assessment of impact is appropriate.

7.39 The procedure for determination of potential impacts on the receiving land, soil and geological environment is to identify potential receptors within the site boundary and surrounding environment and use the information gathered during the desk study and field work to assess the degree to which these receptors will be impacted upon.

7.40 Criteria for assessing importance of site attributes and their magnitude of importance were taken from the NRA Guidelines (NRA, 2009) (as included in 'Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements' (IGI, 2013)).

7.41 The rating of potential environmental impacts on the land, soils and geology environment is based on the quality, significance, duration and type of impact characteristic identified. Consideration is given to both the importance of an attribute and the magnitude of the potential environmental impacts of the proposed activities on that cited attribute.

## Assessment of Magnitude and Significance of Impact on Land, Soils and Geology

7.42 An impact rating has been developed for each of the phases of the proposed development based on the Institute for Geologists Ireland Guidance for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013).

7.43 In line with the IGI Guidance the receiving environment (Geological Features) was first identified.

7.44 The NRA rating criteria Tables of Appendix C of the IGI Guidance are presented as Appendix 7-2 to this assessment: the importance of the geological features Impact Table is followed by the Impact Table for estimation of the magnitude of the impact. This determines the significance of the impact prior to application of mitigation measures as set out in Appendix 7-2's Table 7-1-. Refer to Appendix 7-2 accompanying this assessment.

7.45 The assessments completed in this Section of the EIAR considered phases as follows:

(i) Construction Phase.

(ii) Operational Phase.

(iii) Landscaping, Restoration, Decommissioning & Aftercare.

## Existing Environment

### Introduction

7.46 Desktop mapping and published information were employed to describe the land, soils, underlying quaternary and bedrock geology, areas of geological heritage, areas of economic interest with respect to geological resources and potential for soil contamination.

7.47 Desk study site information resources employed include, as follows:

- Clarke, A., Parkes, M. & Gately, S. (2007) The Geological Heritage of Kilkenny. Irish Geological Heritage Programme, Geological Survey of Ireland.
- EPA mapping for land and geology https://gis.epa.ie/EPAMaps/.
- GSI On-line Groundwater database. Teagasc Soil, GSI Subsoils, Bedrock Classifications and Geoheritage Reporting https://dcenr.maps.arcgis.com/apps/MapSeries/.
- GSI (2002a) Bedrock Geology Sheets 18, 19, 20 & 22, 1:100,000 Map Series. Geological Survey of Ireland.
- GSI (2002b) County Kilkenny Groundwater Protection Scheme Volume I Main Body & Volume II Source Protection Zones and Groundwater Quality. July 2002. Kilkenny County Council & GSI.

- GSI (2004) Kilkenny GWB Description Sheet.
- GSI (2004b) Stoneyford Gravels GWB Description Sheet,
- Ordnance Survey of Ireland, 1:50,000 Discovery Map Series.
- Google Earth Pro Historic Photography series.
- EIA portal (https://housinggovie.maps.arcgis.com/).
- Kilkenny County Council and An Bord Pleanala historic files for the site.
- Previous EIARs created for applications for the site. Previous Permissions associated with the site are listed in the introductory sections of this EIAR.

7.48 In addition to national datasets and desktop available published information, this section also presents an overview of the significant body of historic site investigations at the site and the results of the current site investigation works, completed between 2015 to present in order to support the development of the baseline environment.

7.49 Desk study, historic and current site investigation results were then used to complete an Impact Assessment, identification of required mitigation measures and presentation of residual effects, if found.

## Site Location & Topography

7.50 As described in more detail in Chapter 3 of this EIAR, the site is located within the townland of Kilree, Co. Kilkenny.

7.51 The application site is comprised of an existing operational quarry (Plan File Ref. No. 18/858) and greenfield lands adjacent to the west of the quarry. The proposed development will take place within an overall application area of approximately 61ha.

7.52 The application site and regional topography are presented as **Figure 7-1**. The quarry is located to the north of the M9 Motorway connecting Waterford to Dublin: the M9 merges with the M7 to Dublin in the vicinity of Newbridge, Co. Kildare, at a distance of 70km to the north east of the quarry. The site is located between Junctions 9 and 8 on the M9. Kilkenny city is c. 7km to the north west and the village of Bennettsbridge is 1.5km to the south east. Carlow town is c. 32km to the north east and Waterford is c. 38km to the south. Refer to Figure 1.1.

7.53 The site is permitted to work the south eastern portion of the floor to 12m OD and no deepening of the currently permitted floor is proposed. It is only proposed to deepen the adjacent greenfield lands by two benches to an elevation of 25 to 30m OD.

7.54 The application area 'Red Line' boundary and proposed extraction area are shown in Figure 3.1 of the Quarry Consulting Drawing Series of the 2025 application.

7.55 Access to the site is from a minor road (L26322) that branches from the R700 regional road that links Bennettsbridge Village with Kilkenny City. To the east of the existing quarry there is an office building, weighbridge and wheelwash located near the entrance to the quarry. The M9 motorway forms the southernmost boundary.

7.56 There are two other operational quarries located to the north east of the subject quarry: one of those quarries is a Sand & Gravel quarry and the other is a bedrock quarry. The Sand & Gravel quarry is the P. Hennessy & Company Ltd. (Hennessy Concrete) and they have a licence to discharge (Kilkenny County Council ENV/W/94). The bedrock quarry owned and operated by Roadstone has an EPA IPPC Licence (P0521-03). Hennessy's Concrete Quarry is

located 1km, approximately, to the north-east and a Roadstone Quarry located 2 kms, approximately, to the north-east. The Roadstone quarry is mapped by the EPA in the same bedrock Kilkenny GWB as the application quarry. The Hennessey Quarry is mapped by the EPA as lying in the Stoneyford Gravels GWB. The LSG potential for interaction between the three quarries and potential cumulative impacts are discussed in the 'Cumulative Impact' section of this chapter. Their potential for water related interaction and cumulative impacts is dealt with in the Water Chapter, chapter 8.



7.57 The quarry overall 'blue line' ownership boundary landholding is on lands that would have natural greenfield elevations of between the 72m OD contour lines in the western part of the overall site, which slopes towards the 42m OD contour to the east of the final settlement lagoons' system that service the overall site. Refer to the Water Chapter for more detail. Figure 8.1 presents the site layout with the water management components.

7.58 The site's entrance and office areas are in the north east of the landholding at an elevation of c. 50m OD.

7.59 The quarry has excavated a 'Bench 2' floor to the previously permitted 30m OD and a 'Bench 3' floor is currently being worked, as permitted by the 2018 permission, which permits an elevation of 12m OD in the south eastern part of the quarry. As also permitted in the PL18/858 permission was an extension of bedrock extraction into greenfield lands to the south west of the quarry floor: this greenfield is permitted to 30m OD.

7.60 Bedrock is extracted using permitted blasting and rock breaking techniques.

## Land Use & Topography

7.61 According to the Kilkenny County Development Plan 2021 – 2027 (refer to separate Planning Report submitted with the application) the site lies in an area which is not zoned and is not apparent within any designated scenic views or prospects. There are no Prime Special Amenity or Secondary Special Amenity areas designated at the site.

7.62 The proposed quarry extension lands currently comprise agricultural grazing grasslands for a dairy herd. The overall site is securely fenced with screen mounds on the site perimeter.

7.63 There is an area of 6.8 ha (c. 7 ha) of commercial forestry (woodland) in the south of the proposed greenfield application area. This area of woodland is immediately west of the southern spur of the 2018 application extension into the greenfields.

7.64 Beyond the site, the landscape is rural in character, consisting primarily of agricultural land interspersed with some areas of forestry. The main land use in the study area is agricultural, with dairy farming being the predominant sector practiced.

7.65 Residences within the general area typically consist of one-off rural houses and ribbon development along the local road network. The nearest properties to the site are a cluster of one-off dwellings situated to the south of the site's entrance road from the R700 road that connects Bennettsbridge to Kilkenny city.

7.66 A recent history of activities on, and in the vicinity of, the application area was gained from aerial photography and historical mapping and is summarised in Table 7-1.

**Table 7-1 Historical Land-Use at the Site and its Surroundings**

| Ordnance Survey Map / Photo Reference (Dates) | On Site | Immediate Surroundings |
|---|---|---|
| OS 6" colour (1837-1842) | Quarry site is open fields. | To the west of the site, Kilree House is not mapped: Castle (In Ruins) is mapped there. White Williams Well is mapped to the east of the site and a drain connects it to a pond, which is the current location of Settlement Lagoon Pond 1. Bennettsbridge village consists of c. 25 homes and the Flour Mill. |
| OS 6" Cassini (1845) | No change from above. | No change from above. |
| OS 25" Historic (1888-1913) | No change at the site: open fields. | In addition to the above, a spring is now mapped to the south of the current quarry site. |
| Aerial Imagery 1996 | An area of c. 6.5ha shows as a relatively recent excavation of a quarry. There are no Settlement Lagoons serving the site. The site is accessed from a more southerly route off the L26322. | Some farm buildings and 9 on-off houses appear in the immediate landscape of the site's entrance. The two other quarries in the area appear advanced. There is a Farm yard now over White Williams well and the pond is not visible in the landscape. Bennettsbridge village is a substantially bigger agglomeration of homes and there are many on-off and clusters of homes in the wider area. The lands to the west of the quarry (Kilree House and associated lands) remain development free. |
| Aerial Imagery 2001 | The quarry has advanced to c. 12.5ha. The Settlement Lagoons are constructed to their full extent and hold water. There is a small narrow spur of the quarry to the south west. | No significant changes from those described above. |
| Aerial Imagery 2006 | The quarry footprint has expanded to c. 26ha. The Eden shed along the site's northern boundary is fully constructed. | The M9 Motorway to the south of the quarry is complete and has traffic. A culvert has been built under the M9 close to the site's licensed discharge point from the M9. |
| Aerial Imagery 2011 – 12/2024 | No significant changes at the site. | No changes in the vicinity of the site, wider area or Bennettsbridge village. |

## Soils

7.67 Teagasc soil classification, as accessed on the GSI Groundwater Viewer, show that soils at the site, where present, are generally Shallow well drained mineral (Mainly basic), derived from mainly calcareous parent materials (Figure 7-2). The Parent Material Name is Glaciofluvial sands and gravels with a Parent Material Description Limestone sands and gravels (Carboniferous).

## Subsoils (Quaternary Deposits)

7.68 Where present, quaternary deposits are mapped by the GSI as Gravels derived from Limestones (Figure 7-3). It is mapped as a free draining till.

### GSI Mapped Aggregate Potential

7.69 The GSI 'Aggregate Potential' mapping database, available on their Public Mapping viewer, reports for the site, as follows:

- 'Very High Potential' for Crushed **Rock** Aggregate in County Kilkenny.
- 'Vary High Potential' for 'Granular Aggregate' of Carboniferous limestone sands and gravels of glaciofluvial origin.

### Geohazard Mapping

7.70 No Landslides are mapped, by the GSI Landslide Data Viewer, at or near the site and the site is not mapped as having any landslide susceptibility.

### Bedrock

7.71 The operational quarry and the greenfield application area adjacent is mapped by the GSI as being **underlain by bedrock** of the Dinantian Series, Asbian Age, generally named a 'Pure Bedded Limestone' and specifically **named the Ballyadams Formation**, which is described as crinoidal wackestone/packstone (Tietzsch-Tyler & Sleeman, 1995).

7.72 The Ballyadams limestone bedrock is described by the GSI as Clean and well cemented with thick ledges; with Minor Components are Soft, brown weathered clay wayboards in upper beds.

7.73 The Ballyadams Formation is reported to have a high intact rock strength due to its thickly bedded nature and structural uniformity.

7.74 Rock outcrop is shown immediately east and west of the quarry with some karst features (springs) to the east.

7.75 The Ballyadams Formation limestone is reported by the GSI 400 – 700m thick and by Tedd (2011) as at least 200m thick. The Kilkenny County Groundwater Protection Report (2002) states that the average thickness is 200m, and the unit is widespread across the northern half of Kilkenny, where it overlies both the Durrow and the Butlersgrove Formations.

7.76 A different Limestone, named the Butlersgrove Formation, including dolomites, is mapped at a distance of 2km, approximately, to the east and south east. The study area is interpreted as being separated from the Butlersgrove Formation by one or more faults (see Figure 7.4). The Butlersgrove Formation is mapped by the Geological Survey of Ireland as immediately underlying the Ballyadams Formation. The bands of dolomitisation associated with the Butlersgrove Formation are predominantly on the other side, the eastern banks of the River Nore. Bennettsbridge Limestone Quarry is to the west of the River Nore. Dolomitisation is shown on Figure 7.5 Hydrostratigrahpic Bedrock Units.

7.77 The exposed rock in the quarry consists of medium bedded limestones which in the north of the quarry have a moderate dip (10-15 degrees) to the north-east and in the southern part of the quarry have gentle to moderate dips to the south.

7.78 A number of thin shale bands are visible in the eastern and western faces of the second bench. The rock type generally changes with depth to a darker limestone with occasional calcite filled bedding partings with graphitic coatings.

7.79 The upper part of the Ballyadams Formation, underlying the site, has been described in detail (Cozar & Summerville, 2005) and divided into Unit 1 and Unit 2. Unit 1, the lower unit, is

composed of mostly thin to medium well-bedded tabular to lenticular, mainly dark grey limestones with occasional interbedded shales and nodular limestones. The limestone in Unit 1 is dominantly packstone, with common grainstone and occasional wackestones/packstones. Unit 2 overlies Unit 1 and comprises thin to thick massive limestones, with interbedded Shales at the base and in the middle part of the unit. Occasional clay wayboards have been described, up to 20-30 cm thick.



7.80 The Butlersgrove Formation, mapped to the north east, consists of very dark grey well-bedded muddy bioclastic limestones interbedded with thin calcareous shales with some thin pale grey fine beds of muddy limestone. There are occasional beds of limestone rich in brachiopod and coral fossils which have been used, when cut and polished, as "Kilkenny Black Marble". At the base of the Butlersgrove Formation there are frequent cherty or siliceous limestones. Under microscopic (petrographic) examination many of the limestones can be seen to be composed of peloids (lime pellets) bound by a relatively coarse calcite cement.

## Structural Geology

7.81 There are no GSI mapped structures within the overall landholding or site application site. However, there are structural features within the site and these will be discussed in the Section entitled Site Investigations Completed.

7.82 The nearest GSI mapped structure is off site and is a major NS Lower Carboniferous normal fault between the quarry's underlying Ballyadams formation and the Butlersgrove Formation to the east of the mapped fault.

7.83 Moore & Walsh (2013 & 2021) provide that Lower Carboniferous normal faults and Variscan veined faults and fractures tend to be intrinsically sealed due to formation conditions and post-formation burial. The most important control on their formation is how close the structural change formation potential is to bedrock surface. Bedrock surfaces could include voids on other fractures, such as those on Cenozoic faults, or karst cavities.

## Geoheritage

7.84 The Geoheritage of County Kilkenny was reported by Clarke *et al.,* (2007).

7.85 Whilst there are multiple references to 'Bennettsbridge Quarry", cross referencing to GSI mapping allows clarification that the GSI refer to the quarry to the north east of this application siter as the "Bennettsbridge Quarry": that is the Roadstone Quarry.

7.86 Geoheritage sites are shown in Figure 7.6 and it is noted that 3 of the 4 GSI mapped Geoheritage sites are mapped because they allow evaluation of the exposure of bedrock along cuttings for the M9 Motorway.

7.87 Summary details for each of the mapped Geoheritage Sites are, as follows:

- King's River M9 Cutting: Site Code KK026. Photographs are presented in Clarke *et al.*, (2007). It is a cutting on the banks of the M9 that provides an "excellently displayed section of Carboniferous limestone, probably of Upper Viséan age. It is noticeably prolific in white blobs of the mineral calcite (of the same composition as the limestone itself, but in a crystalline form) which may have been developed during the conversion of lime sediment into hard rock (a process called diagenesis)". Part of the Butlersgrove Formation. King's River M9 Cutting site is complemented by exposures of the same formation at the Roadstone quarry.

- Danesfort M9 Cutting: Site Code KK022. The site is of County Geological Site importance as a well exposed, scientifically useful long representative section of Carboniferous limestone in Kilkenny. Butlersgrove Formation bedrock. The 350m long cutting allows examination of "older features and highly convoluted bed surfaces, with dimpled surfaces of 1-2 cm height, coated with a veneer of pinkish coloured clay. These may have been caused by periods of emergence of the sediment above the sea, with weathering and soil formation taking place. It is perhaps more likely that they are features called stylolites, where the clay is a residue of insoluble material from the dissolving of limestone. If this is the cause, it probably happened during the conversion of soft wet sediment into hard rock. Later karstification, which has probably occurred in the last few thousand years, is evident in many expanded joints, and some larger cavities, with a brown staining typical of such weathering. There may also be a karstic doline seen on each side of the cutting, right within the rock cliffs. Dolines are enclosed depressions, sometimes filled with unconsolidated sediments. Engineers have left short grassy slopes over the sediments. An additional feature of interest is a small syncline (downfold), bounded on each side by faults, which disturbs the regular dip of the limestone beds to the south".

- Bennettsbridge M9 Cutting: Site Code KK021. Two long sections of bedrock exposure. The rocks are limestones of Carboniferous age (approximately 330 million years). They are part of the Ballyadams Formation. This site is complementary to Ballykeefe Quarry and Ballyragget Quarry, a working quarry with glacial till overlying the Ballyadams Formation. "The cutting has low cliffs of limestone between 2 and 4 m high. The beds of limestone are nearly horizontal throughout the sections. There are localised sections of weathered rock, with red clay infills and brown stained joints, over 4 m in length at one point. This solution weathering of limestone near the surface of the bedrock is called epikarst and is well developed along much of the exposure here. Fossil coral colonies of *Lithostrotion* around 30 cm in height are clearly evident in the section, occurring prolifically in certain beds. In parts there are 0.5 – 1 m thick massed colonies of coral. Glacial striae, which are scratches and gouges on the surface of the rock, caused by the grinding action of rocks held within the base of an ice sheet as it moved over the locality, are seen in the central portion of the east side of the northern cut, and are oriented 336o to 156o. These show that the ice moving over the locality during the last ice age moved along this direction, north-northwest to south-southeast. As well as this, a 6 m - 8 m depth of glacial till is seen on top of much of the bedrock along the eastern cutting".

- Dunbell M9 Cutting: Site Code KK023. Road cutting, 600 m long, along the M9 motorway, in two parts with relatively low cliffs of rock overlain by glacial till. The rocks are limestones of Carboniferous age (approximately 330 million years). They are part of the Butlersgrove Formation [same formation as the Roadstone Quarry]. "Rocks are generally dipping gently to the south in the southern section but the northern part of the section includes a very clear anticline (an upfold or arch). The northern end of the fold is broken up by two closely spaced faults. The beds in the lower section of cutting are essentially flat lying. The distinctive characteristic, clearly visible to a passing motorist is the abundant distribution of blobs of the white mineral calcite. It is known that these are of the same composition as the limestone itself, but in a crystalline form which may have been developed during the conversion of lime sediment into hard rock (a process called diagenesis). However, they may have replaced the mineral anhydrite which was formed earlier in the process." The site is of County importance because this type of rock is not often

exposed in County Kilkenny. At the Dunbell Cutting, the bedrock is overlain by approximately 5 m depth of glacial till subsoil, which was deposited by the last ice sheet to cover the area.

- Bennettsbridge Quarry: [GSI reference for the Roadstone Quarry] – Site Code KK010. Site is deemed important by the GSI because it provides an opportunity to see Dolomitisation. "Within a Roadstone quarry, just north of Bennettsbridge are well exposed beds of Lower Carboniferous dolomitic limestone. Dolomite is formed when the calcite (Ca) in the limestone (calcium carbonate - CaCO3) is replaced by magnesium (Mg) though a process called dolomitization. These rocks can be identified by their pinkish colouration (from the mineral dolomite) and often have appearance like marble."



## Extractive Management Plan

7.88 The quarry operates with an extractive waste management plan which complies with the Waste Management (Management of Waste from the Extractive Industries) Regulations 2009 by the provision of measures, procedures and guidance to prevent or reduce as far possible any adverse effects on the environment, in particular water, air, soil, fauna and flora and landscape, and any resultant risks to human health, brought about as a result of the management of extractive at the quarry.

## Aggregate Materials Testing

7.89 The site supplies a large range of aggregates. Materials Testing for the aggregates is completed at the MTS INAB Accredited Laboratory Certificates of Analysis are available in the site office for review. Hydro-G has reviewed the results. They are relevant to the nature of the rock when converted to different grades of aggregate and pass all standards required but are not strictly necessary for an EIA.

7.90 Assessment for SR16-21 is completed by professional geologist John Colthurst and concluded that the aggregate being produced from the quarry is compliant with Standards for the intended uses.

## Bedrock Quality

7.91 Advanced Mining Solutions Ltd. (AMS) are commissioned by the applicant to complete the Construction Regulations requisite Geotechnical Assessment of the site every two years. The most recent routine assessment for the operational quarry was completed in 2024. An additional geotechnical assessment was completed in 2025 for the Greenfield application area and this is discussed later.

7.92 Key points to note from the geotechnical assessment reporting to date are as follows:

- Since the last assessment the quarry has opened up an extension *(sic. into greenfields)* in the south west of the quarry. The rock in this section is of extremely good quality. There is little or no weathering and minimal structure despite some potential faults being identified in the geophysical investigation.

## Site Investigations Completed

### Geotechnical Assessments

7.93 Advanced Mining Solutions Ltd (AMS) is employed by Bennettsbridge Limestone Quarries to conduct a Geotechnical Assessment of the **operational quarry** every two years. The Geotechnical Assessments are completed as per the requirements of the 2008 Quarry Regulations, which specify that a geotechnical appraisal must be carried out regularly by a competent person. The two most recent bi-annual Geotechnical Assessment reports are presented in Appendix 7-3: AMS (2022) and (2024).

7.94 The most recent routine, bi-annual, AMS Geotechnical Assessment was undertaken in May 2024 and it assessed the quarry's faces, stockpiles, berms and the settlement lagoons in the **operational and permitted working areas** (PL18/858). The assessment stated that "From visual observations the intact rock strength of the rock in the quarry is good. There are local areas of weathering to the East and Southeast of the quarry primarily in the upper benches" & "Outside of the observed structure in the quarry there is no major karstic feature potential in any of the faces".

7.95 The Routine Geotechnical Assessments reported by AMS provide information on the Structural Geological features within the operational quarry. Some examples are shown in Plate 7-1, as extracted from AMS Geotechnical Assessment Reports (2022 & 2024).

7.96 With respect to Figure 7.1(a), AMS (2024) explains that "Structurally there is a large fault running close to West East through the middle of the quarry. This fault has a large persistence, an aperture of between 0.5m and 2m depending on location with a weathered clay/rock infill. The fault has a measured strike of 080° and a Dip of 80° South." Hydro-G provides further information in that this is a dry karst feature.

7.97 With respect to Figure 7.1(c) and (d), AMS (2024) explains that "The primary joint set has an average orientation of 350° Strike and 85° Dip with a secondary joint set with an average orientation of 064° Strike and 82°Dip. The bedding within the rock is close to horizontal with a slight tendency in dipping to the East.

7.98 The Appendix 7-3 example ASM Reports of 2022 and 2024 are the routine bi-annual reports for the **operational quarry**. In 2025 AMS reported a Geotechnical Assessment of the **proposed extension area.**

7.99 The ASM (2025) report was prepared in response to a recommendation from Transport Infrastructure Ireland (TII) during pre-application consultation on the EIAR. TII requested that the EIAR should include "*A geotechnical assessment and monitoring strategy to maintain the physical integrity of, and mitigate any potential impact on, the M9 motorway, its reservation, and associated infrastructure.*"

The ASM (2025) report specifically addressed the TII recommendation and assessed the geotechnical stability of the proposed extension to the quarry in accordance with the 2008 Quarry Regulations. The ASM (2025) stated that *"Given the good rock mass strength of the proposed extension and the designed overall standoff distance of both the crest and the base of the final quarry face it is AMS's professional opinion that there is no threat to the M9 motorway from a rock stability perspective as a result of quarrying the proposed extension."* The conclusion was supported by analysis of the information for rock mass strength based on extensive field investigation, including RQD surveys, geophysical analysis, and rotary percussive boreholes.

## PLATE 7-1 Structural Geological Features at the Quarry (ASM, 2020, 2024).

7.1(a) The main West East trending fault

7.1(b) Close up of the same main West East trending fault.

7.1(c) The primary joint set in a boundary wall with the application area.

7.1(d) The secondary joint set in a boundary wall with the application area.

## Examination of Bedrock Exposed at the Site

7.100 The eastern portion of the overall application area is already a working quarry that has excavated its southern portion of bedrock to a permitted elevation of c. 30m OD on the floor of the 2nd Bench and to the permitted 12m OD on the floor of the 3rd Bench. The greenfield application area is in lands to the west of the of the working quarry and proposes the same floor level: 25m to 30m OD. Therefore, large expanses of the bedrock beneath the application area are readily visible. Dr. Pamela Bartley visited the site and observed its exposed rock walls on many occasions in differing seasons in the course of the last 10 years.

7.101 Photographs of the floor of the quarry and the boundary wall of limestone beneath the application area are presented in Plate 7-2 (a), (b) and (c).

7.102 The proposal to extend the quarry floor laterally in the direction approaching the site's overall western boundary is that there are large extents of exposed bedrock boundary walls of the void that facilitate examination for the potential for evidence of any discontinuities or evidence of water movement zones from upgradient to the extension areas. The western lands are upgradient in terms of any potential for groundwater flow. In the case of the westerly extension area proposed, the boundary wall between the operational quarry and the proposed greenfield area is a north to south trending wall of limestone exposed. This wall is a solid massive block of limestone with some seeps in the southern corner that respond to rainfall intensity.

**Plate 7-2 (a)** View to the west of 1 Bench below ground level.

**Plate 7-2 (b)** View to the west from the southern portion of the operational quarry.

Plate 7-2 (b) presents the view of 2 Benches from the 30m OD floor of the 2nd Bench of operational quarry to Ground Level of the proposed extension area

**Plate 7-2 (c)** View of the wall of bedrock beneath the northern greenfield application area from the south western part of the operational quarry.

## Geophysical Assessment

7.103 A number of site investigation programmes have been undertaken by APEX Geoservices for the existing quarry and the greenfield area. Geophysical surveys and the subsequent interpretive reports provide information on the type, thickness and variation of the soils, the depth to bedrock, type of bedrock, extent of weathering, fissures and clays, and to calculate a potential limestone rock resource across the site.

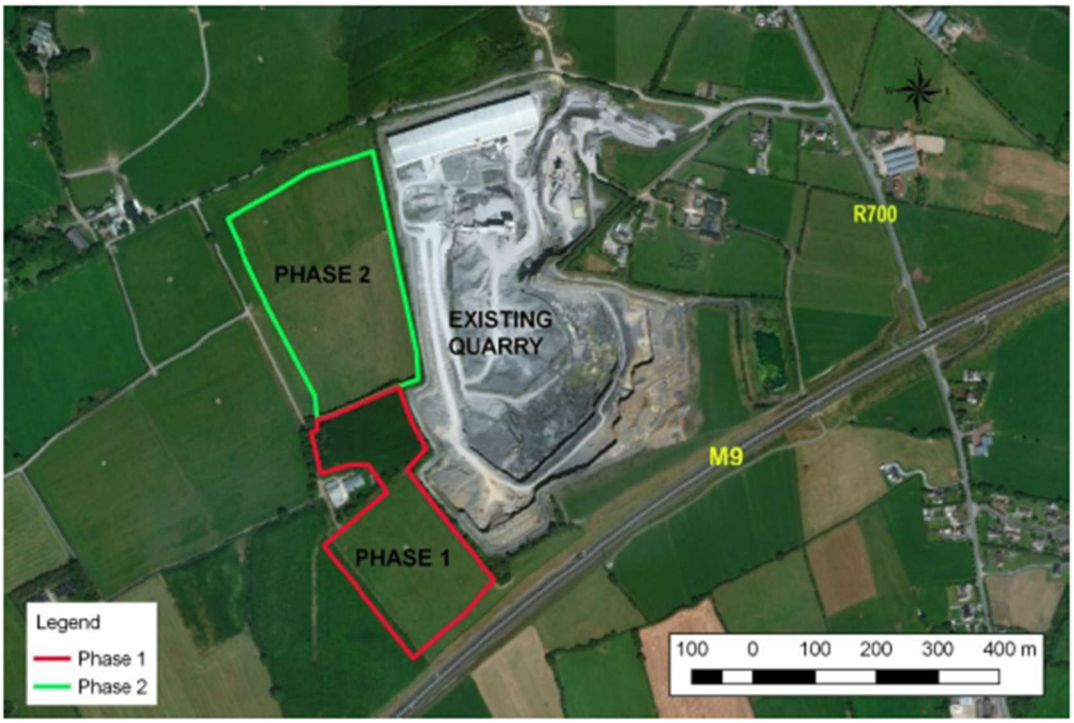
7.104 The Geophysical surveys completed consisted of 2D Electrical Resistivity Tomography (ERT) surveys, Seismic Refraction Profiling surveys, Ground Penetrating Radar (GPR). Following interpretation of the geophysical responses, follow up work included EM31, rotary percussive drilling and chemical analysis of samples. Copies of the Apex site investigation reports (2018a, 2018b, 2025) are attached in Appendix 7-4.

7.105 Apex (2018a) surveyed a 2018 named 'Phase 1' area: this is area of greenfield that gained permission for extension into the west in PL18/858. Those lands are being worked now and the bedrock is

7.106 Apex (2018b) surveyed a 2018 named 'Phase 2' area: this is the northern greenfield area of this 2025 application.

7.107 The 2018 reported areas surveyed by Apex are shown in Plate 7-3 and it is advised here that only Phase 2 of the 2018 works is applicable to this 2025 application for the northern greenfield, which is part of a wider area under consideration.

**PLATE 7-3 Areas Investigated by Apex 2018**




7.108 Apex (2025) reports additional geophysical surveys that incorporate an additional c. 25.1ha of lands, which is the proposed extension to the west of the quarry. The objectives of the investigation were to provide information on overburden type and thickness, depth to and type of bedrock, quality of bedrock and weathered /fractured karst zones. Ground elevations across the investigation site range from 59 mOD to 72 mOD, approximately. The overall integrated assessment area reported by Apex (2025) is shown as Plate 7-4.

**PLATE 7-4 Area reported by Apex 2025**

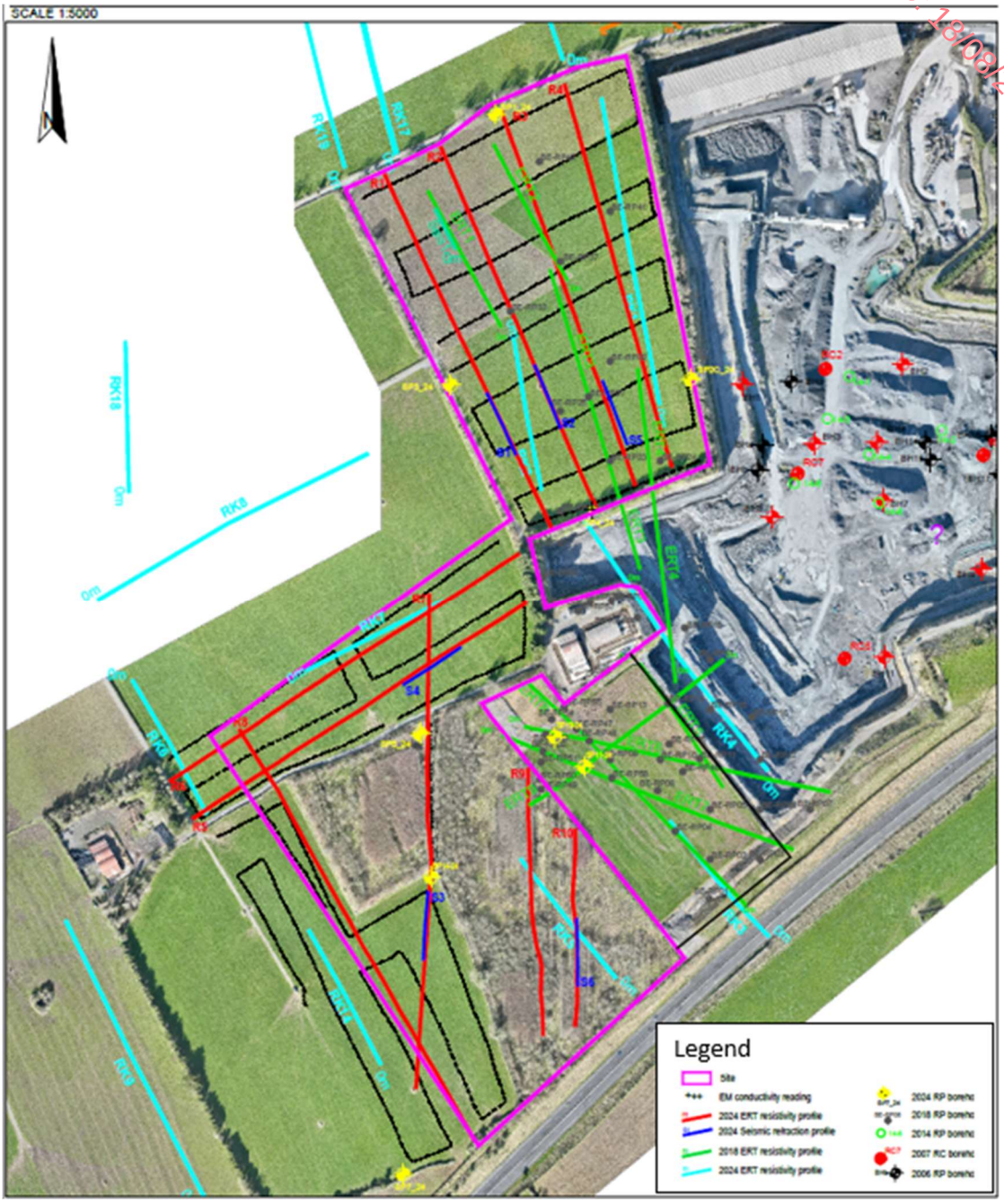

7.109 The results of Apex (2018b) Phase 2 area is integrated into Apex (2025) and the forested lands are now included because they did not form part of Apex 2018a Phase 1. As stated, Apex (2018a) Phase 1 is now being worked.

7.110 Whilst the extent of geophysical survey lines and follow up SI BHs are shown on Plate 7-5, Figure 7.7 of this Chapter allows for easier reference to the BH IDs. Note: Apex (2018a and 2018b) SI BHs are Labelled BE-RP01 to BE-RP61 and the 7 SI BHs drilled by Hydro-G are labelled SP24_01 to SP24_07.

7.111 Key points to note from the Apex (2025) integrated geophysical report for the total greenfield area of this 2025 application are presented after Plate 7-5. The geophysical results are presented in Apex (2025) as Drawings AGP24120_R1 to AGP24120_R10, and a summary is given on Drawings AGP24120_04.

7.112 The results for Apex drilling are discussed in the Bedrock Drilling Section of this Chapter.

**PLATE 7-5 Extent of Greenfeld Area Geophysical Survey and SI BHs (Apex 2018a, 2018b, 2025)***




* This Figure is the 1st Drawing of the Apex (2025) report (DWG AGP24120_01).

7.113 Apex (2025) reported interpretations can be summarised as follows:

- Overburden information interpreted from Geophysics:
  - Over most of the greenfield application area, the depth of soil and subsoil (overburden) is 1m to 5m thick.

- However, there is one distinct area in the northern field of the greenfield application area in which there is a channel, up to 150 m wide, of thick (5 - 20m) overburden. This channel is aligned with the zone of weathering and clay filled fissures previously encountered in the quarry to the east (see Drawing AGP24120_04). The channel of clay is a zone of weathered dry karst is visible in the boundary eastern wall in the northern part of the operational quarry. This channel would have previously been excavated in the initial periods of working the void and this area is now part of the northern stockpile area on the floor. A Haul Road running north from the floor of the 2nd Bench to the crushers, in the direction of Eden Shed, passes this feature. It is stable and it is dry. A subsoil bund is proposed in this area.
- Resistivity values of the overburden are generally in the range 50 – 400 Ohm-m indicating a predominantly gravelly CLAY overburden with occasional GRAVEL and highly weathered/fractured LIMESTONE. Seismic velocities of the overburden are typical of a soft-firm soil becoming stiff to very stiff at depth. The contoured bedrock elevation is shown in Drawing AGP24120_03B.

- Bedrock information interpreted from Geophysics:
  - Over the majority of the greenfield application area, bedrock is generally <5m beneath ground level: the exception being the 150m wide deep channel of clay running from NW to SE through the northern field of the greenfield application area.
  - Geophysical Survey results, confirmed by thin section analysis on rock samples taken from Bench 1 and Bench 3 in the quarry classify the bedrock as bioclastic LIMESTONE.

## Bedrock Drilling Results

7.114 A total of 69 SI BHs have been drilled in the greenfields to the west of the operational quarry: 61 by Apex in 2018 and 7 by Hydro-G in 2024. Driller's records and borehole details are presented in the Apex reports of Appendix 8-4 and in the details for the 2024 Site Investigation Logs of Appendix 7-5.

7.115 Summary information for soils and bedrock under the greenfield application area are presented in Table 7-2(a) for the 2018 drilled SI BHs in the northern field of the greenfield application area and in Table 7-2(b) for the 7 SI BHs drilled in 2024 under Hydro-G's supervision.

7.116 Whilst boreholes are indicated on Plate 7-5, above, they are more clearly discerned in Figure 7-7: 'All Site Investigation Boreholes'.

7.117 With respect to the 61 Site Investigation (SI) BHs drilled, by Percussive Rotary methods, in the greenfield area west of the site in 2018 (Apex 2018a, 2018b) as labelled in Figure 7-7, the information can be divided into relevancy to this 2025 application for consent, as follows:

- The 61 SI BHs drilled in 2018 are Labelled BE-RP01 to BE-RP61.
- Many of the SI BHs relate to the 2018 named 'Phase 1' and that is the greenfield area granted permission in PL18/858 and the bedrock in that area is currently being extracted. Details for those BHs are provided in Appendix B of Apex (2018a).
- Ten SI BHs were drilled in the 2018 named 'Phase 2' and that is the northern field of the greenfield currently part of this 2025 application. Details for those BHs were provided in Appendix B of Apex (2018b) but they are also extracted here as Table 1 and Table 2 of Appendix 7.5 of this Chapter because they are wholly relevant.
- Apex (2025) concludes that boreholes from 2018 and from 2024 do not record any change in rock type from the dark grey/black LIMESTONE generally recorded but an increase in fracturing at shallow levels has been noted at some locations but otherwise medium-strong to strong dark/black limestone to end of hole at 46 m bgl.
- No significant water flows were encountered in any of the 61 SI BHs drilled in 2018 or any of the 7 SI BHs drilled in 2024.

7.110 The 7 Site Investigation (SI) BHs drilled, by Percussive Rotary methods, in 2024 are labelled SP1_24 to SP7_24 in Figure 7-7. Information on the location of the drill site in presented with details for the subsurface in Table 7-2(b).

**Table 7-2 Overburden and Bedrock information from BHs drilled across the 2025 application site**

| BH IDs | Depth (m bgl) | | Description |
|---|---|---|---|
| | From | To | |
| **(a) Apex (2018b) SI BH ID** | | | |
| **BE-RP-021** | 0 | 2.5 | Overburden - Medium brown - sandy / gravelly. |
| | 2.5 | 35 | Fresh Strong Limestone, angular cuttings, steady penetration. |
| | | | |
| **BE-RP-023** | 0 | 2.5 | Overburden - Medium brown - sandy / gravelly. |
| | 2.5 | 35 | Fresh Strong Limestone, angular cuttings, steady penetration. 0.25m deep orange clay layer at 19m bgl. |
| | | | |
| **BE-RP-024** | 0 | 2.5 | Overburden. |
| | | | Lighter coloured and finer limestone. Less chips. |
| | | | |
| **BE-RP-025** | 0 | 12 | Deep Overburden: Brown, clayey, silty sand with medium grey limestone pebbles and cobbles. Refusal at 9.9m, air-flushed and continued to 12m. Refusal again at 12m EOH called. |
| | | | Note: this is in the clay infill fault. |

| | | | |
|---|---|---|---|
| | | | |
| **BE-RP-027** | 0 | 9 | Overburden: Brown/orange silty sands, minor clay, few dark grey, subrounded limestone pebbles and cobbles. |
| | 9 | 16 | Pale coloured limestone. 2m of orange clayey fines, loose at 16m. Heavily weathered to 30m bgl refusal of rig – material too loose. |
| | | | Note: this is in the clay infill fault. |
| | | | |
| **BE-RP-032** | 0 | 3.5 | Overburden: Brown sandy clays. |
| | 3.5 | 35 | Weathered limestone to 30m. Steady and darker to 35m. This is the weathered edge of the fault zone. |
| | | | |
| **BE-RP-033** | 0 | 5.5 | Overburden - Medium brown - sandy / gravelly. |
| | 5.5 | 35 | Weathered limestone to 16.5m. Steady and darker to 35m. This is the weathered edge of the fault zone. |
| | | | |
| **BE-RP-037** | 0 | 1 | Overburden. |
| | 1 | 35 | Pale Limestone to 17m, 5m of sandy clay, rounded chips of limestone from 22m to 35m bgl. |
| | | | |
| **BE-RP-041** | 0 | 4.5 | Overburden: weathered, subrounded pebbles and cobbles, brown sandy clays. |
| | 4.5 | 35 | Pale Limestone to 21m, 1.5m deep brown sandy layer, limestone to base but gets darker at 26m bgl. |
| | | | |
| **BE-RP-042** | 0 | 2 | Overburden. |
| | 2 | 6 | Limestone, harder, chippier. |
| | | | |
| **(b) Petersen and Hydro-G SI BHs 2024** | | | |
| **SP1_24** | 0 | 0.7 | 0.2m of Topsoil. 0.5m of Stiff brown silty sandy CLAY |
| | 0.7 | 48 | Weathered, weak epikarst with clay infills from 0.7 to 2.3m bgl (1.4m deep). Strong to Very strong dark grey blackish LIMESTONE rare fractures occasional calcite veins from 2.3m to 48m bgl. Competent deep dark hard limestone to End of Hole base elevation of 15m OD. |
| | | | |
| **SP2_24** | 0 | 0.5 | Firm to stiff brown very sandy gravelly CLAY |
| | 0.5 | 36.5 | Very weathered limestone to 7.8m bgl. 1.6m orange clay, Strong dark grey blackish LIMESTONE from 12 to 36.5m bgl. This BH is close to the |

| | | | |
|---|---|---|---|
| | | | boundary wall between the greenfield application area and the operational quarry. It captures the edge of the fault. There is a weathered subsurface to 12m bgl but 22m of strong limestone beneath it to End of Hole base elevation of 24m OD. |
| | | | |
| **SP3_24** | 0 | 8.7 | Overburden. Firm to stiff brown sandy silty CLAY high cobble content limestone fragments possible highly weathered rock. |
| | 8.7 | 42.5 | Weak to Medium strong dark grey blackish LIMESTONE frequent fractures occasional calcite veins from 8.7m bgl to 42.5m bgl with a 1.1m deep firm orange tinted brown CLAY layer at 16.10m bgl. This BH is midway on the western edge boundary of the northern field of the greenfield application area. It captures weathering int eh upper subsurface but strong limestone beneath it to End of Hole elevation of 25m bgl. |
| | | | |
| **SP4_24** | 0 | 1.8 | Firm to stiff orangish brown silty sandy CLAY with frequent limestone fragments, possibly highly weathered rock (epikarst). |
| | 1.8 | 36 | Very weathered limestone (epikarst) from 1.8m to 3.3m bgl and thereafter a Medium strong to Strong dark grey blackish LIMESTONE with frequent calcite veins with occasional fractures to End of Hole elevation of 25m OD. |
| | | | |
| **SP5_24** | 0 | 0.4 | Overburden: Brown/orange silty sands, minor clay, few dark grey, subrounded limestone pebbles and cobbles. |
| | 0.4 | 43 | Medium strong to Strong dark grey blackish LIMESTONE with occasional fractures and calcite veins to End of Hole elevation of 25m OD. |
| | | | Note: this is at the northern boundary of the woodland area of the application area. |
| | | | |
| **SP6_24** | 0 | 1.5 | Overburden: Firm to stiff orangish brown silty gravelly CLAY with frequent limestone fragments possible highly weathered rock |
| | 1.5 | 51 | Medium strong to Strong dark grey blackish LIMESTONE occasional fractures and calcite veins to End of Hole elevation 25m OD. Note: this is an SI BH farther west of the proposed greenfield application area. This drill location represents upgradient bedrock. |
| | | | |
| **SP7_24** | 0 | 1.2 | Overburden: Firm to stiff orangish brown silty gravelly CLAY with frequent limestone fragments possible highly weathered rock. |
| | 1.2 | 42 | Medium strong to Strong dark grey blackish LIMESTONE occasional fractures and calcite veins to End of Hole elevation 25m OD. Note: this is an SI BH farther west of the proposed greenfield application area and this location is closer to the M9. This drill location represents upgradient bedrock. |

## Site Investigations - Bedrock Permeability

7.118 Permeability testing by falling head and rising head methods has been undertaken in Envirologic (2024) in the 7 of the SP-24 MWs supervised by Hydro-G. The bedrock permeability report is presented as Appendix 7-6 and results reported are presented as Table 7-3.

**Table 7-3 Bedrock permeability data**

| Well ID | Test Phase | Bedrock K, m/s |
|---|---|---|
| SP1-24 | Pumping | $5.1 \times 10^{-8}$ |
| | Recovery | **$6.6 \times 10^{-9}$** |
| SP2-24 | Pumping | $3.6 \times 10^{-7}$ |
| | Recovery | **$4.3 \times 10^{-8}$** |
| SP3-24 | Pumping | **$1.1 \times 10^{-6}$** |
| SP4-24 | Pumping | $5.8 \times 10^{-7}$ |
| | Recovery | **$2.5 \times 10^{-9}$** |
| SP5-24 | Pumping | $1.3 \times 10^{-7}$ |
| | Recovery | **$1.2 \times 10^{-7}$** |
| SP6-24 | Falling Head | **$1.3 \times 10^{-8}$** |
| SP7-24 | Falling Head | **$8.1 \times 10^{-9}$** |

7.119 Envirologic (2025) reported that their analysis of the pumping phase data using the Cooper-Jacob approach may not be entirely appropriate at all wells as necessary criteria were not always satisfied (e.g. achievement of steady-state pumping conditions). However where steady-state conditions were not achieved, the Bouwer-Rice method was considered to be more appropriate.

7.120 In terms of practical water management at quarries bedrock hydraulic conductivity values of the order of $10^{-8}$ to $10^{-10}$ m/s can essentially be regarded as impermeable and groundwater inflows to the void are likely to be negligible.

7.121 Whilst SP2_24 and SP3_24 are in or near the dry karst clay infill fault in the northern field of the greenfield application area, those SI BHs have 2" piezometers installed with only the screened interval at base open to the bedrock. Therefore, their bedrock permeability is the same as at other locations at the site.

7.122 Hydraulic Conductivity values of the order of $10^{-8}$ to $10^{-10}$ m/s are the values specified for Clay liners under earth lined slurry tanks, or Integrated Constructed Wetlands designed to accommodate wastewater, because such low values mean that they are essentially impenetrable and safeguard the receiving environment. This is the reason that ponds of rainwater accumulate on the bare rock at times, as is seen occasionally in aerial photographs.

## Integration of Site Investigation Information

7.123 In order to conceptualise the proposal and the scale of the potential impact, a number of Cross Sections have been prepared. The orientation of the Cross Section lines are shown on Plate 7-6.

**PLATE 7-6** Cross Section lines.


7.124 Cross Section lines A-A', B-B', C-C' and D-D' are presented overleaf in Plates 7-7 to 7-10.

7.125 The significance of the information portrayed in the Cross Sections is that the operational quarry and the greenfield application area are entirely underlain by Ballyadams Formation Bedrock. The Cross Sections also show the permitted elevation of the floor and that will not change. The Cross Sections show that the proposal is to bring the elevation of the greenfields to the west to the same elevation of the floor of the 2nd Bench of the operational quarry.

**PLATE 7-7** Cross Section line A-A'.

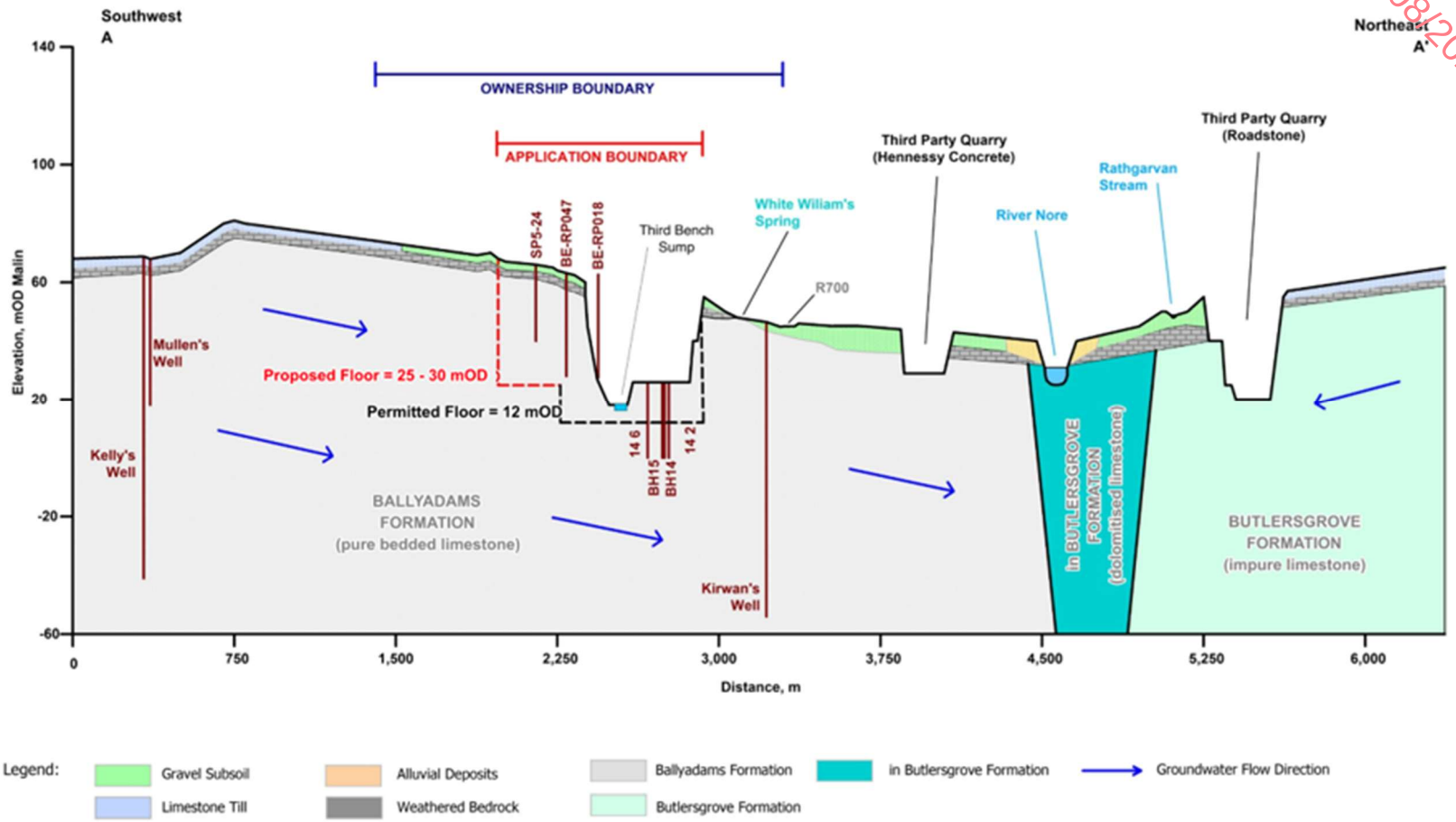


**PLATE 7-8** Cross Section line B-B'.

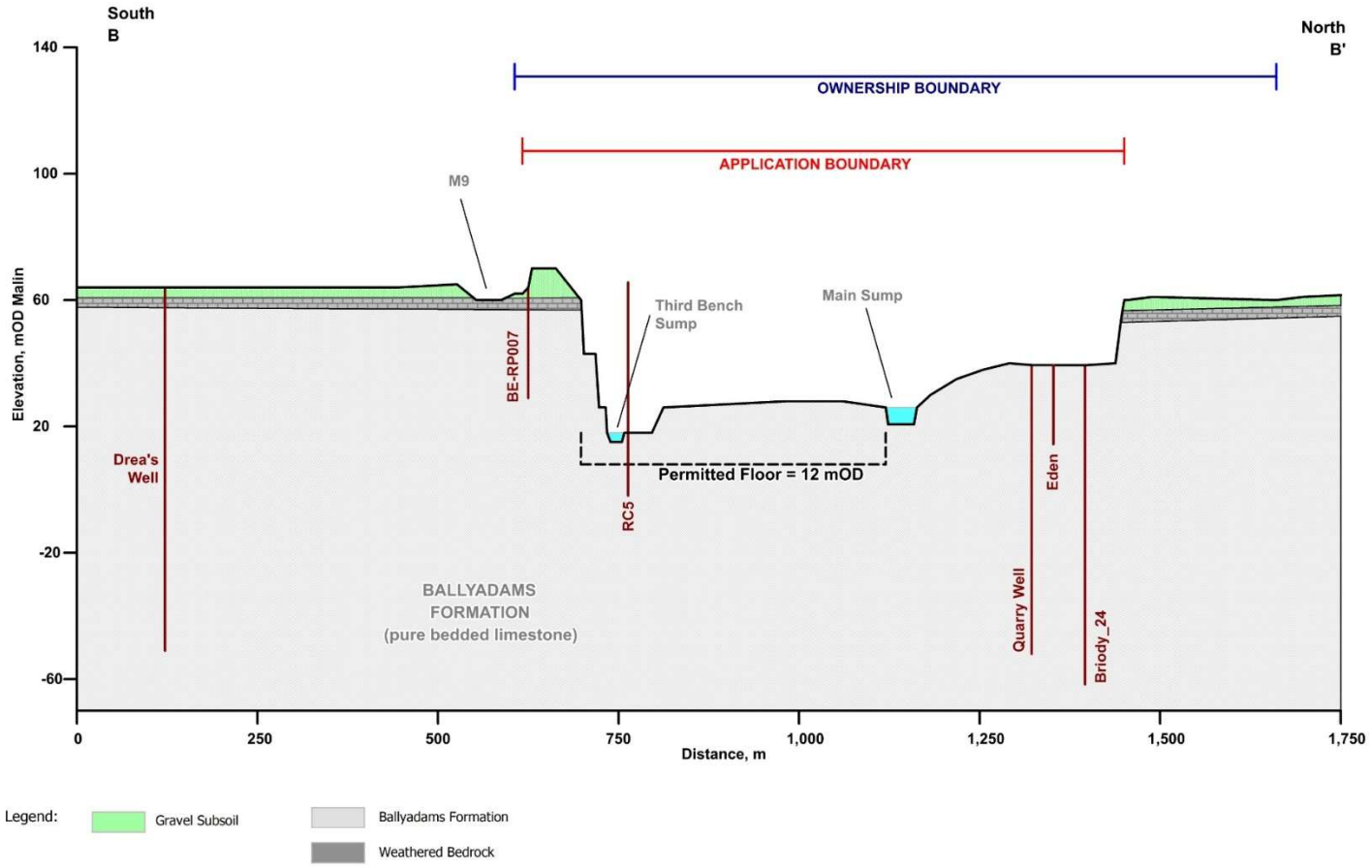


**PLATE 7-9** Cross Section line C-C'.

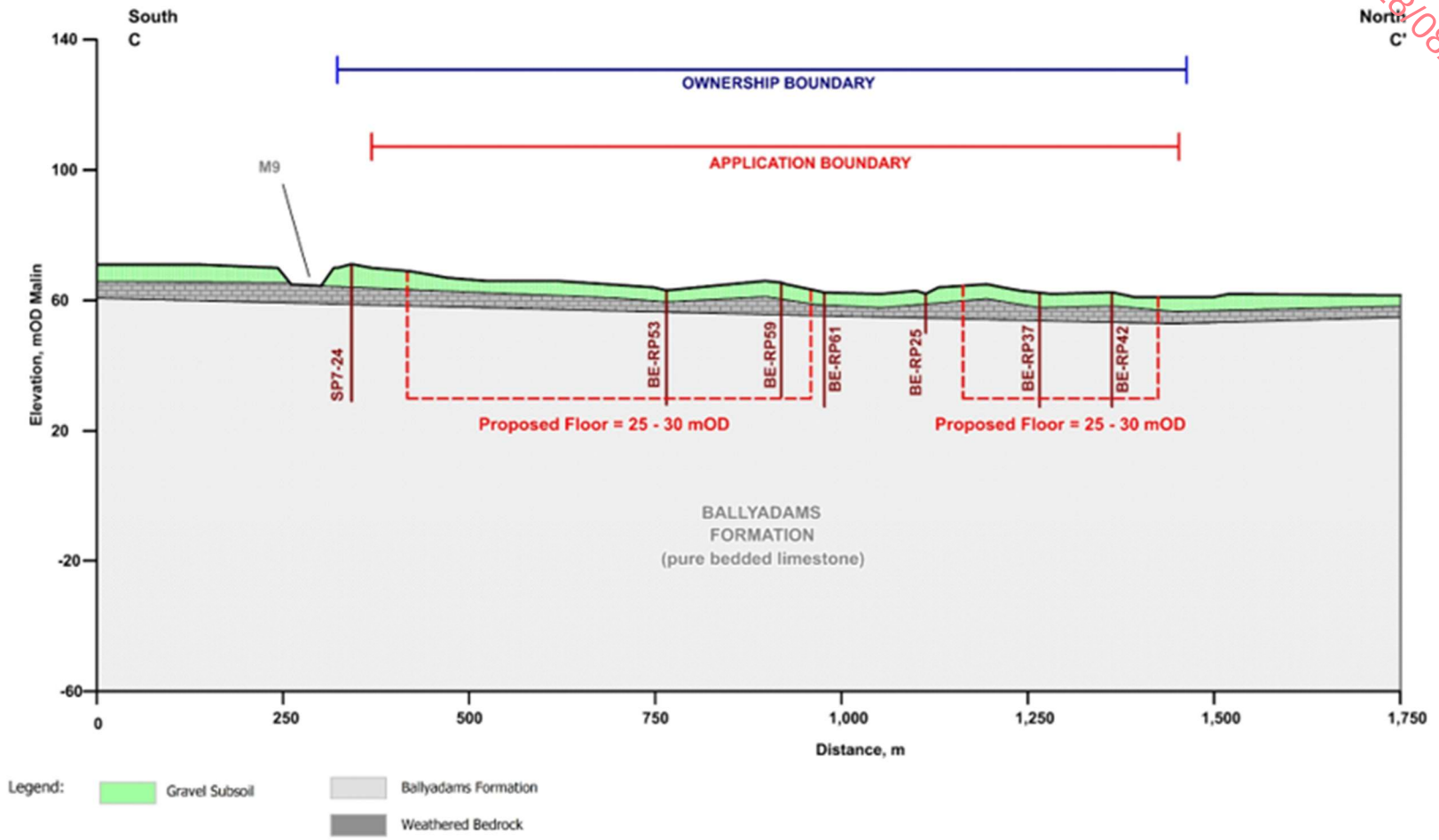
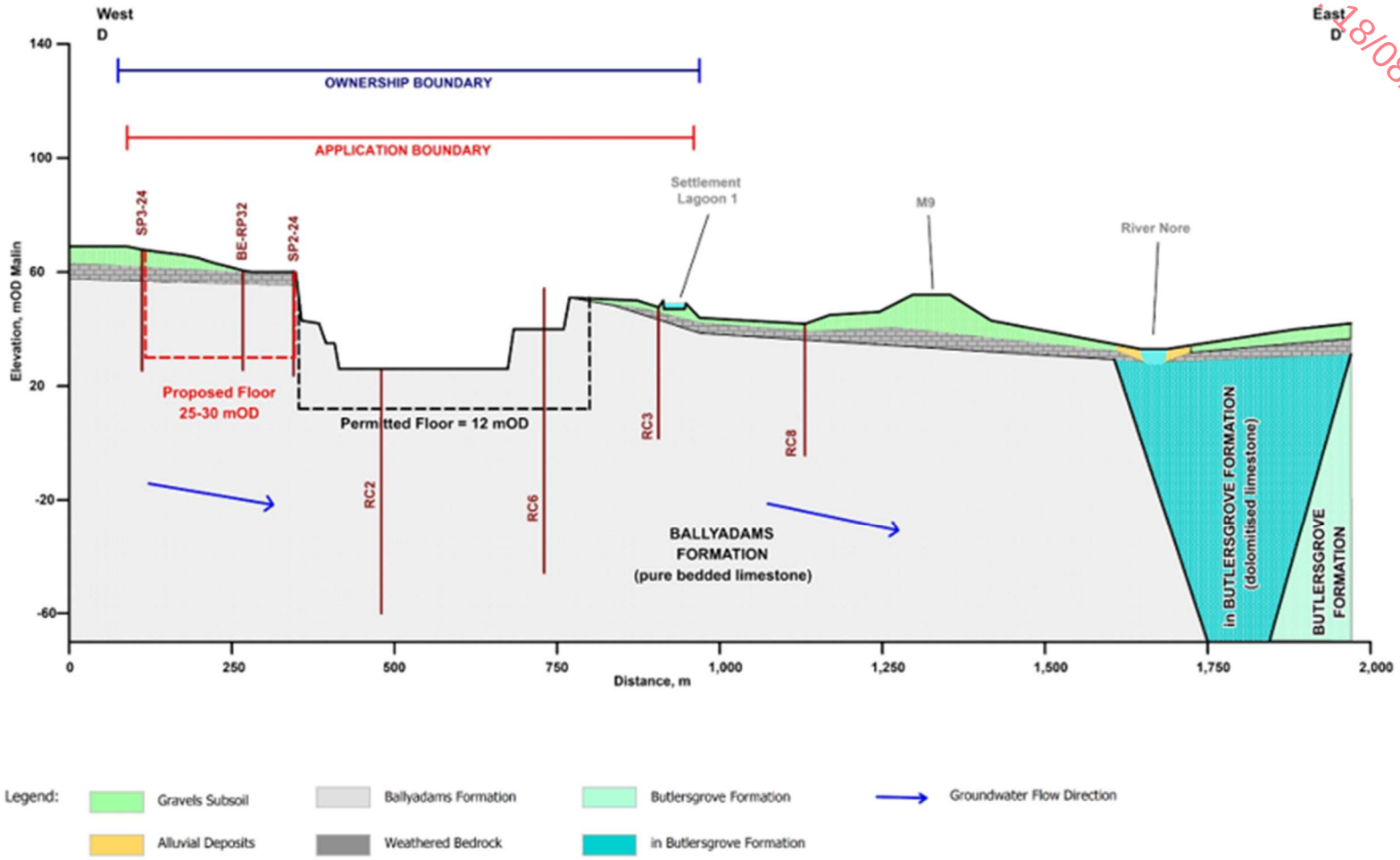


**PLATE 7-10** Cross Section line D-D'.



## Impact Assessment

7.126 The proposal assessed for potential impact relates to the proposed extraction of bedrock over the course of a 25 year permission for extraction plus 2 years to complete site preparation for the natural water restoration process proposed. Details were presented in the opening chapters of the EIAR.

7.127 The application of the framework and methodologies, as shown in Appendix 7-2, provides a general screening of the likely impact to the land, soils and geology environment.

7.128 The procedure for determination of more specific potential impacts to the receiving land, soils and geology environment is to use the information gathered, by desk study and field work, within the site boundary and surrounding landscapes and the assessment of potential impacts to these receptors are then described in terms of quality, significance, duration and type. This methodology adheres to the terminology provided by (EPA, 2022)'s Table 3.4 'Description of Effects', as provided in 'Guidelines on the information to be contained in Environmental Impact Assessment Reports'. Refer again to Appendix 7-2 of this Chapter.

### Potential Impacts - Direct

7.129 Potential Impacts can arise from three project phases:

(i) Construction (enabling) Phase.

(ii) Operational Phase, and

(iii) Landscaping, restoration, decommissioning and aftercare Phase.

7.130 By its nature, quarrying of the underlying rock will involve removal of an identified geological resource and therefore impact upon land, soils and geology must be expected. There will be impact arising from removal of rock. There need not be negative impacts, by virtue of correct design and mitigation measures.

7.131 Quarrying presents a risk of potential impact on the stability of the bedrock environment. Subsidence, slope stability, compaction and slope failure are fully considered in the design of all extraction phases at this site, which ensures that these impacts will be prevented. Refer to AMS Geotechnical Assessment reports specific to the site (2022, 2024 and 2025).

7.132 With respect to the Construction (Enabling) Phase, activities with potential to affect the environment include, as follows:

- Stripping and moving of overburden soils and subsoils: This is considered to be a direct and permanent impact to overburden.
- Tree Felling, clearing and removal of roots from the 6.8ha (c. 7ha) of woodland from an area within the application area proposed for future quarrying.
- Use of machinery and associated hydrocarbons and oils.

7.133 With respect to the Operational Phase, The development of the existing quarry to date has involved the stripping of soils and overburden followed by the extraction and processing of rock. This has taken place within the footprint of the current permitted quarry. Removal of soils and subsoils to facilitate extraction of further bedrock is considered to be an impact of moderate significance, largely due to the spatial footprint. The removal of soil/subsoil will remove the capacity of the subject lands to provide agricultural production. Soil/subsoil used in perimeter berms provides both site security screening (visual, noise & dust) and will be reused or integrated as a fundamental part of site rehabilitation.

7.134 Extraction of bedrock within the application site and associated activities, such as blasting and mechanical removal of rock, will have a direct impact on the geology of the sandstone/mudstone within the bedrock extraction area. This is therefore considered to be a direct and permanent impact to bedrock. This impact has occurred historically within the active quarry and it is considered appropriate in order to continue extraction of bedrock at this site. The significance of the continued extraction of bedrock from this geological unit is considered to be significant/moderate, again as a function of scale. An extraction capacity of up to 288,462 m3/yr is being sought as part of this application. A quarry of this size would be considered to be Moderate scale for quarry development. The significance of the future proposed additional area of 21.5ha extraction of bedrock from this geological unit is considered to be significant/moderate. Bedrock extraction of this size would be considered to be at Moderate scale for quarry development.

7.135 It is proposed to develop additional two extractive benches of limestone below the current land surface elevation to the west of the existing quarry floor. The proposal is to increase the area of the floor but the extension is lateral and there is no proposal to deepen the quarry deeper than its current permitted elevations, which are the 2nd Bench floor of 30m OD and the southern portion of the operational quarry's 3rd Bench 12m OD.

7.136 The proposed lateral extension into the west will be worked from the existing and operational quarry in a series of c. 19 benches of bedrock beneath the western greenfields to a floor elevation ranging from 25m to 35m OD. The floor of the current operational quarry will be the deepest part of the site and its permitted 12m OD will not go deeper.

7.137 Water Management Systems are already in place to manage the waters that will derive from the excavation of bedrock from the proposed lateral extension area. In order to maintain a dry working environment on the floor of the quarry the floor sumps will evolve with progression into the bench being excavated. From the floor sump water will be sent to the operational settlement lagoon elevated above the floor. Following the settlement lagoon, the waters arising from operation of the site will continue to be discharged under the current Section 4 Discharge Licence for the site (Kilkenny County Council Ref ENV/W/78, 2017). Review of the information presented in the Water Chapter suggests that there is adequate capacity in the existing discharge licence and it will not need review or amendment in order to treat the proposed development's waters. Increases in rainfall amounts have already been accounted for in the climate change factors applied in the site's Emission Limit Value in the 2017 Licence. The report accompanying the application for Review of the Discharge is presented in Appendix 8.2 of the Water Chapter.

7.138 With respect to the Landscaping, Restoration and Afterlife Phase of the project, this phase will provide a safer environment than is currently the case, with the removal of all plant and infrastructure, and creation of stable slopes in the interest of health & safety and long-term sustainability. The restoration plan will involve allowing water to accumulate in the quarry void. This confirms that the long-term land use will have changed from quarrying to biodiversity/amenity. Regular monitoring and maintenance of the mitigation systems will be conducted to ensure their continued effectiveness. Compliance with relevant environmental regulations and standards will be maintained throughout the operational and post closure phases. The site will be reinstated in accordance with the approved quarry restoration scheme and thus integrated back into the surrounding landscape with the attendant improvement to the visual amenity of the area.

7.139 With respect to Land, Soils & Geology or geological features, there are no Designated Sites with Conservation Objectives (SACs or SPAs) specific to land, soils and geology, within the application area or within radius of influence of the proposed development. Conservation Objective Sites are addressed in detail in the Water Chapter.

7.140 On the basis of the foregoing, the Summary Table for Potential Impacts on Land, Soils and Geology is presented as Table 7-4.

## Table 7-4 Summary of Potential Impacts on Land, Soils & Geology Environment

| Phases | Activity | Attribute | Importance of attribute | Nature and description of the effect | Quality | Significance | Extent & Context | Probability of effects (pre-mitigation) | Frequency & Duration | Type of effect |
|---|---|---|---|---|---|---|---|---|---|---|
| Construction Phase | Stripping of overburden | Soils, Subsoils | Low to Medium Importance : Generally very thin soils and subsoils. | Excavation of soil/subsoil, storage in stockpiles and reuse in berms and landscaping. | Moderate Adverse | Slight | Within application boundary | Likely | Permanent | Direct |
| | Removal of Woodland | Soils & Subsoils | Soils & Subsoils: Medium to Low Importance. | Removal of subsoil with roots. Loss of Overburden. | Moderate Adverse | Slight | Quaternary Geology within the site boundary. | Likely | Temporary | Direct |
| | Demolition of farmyard. | Soils & Subsoils | Soils & Subsoils: Medium to Low Importance. | Removal of yards, underground tanks, creation of demolition waste, corrugated metal, reinforcing steel and concrete has the potential to be a nuisance. | Moderate Adverse | Slight | Within application boundary | Likely | Permanent | Direct |

| Phases | Activity | Attribute | Importance of attribute | Nature and description of the effect | Quality | Significance | Extent & Context | Probability of effects (pre-mitigation) | Frequency & Duration | Type of effect |
|---|---|---|---|---|---|---|---|---|---|---|
| | Use of excavator & dump trucks: spillages during refuelling, use and storage of lubricants. | Soils & Subsoils | Soils & Subsoils: Medium to Low Importance. | Contamination of soils and subsoils. | Adverse | Slight | Within application boundary | Likely | Permanent | Direct |
| Operational Phase | Use of Explosives. | Bedrock | High | Contamination of rock with explosives residues. | Adverse | Moderate | Within the site boundary. | Unlikely (Blast Technology is Advanced) | Intermittent Monthly – Bi Monthly)<br>Long-term | Direct |
| | Extraction of bedrock. | Bedrock | High | Loss of Bedrock. Permanent removal of bedrock for society's use. | Positive | Moderate | Bedrock within site boundary. | Likely | Permanent | Direct |
| | Use of Explosives and Extraction of bedrock. | M9 Motorway | Extremely High | Structural Damage to the M9 Motorway. | Adverse | Significant | A 300m stretch of Motorway bounds the greenfield application area. | Unlikely | Occasional, Infrequent. | Direct |

| Phases | Activity | Attribute | Importance of attribute | Nature and description of the effect | Quality | Significance | Extent & Context | Probability of effects (pre-mitigation) | Frequency & Duration | Type of effect |
|---|---|---|---|---|---|---|---|---|---|---|
| | Use of quarrying machinery: spillages when refuelling, lubricant use and storage. | Soils, subsoils and exposed bedrock. | Soils & Subsoils: Medium to Low Importance.<br>Bedrock High Importance. | Contamination of soils, subsoils and bedrock with hydrocarbons. | Adverse | Moderate | Soils, subsoils and bedrock within site boundary. | Unlikely | Medium | Direct |
| Restoration Phase | Removal of semi-mobile and mobile plant (pumps, generators, etc. ). | Soils, subsoils and exposed bedrock. | Soils & Subsoils: Medium to Low Importance. | Elimination of hydrocarbon sources | Positive | Moderate | Within site boundary | Likely | Permanent | Direct |
| | Dismantling and removal of fixed plant & machinery (crushing plant, wheelwash, etc. ) | Soils, subsoils and exposed bedrock. | Soils & Subsoils: Medium to Low Importance. | Elimination of hydrocarbon sources | Positive | Moderate | Within site boundary | Likely | Permanent | Direct |
| | Landscaping and movement of infrastructure and overburden stockpiles necessary to facilitate site restoration | Soils, subsoils and exposed bedrock. | Soils & Subsoils: Medium to Low Importance. | Elimination of hydrocarbon sources | Positive | Moderate | Within site boundary | Likely | Permanent | Direct |

| Phases | Activity | Attribute | Importance of attribute | Nature and description of the effect | Quality | Significance | Extent & Context | Probability of effects (pre-mitigation) | Frequency & Duration | Type of effect |
|---|---|---|---|---|---|---|---|---|---|---|
| Unplanned Events (Major Accidents) | Fuel tank failure or large scale spillage | Exposed bedrock. | Soils & Subsoils: Medium to Low Importance. | Hydrocarbon contamination | Adverse | Significant | Within site boundary and 1 km radius | Unlikely | Momentary | Direct |
| | Face Collapse / Wall Stability | Exposed Bedrock | High | Rock Fall / Slump | Negative | Small / Adverse | Within application site boundary | Unlikely | Medium | Direct |
| | Structural damage to the M9 | Motorway | High | Structural failure arising from removal of bedrock at the quarry. | Adverse | Significant | Along the quarry's boundary with the M9. | Unlikely | Permanent | Direct |

### Potential Impacts - Indirect

7.141 Indirect impacts (or secondary impacts) are those which are not a direct result of the proposed activity, often produced away from the project site or because of a complex pathway. The indirect impact of the conversion of dairy grazing grassland to quarrying is the permanent removal of subsoil.

7.142 Activity at the proposed development site has the potential for the generation of dust, which could have an indirect, brief, imperceptible impact beyond the application boundary, without mitigation and monitoring methods already associated with the site.

### Impacts – Transboundary

7.143 EIA Directive 2014-52-EU invokes the Espoo Convention on Environmental Impact Assessment in a Transboundary Context (1991) and applies its definition of transboundary impacts.

7.144 Given the location of the site at c. 170 km, approximately, at its closest position to the border with Northern Ireland to the north of the site, the nature, size and scale of the proposed development, it is expected that the development will not have any significant transboundary effects with respect to land, soils and geology.

### Impacts – Cumulative

7.145 The aim of the cumulative impact assessment is to examine whether any other proposed developments have the potential to act in-combination with the proposed application, subsequently giving rise to effects that would not otherwise be significant.

7.146 The cumulative impact assessment considered relevant activities within a 10 km radius. The cumulative impact Section of the Water Chapter has considered all potential for cumulative impact on the hydrogeological environment and the same targets are relevant for the geological environment. Given that the Water Chapter could conclude no potential for cumulative impact with other developments with respect to hydro and geology, the same conclusion is possible here in the LSG conclusions: No Potential for Cumulative Impact.

### 'Worst Case' Impacts

7.147 The 'worst case' impacts would involve a substantial fuel or other hydrocarbon spill on-site, resulting in localised contamination of exposed bedrock and that poses a risk to waters collected on the floor and discharged. However, the settlement lagoon Water management system and mitigation measures associated with the Section 4 Discharge Licence (Kilkenny County Council) will ensure that there is no migration of contamination off site.

7.148 Additionally, extending the quarry laterally across a greater area, while maintaining the permitted quarry floor elevation, could result in an increase in water volumes collected in the sump, which will require management. This could lead to increased discharge. The quarry floor is large enough to accommodate any additional, unexpected, water and this is the restoration plan in any case. Therefore, Details are provided in the Water Chapter of this EIAR.

## Mitigation Measures



7.149 Mitigation measures are set out in Table 7-5 and these will be adopted for the proposed extraction activities to reduce the potential impacts to the receiving land, soils and geology environment as identified in Table 7-4.

7.150 As a result of the mitigation measures implemented at the site, it is considered that any impacts associated with the quarrying related activities undertaken at the site will not contribute to cumulative impacts in combination with any developments in the surrounding area.

## Residual Impacts

7.151 Residual impacts refer to the degree of environmental change that will occur after the proposed mitigation measures have taken effect. Residual Impacts are also shown with Mitigation Measures in Table 7-5.

7.152 As a result of the proposed mitigation and enhancement measures incorporated in the design, no significant, long-term, adverse residual impacts are predicted in terms of Land, Soils and Geology during the operational phase, other than the inevitable loss of mineral resources (*i.e.*, limestone) due to quarrying.

7.153 It is considered that following full restoration and closure of the site that there will be no significant, long-term, adverse impacts in terms of Land, Soils and Geology, again other than the permanent, significant negative impact due to extraction of the mineral resources. The restored quarry will provide a more manageable environment, than is currently the case, but with a change in land-use from Mineral extraction to the future beneficial future land-use as wildlife amenity.

7.154 The primary mitigating factor is that the overall regional and national scale of this type of bedrock is large. The impact of the extraction of the proposed footprint of limestone bedrock is small relative to the volume of this type of this rock in the region. Large areas of Laois and Kilkenny are underlain by this type of Limestone. Therefore, it will remain insitu in other parts of the region.

## Table 7-5 Mitigation Measures and Residual Impacts

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| **Construction Phase** | Stripping of Overburden. | Soils & Subsoils. | Excavation and stockpiling of soil and subsoil creates potential for loss of particulates in the stockpiling of soils and subsoils. | There will be no net loss of soils and subsoils as they will be retained on site and reused in landscaping berms. Therefore, there is no loss of resource. Movement of soils and subsoils to boundary berms is part of site mitigation for visual impact, noise, safety.<br>The slope on berms shall be minimised to reduce degradation of subsoil structure and generation of dust.<br>Handling and placement of soils/subsoils shall only take place during appropriate weather conditions and when the soils are in optimum condition (moist but friable). Soils shall not be moved when they are too dry or during unusually windy conditions.<br>Silt fences shall be utilised to prevent loss of sediment across the site boundary.<br>Working contours shall be such that there are no direct pathways for suspended solids to leave the site via uncontrolled runoff. Sprinklers and road sweepers shall be used to suppress dust. | Imperceptible | Unlikely |
| | Removal of Woodland | Soils & Subsoils. | Removal of subsoil with roots. Loss of Overburden. | Tree Felling, stripping and excavating the roots of the trees shall only take place during appropriate weather conditions and when the soils are in optimum condition (moist but friable). Soils shall not be moved when they are too dry or during unusually windy conditions.<br>Silt fences shall be utilised to prevent loss of sediment across the site boundary.<br>Working contours shall be such that there are no direct pathways for suspended solids to leave the site via uncontrolled runoff. Sprinklers and road sweepers shall be used to suppress dust. | | |

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| | Demolition of Farmyard and associated buildings and underground structures. | Soils & Subsoils. | Removal of yards, underground tanks, creation of demolition waste, corrugated metal, reinforcing steel and concrete has the potential to be a nuisance. | Upon complete yard clearance all silage, machinery and other items, the yard will be inspected evidence of hydrocarbon stains or residues of oils and these will be treated appropriately and safely with suitable absorbent and cleaning products. Following this, the yards will be power washed before demolishing any buildings. Farmyard drainage will allow for the collection of all power washing water from the yards and silage storage areas into the underground tanks of the yard. All wash waters arising from power washing the yards will be spread using constraints and regulation criteria of the Good Agricultural Practice Regulations 2022 (S.I. 113 2022) for dirty water and slurry.<br><br>A 'Demolition Waste Management Plan (DWMP)' has been prepared for the removal and demolition of the existing farmyard. The DWMP is submitted with the application and the detail within it outlines the strategy for demolition and managing demolition-related waste in accordance with the Waste Management Act 1996 (as amended) and all associated regulations. | Imperceptible | Unlikely |

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| | Use of quarrying machinery and equipment – spillages during refuelling, use and storage of lubricants | Soils, subsoils, bedrock. | Contamination of soils, subsoils and bedrock with hydrocarbons. | Potentially contaminating substances will be stored in a designated area that is isolated from potential receptors. There are no drainage ditches or surface waters at the greenfield application area or operational quarry.<br>Hazardous wastes such as waste oil will be stored in designated, sealed containers. All waste containers and fuel tanks shall be stored within a secondary containment system (e.g., a bund for static tanks or a drip tray for mobile stores and drums). The bunds will be capable of storing 110% of tank capacity, plus a minimum 30 mm rainwater allowance where the bund is uncovered.<br>Where more than one tank is stored, the bund must be capable of holding 110% of the largest tank or 25% above the aggregate capacity. Drip trays used for drum storage must be capable of holding at least 25% of the drum capacity.<br>Regular monitoring of water levels within drip trays and bunds due to rainfall will be undertaken to ensure sufficient capacity is maintained at all times.<br>Refuelling shall be by mobile bunded bowser at a designated area, i.e., site compound, or where possible off-site.<br>An adequate supply of spill kits and hydrocarbon absorbent packs shall be stored in works area.<br>An oil interceptor forms part of the system the settlement lagoon system and removes hydrocarbons that may be present in the water. | Imperceptible | Unlikely |
| **Operational Phase** | Blasting of bedrock. | Soils, subsoils, exposed bedrock. | Contamination of rock with explosives residues. | Bedrock blasting at all sites is Gardai licenced, supervised and controlled. Installation of, and detonation of, explosives can only be completed by Industry specialists. In the Water Chapter Of the EIAR a sequence of calculations were presented to estimate the residuals of all nitrogen species (Nitrate, Ammonia, Nitrite) in all site waters after blasting. The results of the calculations show that the simulated resultant concentrations all N Species are microscopically very low. It is surmised that the risk of impact to the environment is imperceptible. | Imperceptible | Unlikely |

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| | Extraction of bedrock. | Soils, subsoils, exposed bedrock. | Loss of Bedrock. Permanent removal of bedrock for society's use. | There is no measure to mitigate against loss of bedrock. The amount to be extracted is considered small in terms of the overall limestone bedrock resource available in the County and nationally.<br>The Ballyadams Formation limestone that is being abstracted is reported by the GSI 400 – 700m thick and by Tedd (2011) as at least 200m thick. The Kilkenny GWPSR (GSI, 2002) reports that the average thickness is 200m, and the unit is widespread across the northern half of Kilkenny, where it overlies both the Durrow and the Butlersgrove Formations. The proposed extraction of bedrock over the relatively small lateral extension area and a relatively small depth compared to the reported average 200m thick, and 400 – 700m depth, limestone is inconsequential in terms of the regional resource of bedrock remaining in situ. | Imperceptible | Unlikely |
| | Extraction of bedrock and use of Explosives. | M9 Motorway | Structural damage to the M9 Motorway. | Whilst a 300m length of Motorway bounds the proposed greenfield application area, blasts are carried out over c. 30m lengths of rock at a time. Blast technology and monitoring prevents migration of blast impacts. No impact has occurred to date in the excavation of the operational quarry and neither are impacts envisaged in the future. | Imperceptible | Unlikely |
| | Use of quarrying machinery: spillages when refuelling, lubricant use and storage. | Soils, subsoils, exposed bedrock. | Contamination of bedrock with hydrocarbons and other materials. | The same Mitigation Measure applies to the use of Quarrying Machinery, Spillages, refuelling, use of Lubricants as was presented, above, for the Construction Phase. The same control and mitigation measures will apply to all site activities: enabling, operational and restoration. | Imperceptible | Unlikely |
| **Restoration Phase** | Removal of semi-mobile and mobile plant (pumps, generators, etc. ) | Soils, subsoils, exposed bedrock. | Elimination of hydrocarbon sources | Positive impact. No mitigation required. | Imperceptible | Unlikely |

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| | Dismantling and removal of fixed plant & machinery (crushing plant, wheelwash, etc. ) | Soils, subsoils, exposed bedrock. | Elimination of hydrocarbon and dust sources | Positive impact. No mitigation required. | Imperceptible | Unlikely |
| | Landscaping and movement of infrastructure and overburden stockpiles necessary to facilitate site restoration | Soils, subsoils, exposed bedrock. | Elimination of hydrocarbon and dust sources | Positive impact. No mitigation required. | Imperceptible | Unlikely |
| **Unplanned Events** | Fuel tank failure or large scale spillage | Exposed bedrock. | Hydrocarbon contamination | Spill Kits are SOP and all Refueling Vehicles will carry those Spill Kits; bunded tanks, drip trays, appropriate containers in appropriate locations will be ensured. | Imperceptible | Unlikely |
| | Face Collapse / Wall Stability | Exposed bedrock. | Rock fall / slump. | The existing regime of routine Geotechnical Assessments will continue to ensure continued stability within the extraction area. Compliance with the Quarry Regulations and standards will be maintained throughout the operational and post closure phases. | Imperceptible | Unlikely |

| PHASES | POTENTIAL IMPACT | | | MITIGATION MEASURES | RESIDUAL EFFECT FOLLOWING MITIGATION | |
|---|---|---|---|---|---|---|
| | Activity | Attribute | Character of the Potential Impact | Description of Mitigation | Significance or Quality of the Effect | Probability of Effect Post Mitigation |
| | Structural damage to the M9. | M9 Motorway | Significant | A site-specific Geotechnical Assessment has been completed for the proposed greenfield application area (ASM, 2025) and it concluded that the proposed development will not pose a risk to the structural integrity of the M9 motorway corridor. | Imperceptible | Unlikely |

## Interaction with other Impacts

7.155 The EIAR guidelines (EPA, 2022) highlight that the interaction of impacts to the land, soils and geological environment, arising from proposed activities, must be given due consideration alongside potential receptors identified in other EIAR sections. The likely interactions have been identified as follows:

(i) The movement of bedrock by blasting and mechanical means can give rise to increased dust emissions.
(ii) The operation of plant associated with extraction and haulage can give rise to increased traffic movements.
(iii) The operation of plant associated with extraction and haulage can give rise to increased noise emissions.
(iv) The extraction of bedrock can impact upon surface and groundwater quality and flow patterns.
(v) The extraction of bedrock can impact upon biodiversity and cause disturbance to habitats in the area.

7.156 Each of these issues and the mitigation measures proposed are addressed in detail in the relevant chapters of this EIAR & the 'Interactions of the Foregoing'. These impacts are considered to be negative but with suitable measures in place, their significance can be mitigated, with the exception of the extraction of bedrock, the removal of which is permanent. However, this is an inevitable consequence of quarrying and extractive activities that is deemed essential to development of society.

## Do-Nothing Scenario

7.157 The 'Do Nothing Scenario' evaluation requires consideration of the effect on the environment as it would be in the future should the proposed works not be carried out.

7.158 If the development did not proceed, the aggregate resource would remain unused in situ, and the local supply of quality aggregates would be more restricted.

7.159 The lands of the operational quarry represent a disturbed and degraded landscape with infrastructure and stockpiles on the quarry floor. Under the 'Do Nothing' scenario, all quarrying activities would cease. The site would be restored to beneficial after-use as per the requirements of the existing planning permission. However, the potential future resources of the quarry would remain *in situ*, unutilised, and would possibly result in the requirement to develop a more remote greenfield site in a different part of the landscape, whether that is near Kilkenny city or another part of the County.

7.160 As the proposed activities are a continuation and extension of activities at an established extraction site, it is envisaged that no new or different potential impacts shall be introduced when compared to the current operational phase.

7.161 It is considered more appropriate to continue activities at an existing active quarry as opposed to opening a new quarry on a greenfield site. The extractive industry is necessary in order to meet the needs of society for homes, transport networks, places of work and recreational areas. Quarrying is an established land use at this site and it has been integrated

into the local environment. As it is a continuation of existing activities, there will be effectively no construction or enabling phase with respect to access to the extraction area.



7.162 Extraction capacity is sought to provide the applicant with the ability to respond to demand for aggregates in the region. Permission is sought for a period of 25 years of bedrock extraction plus 2 years for the enabling and decommissioning for the natural restoration phase.

7.163 Whilst machinery will be replaced as necessary, there will be no increase in site infrastructure associated with ongoing extraction, internal haulage and processing of raw material.

7.164 Sourcing of bedrock at a greenfield site at a further remove would significantly increase impacts linked to traffic such as increased combustion of fossil fuels.

## Monitoring

7.165 As no significant impacts are expected other than the loss of the mineral resource, the only monitoring required, with respect to the land, soil or geological environment is the continuation of the biannual Geotechnical Assessment.

7.166 The detailed procedures to be followed, in respect of monitoring for the purpose of demonstrating compliance with Permissions and Licences etc. , are understood by site workers, operators and management. Operation of the quarry already includes monitoring activities (e.g., Water, Blasting, Noise and Dust) to demonstrate that the development is not having an adverse impact on the surrounding environment.

7.167 Future environmental monitoring reports for the site will continue to be submitted to Kilkenny County Council for their approval.

7.168 New monitoring programs will be compiled to comply with any new Conditions attached to any decision to grant planning permission, and also to ensure that the development is not having an adverse impact on the surrounding environment.

## Close

7.169 The Kilkenny County Development Plan (2021 – 2027) acknowledges quarrying as an important source of employment and that the continual supply of aggregates is necessary for future growth. In addition, Kilkenny County Council acknowledges the need for environmental protection and that extractive industry guidelines (EPA, 2006) must be adhered to.

7.170 The field works and application of EPA (2022), NRA (2009) and IGI (2013) Guidelines for Assessment enable a conclusion that the quarry can continue to extract rock from a lateral extension into the west to an elevation of 25 to 30m OD, supply rock, with the application of mitigation measures, and that there will be no residual negative effects on Lands, Soils & Geology, other than the removal and relocation of rock product. It is respectively suggested that the site has been assessed in accordance with the EU EIA Directive 2011/92/EU, as amended by EIA Directive 2014/52/EU, and the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

## References

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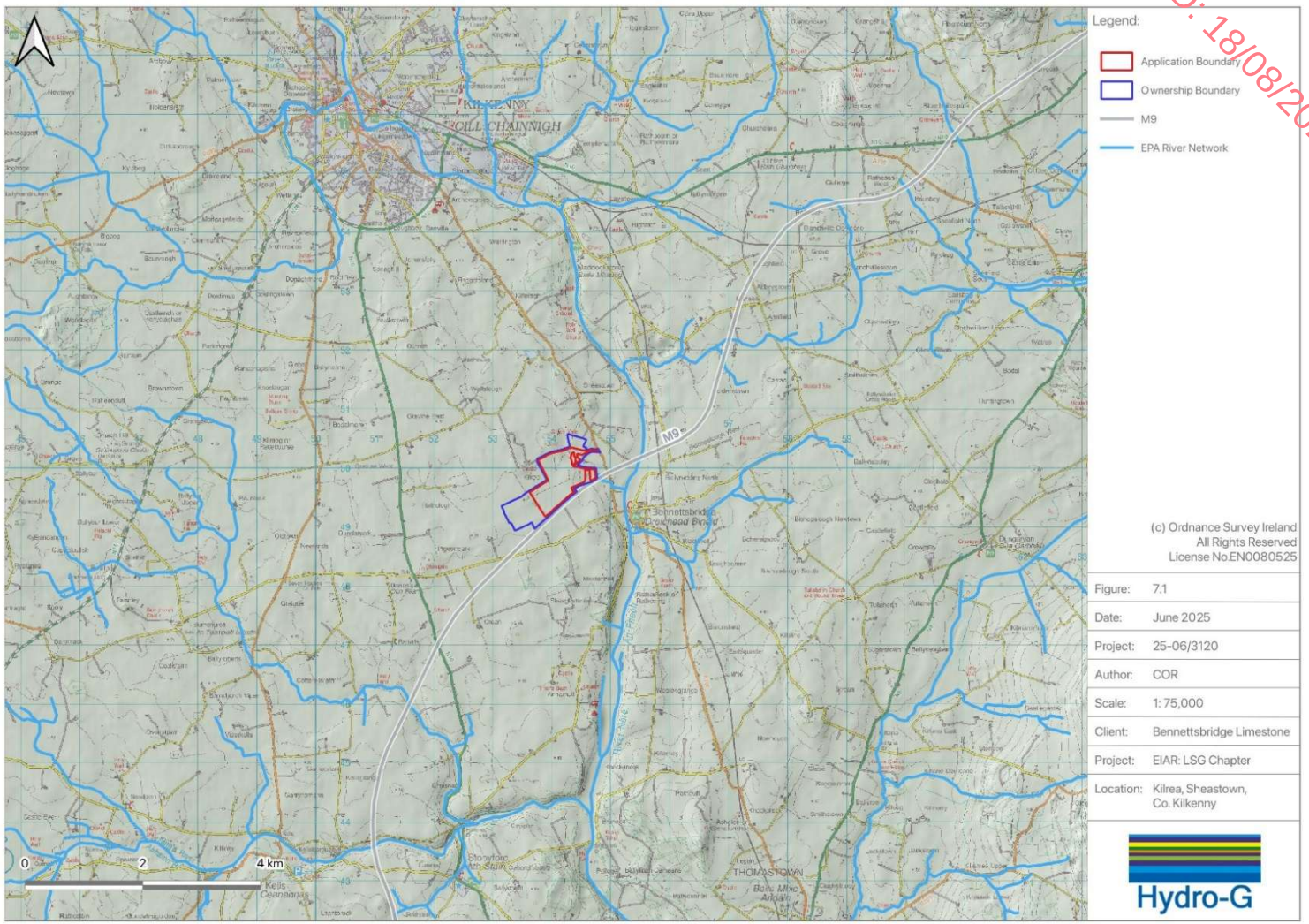
# Figures

## Figure 7-1 Site Location and Topography



## Figure 7-2 General Soils

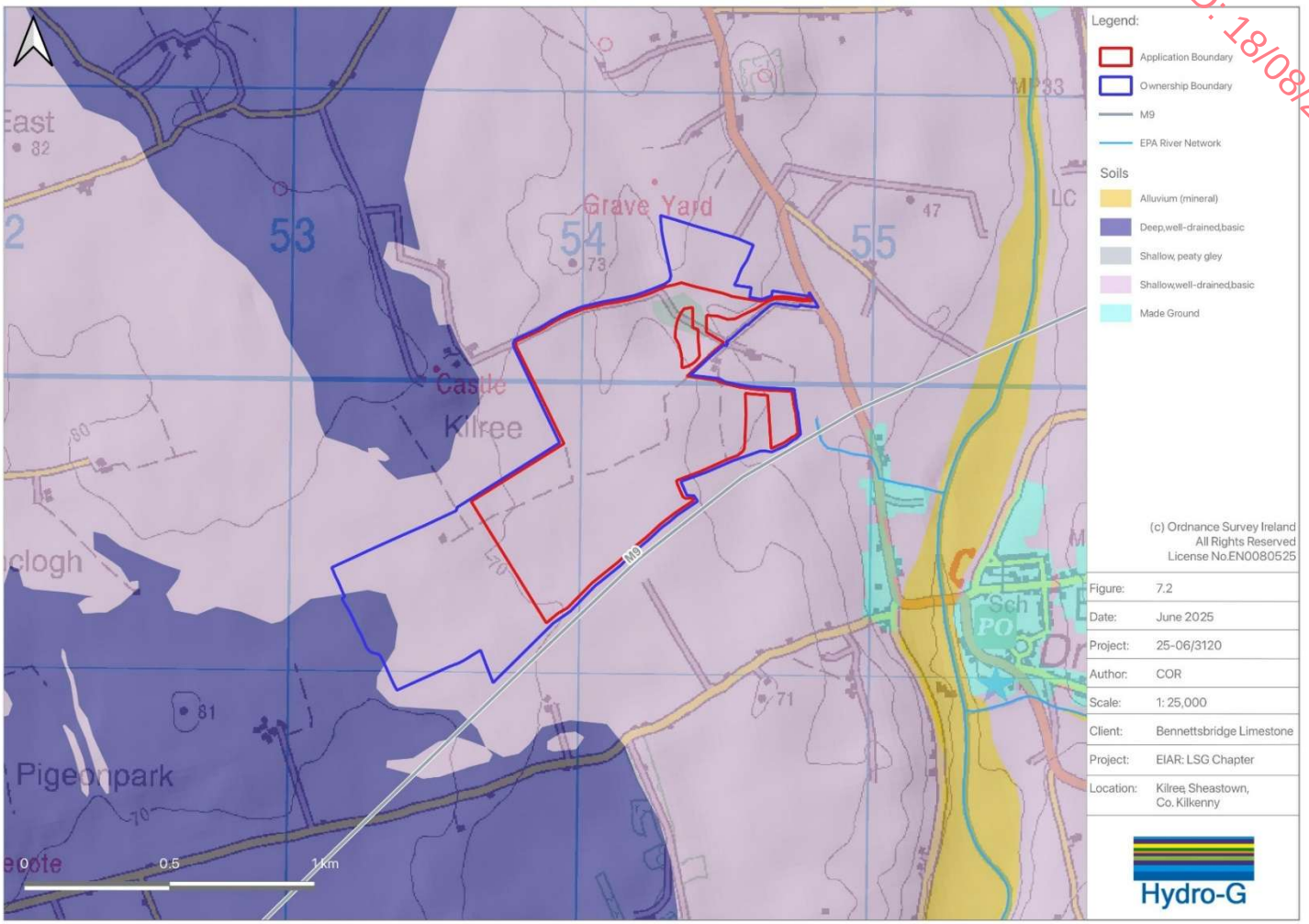


Figure 7-3 Quaternary Geology

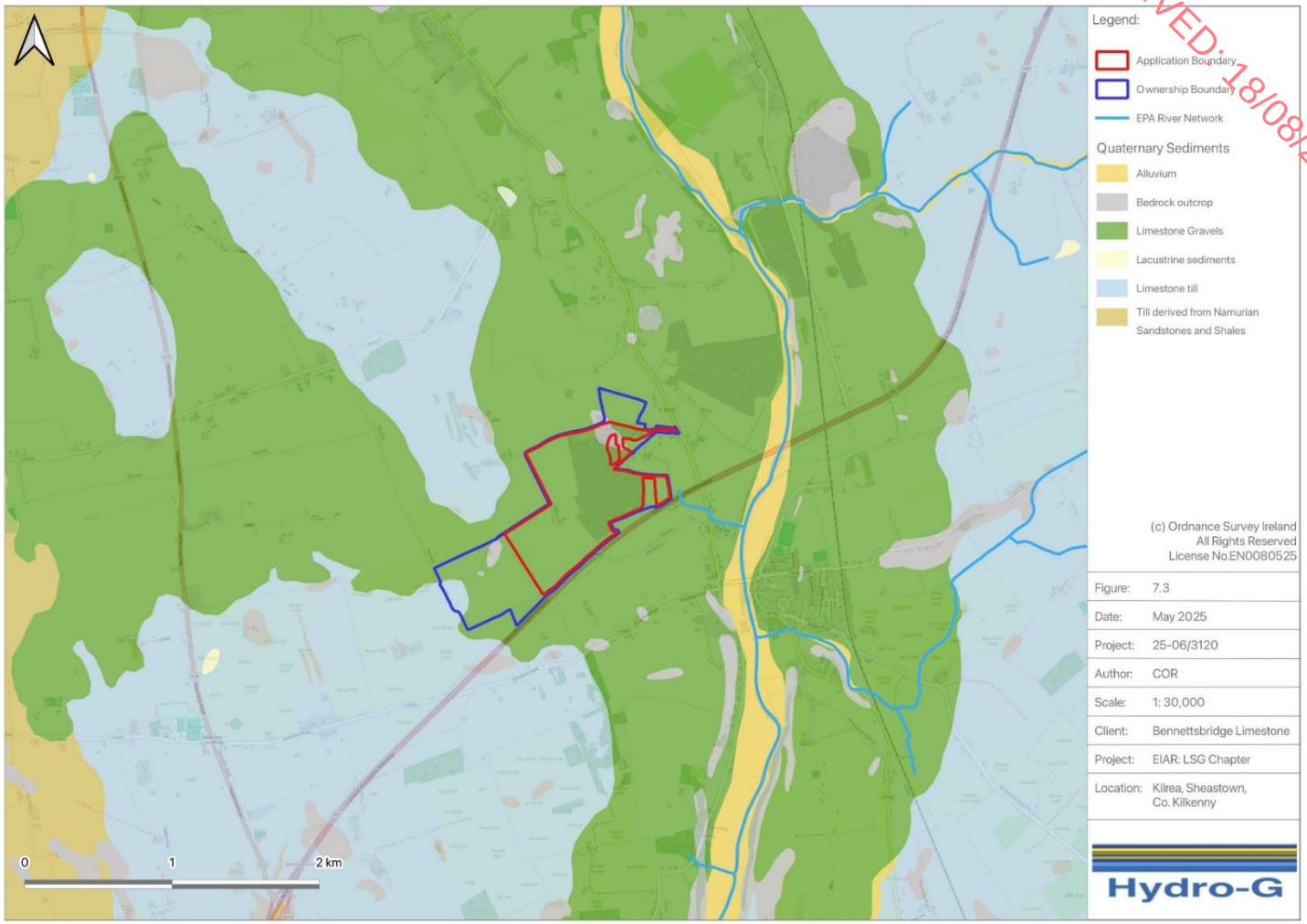
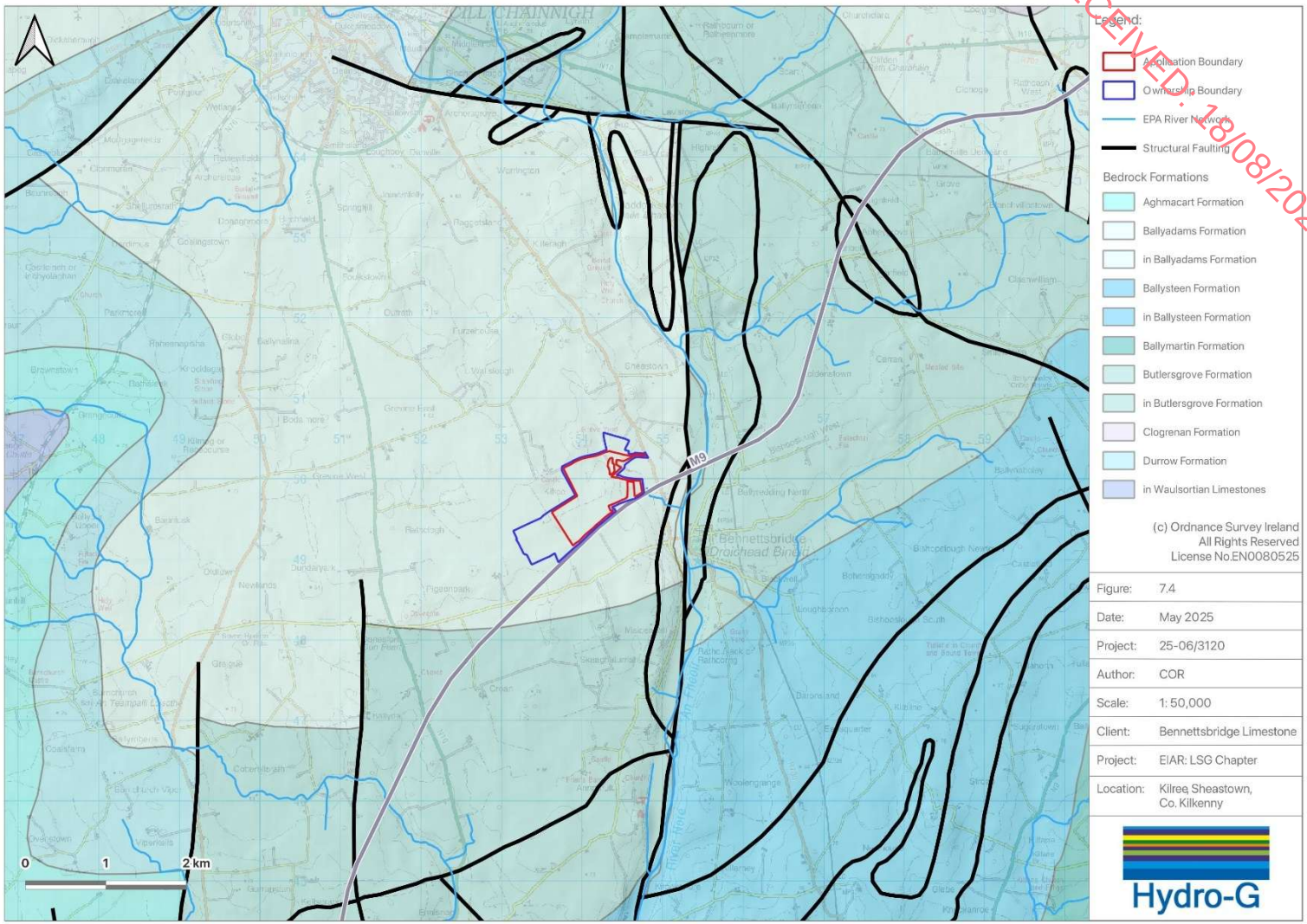
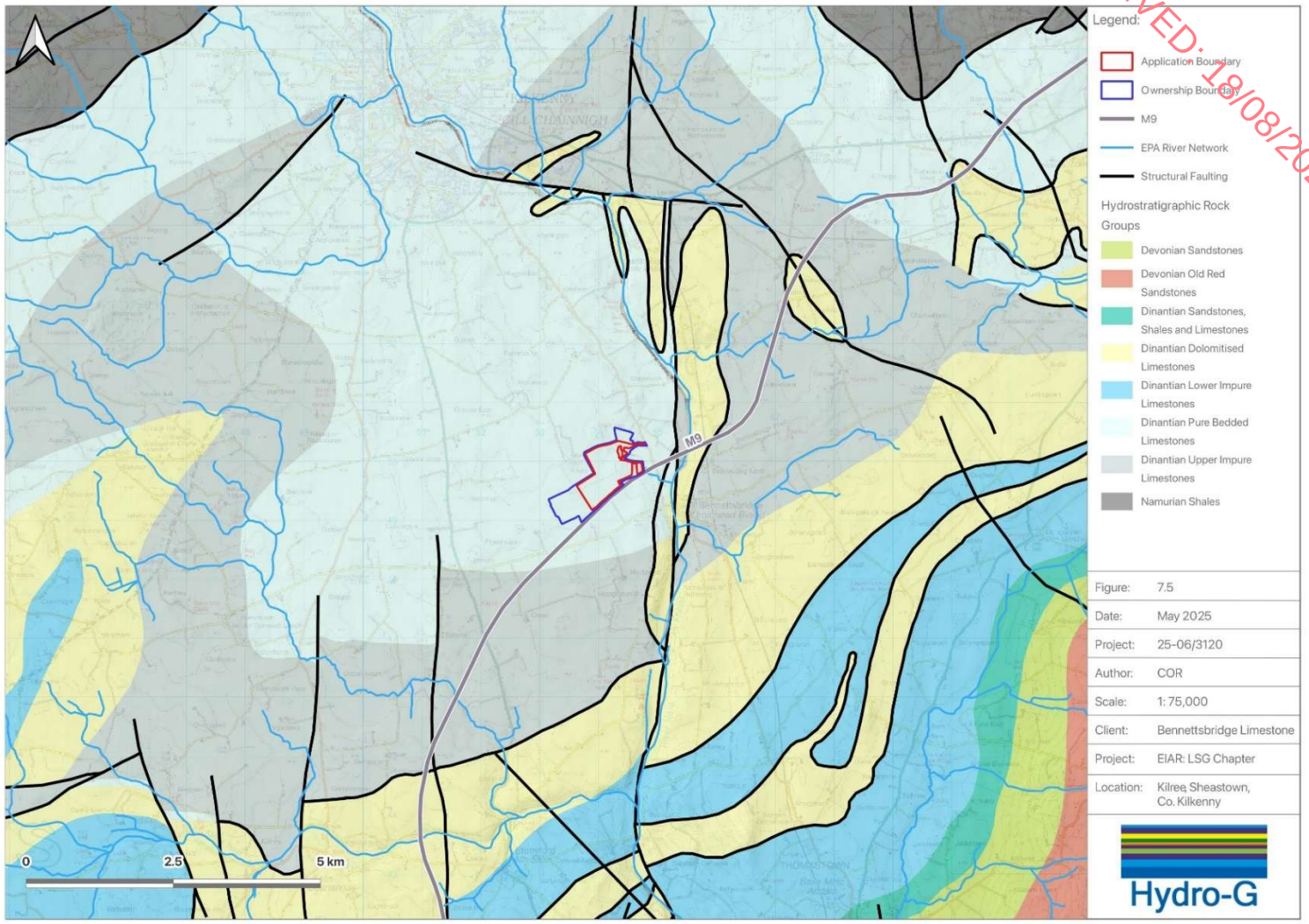


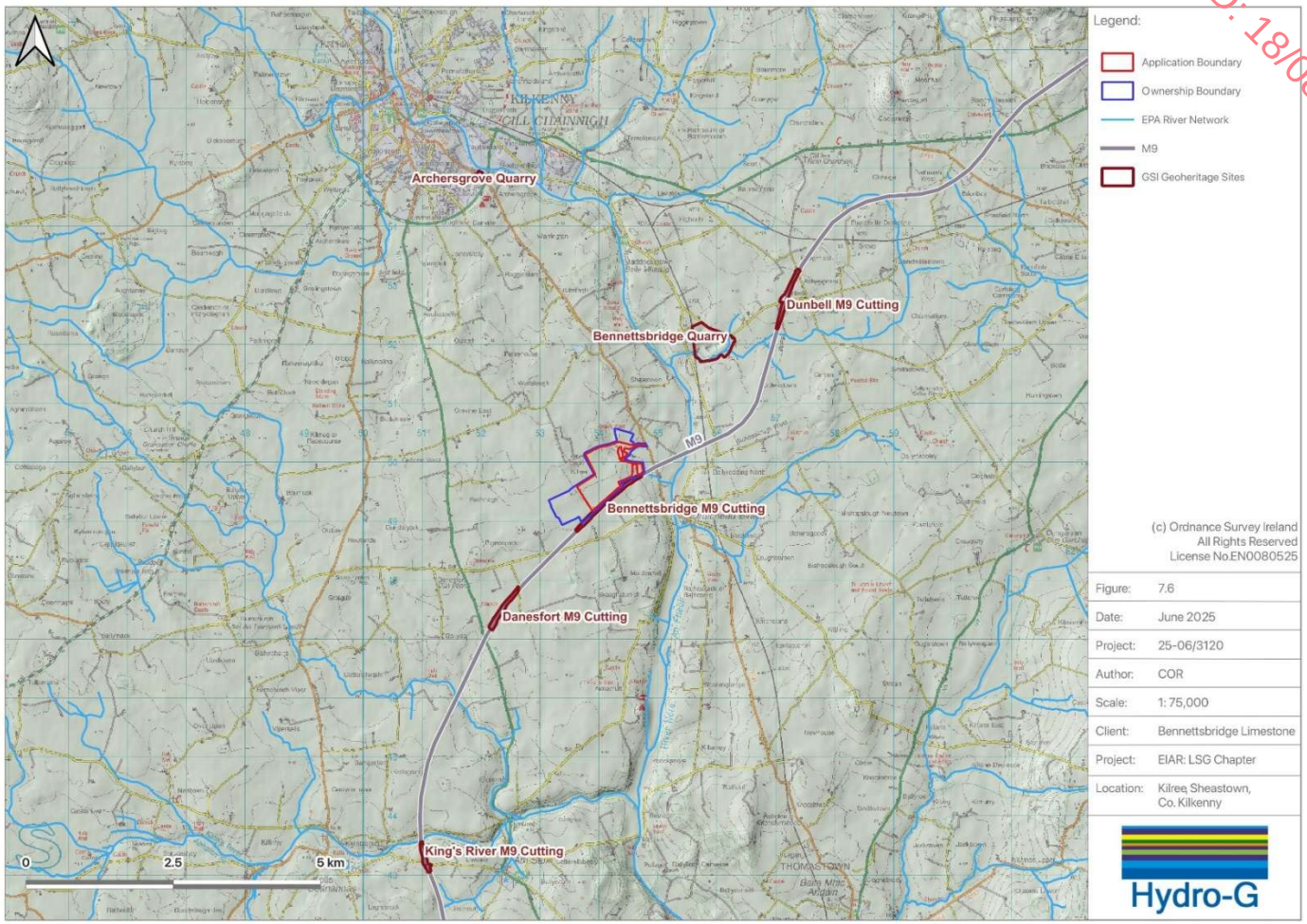

Figure 7-4 Bedrock and Structural Geology



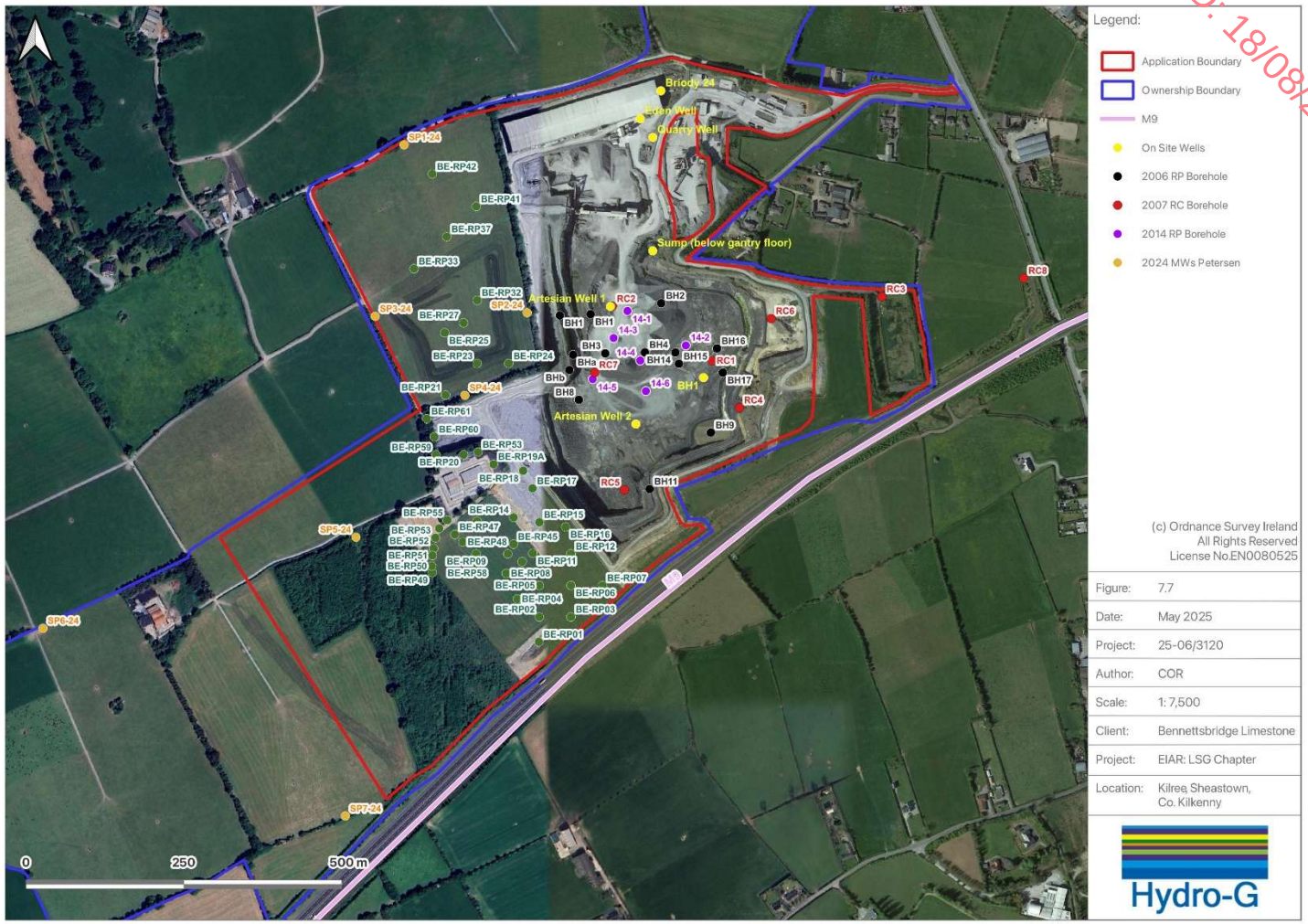
## Figure 7-5 Hydrostratigrahpic Rock Groups



## Figure 7-6 Geoheritage Areas



## Figure 7-7 All Site Investigation Completed



## Figure 7-8 Cross Section Lines

# Appendices

Appendix 7-1 GSI & TII Scoping responses with Hydro-G technical responses.

Appendix 7-2 Impact Assessment.

Appendix 7-3 Geotechnical Report (AMS, 2022; 2024; 2025).

Appendix 7-4 Geophysical Reports - Greenfield Area 2025 (Apex 2018a, 2018b, 2025).

Appendix 7-5 Drillers Records and Borehole Details (2024).

Appendix 7-6 Bedrock Permeability (Envirologic, 2025).

# Appendix 7-1 GSI & TII Scoping responses with Hydro-G technical responses

# Appendix 7-2 NRA rating criteria Tables of Appendix C of IGI (2013) Guidance

**Table 7-1-A Criteria for Rating Site Importance of Geological Features (NRA, 2009)**

| Magnitude | Criterion | Description & 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 the site is significant on a national or regional scale | • Geological feature on a regional or national scale (NHA).<br>• Large existing quarry or pit.<br>• 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 the site is significant on a local scale | • Contaminated soil on site with previous heavy industrial usage<br>• Large recent landfill site for mixed wastes<br>• Geological feature of high value on a local scale (County Geological Site)<br>• Well drained and/or high fertility soils<br>• Moderately sized existing quarry or pit<br>• 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 the 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<br>• Small existing quarry or pit<br>• Sub- economic extractable mineral resource |
| Low | Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying the site is small on a local scale | • Large historical and/or recent site for construction and demolition wastes<br>• Small historical and/or recent landfill site for construction and demolition wastes<br>• Poorly drained and/or low fertility soils<br>• Uneconomic extractable mineral resource |

The assessment of the magnitude of an impact incorporates the timing, scale, size and duration of the impact. The magnitude criteria for geological impacts are defined in Table 7-1-B.

## Table 7-1-B Criteria for Estimating Magnitude of Impact on Geology Attribute (NRA, 2009)

| Magnitude | Criterion | Description & Example |
|---|---|---|
| Large Adverse | Results in loss of attribute | • Loss of high proportion of future quarry or pit reserves<br>• Irreversible loss of high proportion of local high fertility soils<br>• Removal of entirety of geological heritage feature<br>• Requirement to excavate / remediate entire waste site<br>• Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment |
| Moderate Adverse | Results in impact on integrity of attribute or loss of part of attribute | • Loss of moderate proportion of future quarry or pit reserves<br>• Removal of part of geological heritage feature<br>• Irreversible loss of moderate proportion of local high fertility soils<br>• Requirement to excavate / remediate significant proportion of waste site<br>• Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment |
| Small Adverse | Results in minor impact on integrity of attribute or loss of small part of attribute | • Loss of small proportion of future quarry or pit reserves<br>• Removal of small part of geological heritage feature<br>• Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils<br>• Requirement to excavate / remediate small proportion of waste site<br>• Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment |
| Negligible | Results in an impact on attribute but of insufficient magnitude to affect either use or integrity | No measurable changes in attributes |
| Minor Beneficial | Results in minor improvement of attribute quality | Minor enhancement of geological heritage feature |
| Moderate Beneficial | Results in moderate improvement of attribute quality | Moderate enhancement of geological heritage feature |
| Major Beneficial | Results in major improvement of attribute quality | Major enhancement of geological heritage feature |

The matrix in Table 7-1- determines the significance of the impacts based on the site importance and magnitude of the impacts as determined by and Table 7-1-B.

**Table 7-1-C Criteria for Rating of Significant Environmental Impacts (NRA, 2009; IGI, 2013)**

| Importance of Attribute | Magnitude of Impact | | | |
|---|---|---|---|---|
| | **Negligible** | **Small** | **Moderate** | **Large** |
| **Extremely High** | Imperceptible | Significant | Profound | Profound |
| **Very High** | Imperceptible | Significant/moderate | Profound/significant | Profound |
| **High** | Imperceptible | Moderate/slight | **Significant/moderate** | Severe/significant |
| **Medium** | Imperceptible | Slight | Moderate | Significant |
| **Low** | Imperceptible | Imperceptible | Slight | Slight/moderate |

# Appendix 7-3 Geotechnical Report (AMS, 2022; 2024; 2025).

# Appendix 7-4 Geophysical Reports - Greenfield Area 2025 (Apex, 20218a, 2018b, 2025)

# Appendix 7-5 Drillers Records and Borehole Details (2024).

[Note: the 2018 Drilling Records are presented in Apex 2018b Phase 2 Report of Appendix 7-4]

# Appendix 7-6 Bedrock Permeability Report (Envirologic, 2025)