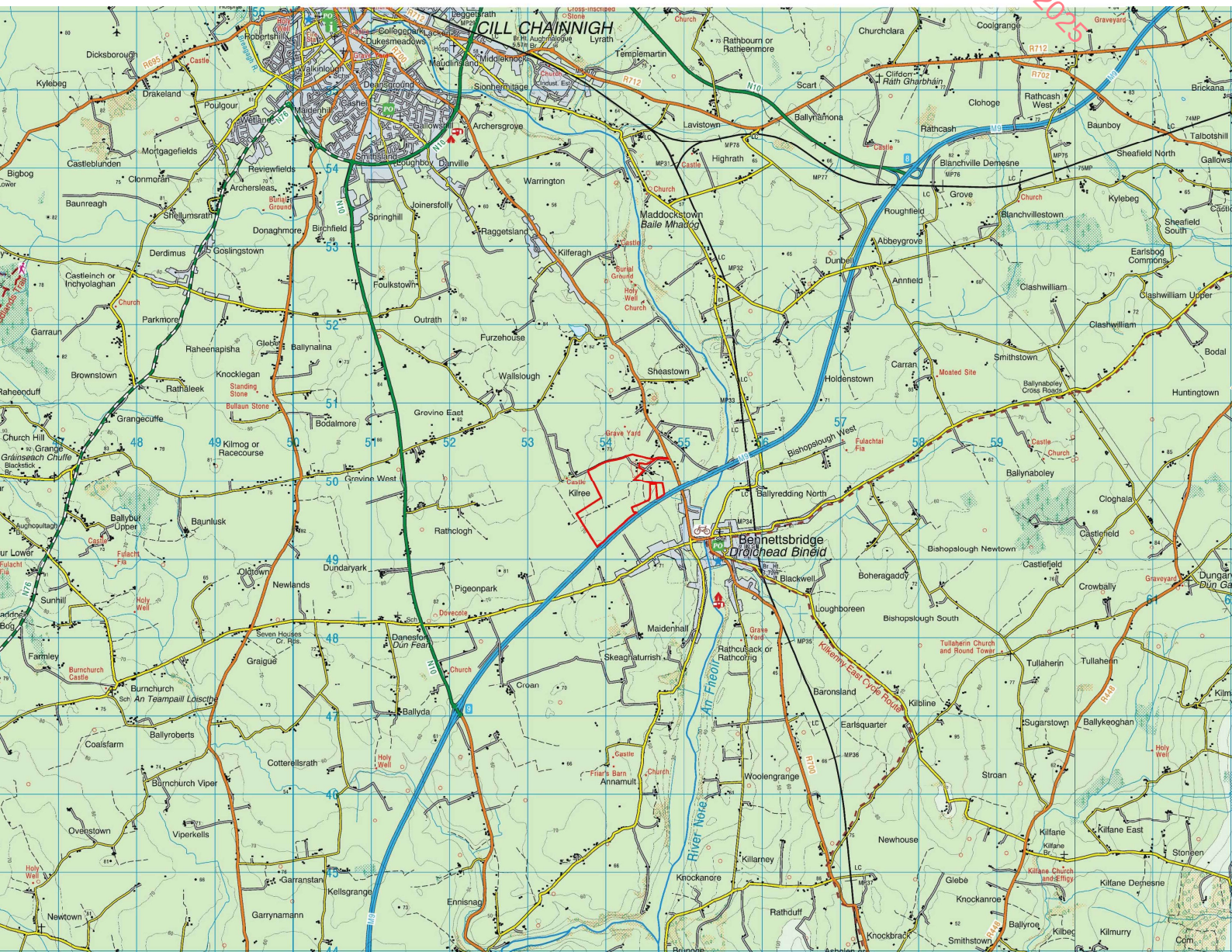


CHAPTER 17

MITIGATION AND MONITORING



JULY 2025

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INTRODUCTION

- 17.1 This chapter on 'Mitigation and Monitoring' is a critical component of the Environmental Impact Assessment Report (EIAR), designed to outline the specific actions and strategies that will be implemented to mitigate potential environmental impacts identified during the assessment phase of the proposed development. Following the Environmental Protection Agency's (EPA) guidelines, this chapter emphasises the importance of clarity, specificity, and commitment in presenting all mitigation and monitoring measures.
- 17.2 Mitigation measures are actions taken to avoid, reduce, or compensate for environmental impacts. Monitoring measures, on the other hand, are implemented to track the effectiveness of mitigation actions and ensure ongoing environmental protection throughout the lifespan of the development. Together, these measures play a pivotal role in safeguarding environmental resources and ensuring the sustainability of the project.
- 17.3 For organisational clarity and ease of reference, the chapter is structured to include a comprehensive compendium of all mitigation and monitoring commitments. The detailed elaboration on each measure is addressed within the main body of the EIAR.

Proposed Mitigation Measures

- 17.4 Proposed Mitigation Measures are provided in Table 17.1.

Table 17-1: Mitigation Measures

Topic	Mitigation Measures
Population and Human Health	- Radon Periodic workplace testing will be undertaken in accordance with the guidelines set out in the Protocol for Measurement of Radon in Homes & Workplaces, EPA, 2019. - Silica Dust Existing health and safety policies and procedures will continue to be reviewed and updated to ensure it is in keeping with best practice and current legislation. - Unplanned Events Existing emergency procedures will continue to be reviewed and updated to ensure it is in keeping with best practice and current legislation.
Biodiversity	- Pre-clearance checks - Ecologist to inspect all areas immediately prior to clearance. - If badger setts are found, obtain a derogation licence from NPWS before works proceed. - Bat safeguard - Three mature ash trees (and any other trees with bat-roost potential) to be soft-felled; felled material left on the ground for ≥ 24 hours before removal. - Bird-nest protection - Wherever possible, remove trees, shrubs and ground vegetation outside the bird-breeding season (March–August). - If clearance during the breeding season is unavoidable: - Experienced ecologist/ornithologist to survey for nesting activity.

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	○ Mark any nests found and establish an exclusion zone (typically ≤ 20 m radius) until young have fledged. • Compensatory & enhancement planting 1. Broadleaved woodland ○ Approx. 5.5 ha of mixed broadleaved woodland on new screening berms, with scalloped edges for structural diversity and improved invertebrate/bat/bird foraging. 2. New hedgerow ○ c. 860 m native hedgerow along parts of the western boundary to link compensatory woodland with existing boundaries. 3. Hedgerow enhancement ○ c. 300 m of existing hedgerow on the northern boundary to be gapped-up and planted with additional trees.
Land, Soils and Geology	• Topsoil/Subsoil Management ○ All stripped soils retained on-site for landscaping berms; no net loss of resource. ○ Berm slopes minimised; handling only in moist, calm conditions. ○ Silt fences installed; working contours prevent uncontrolled runoff; sprinklers/road sweepers used for dust control. • Tree-Felling & Root Excavation ○ Undertaken only in suitable weather/soil conditions; same sediment and dust controls as above. • Farmyard Decommissioning ○ Yard cleared; hydrocarbons treated with absorbents. ○ Power-wash runoff captured in underground tanks; disposal via Good Agricultural Practice Regs (S.I. 113 / 2022). • Hazardous Substances ○ Fuels/oils stored in bunded, sealed containers (110 % capacity + rain allowance). ○ Drip trays for drums; regular emptying of bunds/trays.

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	○ Refuelling via mobile bunded bowser in designated area; spill kits kept on-site. ○ Settlement lagoon system includes oil interceptor. • Sediment & Water Protection ○ Silt fences at boundaries; no direct pathways for suspended solids. ○ Same controls apply during enabling, operational and restoration phases. • Blasting Controls ○ Garda-licensed, specialist-managed blasting; real-time monitoring. ○ Nitrogen species modelling shows imperceptible residual concentrations. ○ 30 m blast segments minimise vibration; proven safe relative to M9 motorway. • Resource Consideration ○ Bedrock removal negligible relative to 200 m – 700 m thickness of regional Ballyadams Limestone; no mitigation necessary. • Spill Response ○ All refuelling vehicles equipped with spill kits; SOP for immediate containment. • Geotechnical Stability ○ Ongoing routine geotechnical inspections per Quarry Regulations. ○ Site-specific assessment (ASM 2025) confirms no risk to M9; monitoring regime maintained through operation and post-closure.
Water	A comprehensive suite of mitigation measures will be implemented throughout the enabling, operational, restoration, and post-closure phases of the proposed development to minimise environmental impact and ensure regulatory compliance. These measures are summarised under the following key headings: • Soil and Subsoil Management

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- All soils and subsoils will be retained on-site and reused in landscaping berms, avoiding resource loss, or sold as engineered fill.
- Berm slopes will be minimised to reduce dust and structural degradation.
- Soil handling will only occur during suitable weather conditions when soils are moist but friable. Works will cease during excessively dry or windy conditions.
- Silt fences will be installed to prevent sediment loss across site boundaries.
- Dust and Particulate Control
 - Sprinklers and road sweepers will be used to suppress dust emissions.
 - Dust-generating activities (e.g., excavation, stripping) will be avoided during dry and windy periods.
 - A wheel wash facility is in place, with routine maintenance and monitoring to prevent off-site transport of dust or silt.
- Surface Water and Groundwater Protection
 - Working contours are designed to prevent direct runoff and facilitate retention within the site.
 - Surface water is managed via floor sumps and a multi-stage settlement lagoon system, including a hydrocarbon interceptor.
 - Monthly monitoring of discharge water is undertaken, with results showing compliance with the Section 4 Licence ELV of 10 mg/l for Suspended Solids (SS).
 - The established system is demonstrated to have sufficient capacity and efficiency, with no observed flooding from the permitted discharge rates.
- Slurry and Hydrocarbon Management (Farmyard Clearance)
 - Slurry from farmyard tanks will be spread in accordance with the Good Agricultural Practice Regulations 2022 (S.I. 113/2022) and Low Emission Slurry Spreading (LESS) requirements.
 - All machinery and silage will be removed before yard demolition.

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- Power washing waters will be collected and managed through existing underground tanks and applied to land under regulatory criteria.
- Surfaces will be inspected for hydrocarbon contamination and cleaned as necessary.

Fuel and Hazardous Material Management

- All fuels, oils, and hazardous substances will be stored in bunded or drip-tray-equipped containers meeting 110% capacity and rainwater margin requirements.
- Refuelling will occur in designated areas using mobile bunded bowsers.
- Spill kits and hydrocarbon absorbents will be kept at strategic locations.

- Blasting Management

- Blasting is licensed and undertaken by qualified specialists.
- Nitrogen species generated from blasting have been assessed and found to be significantly below relevant Environmental Quality Standards, posing no risk to groundwater or surface water.

- Groundwater and Abstraction Impact

- Groundwater monitoring is ongoing under the conditions of permission PL18/858.
- The quarry's discharge has been shown to represent <2% of River Nore's baseflow, well within the EPA (2025a) thresholds (up to 15–30%).
- Cumulative groundwater abstraction from the quarry and other users represents 14% of Kilkenny GWB flow, deemed to pose only a moderate and acceptable potential for impact.
- The quarry is not located within any Source Protection Zones or Zones of Contribution and is served by its own robust well.

- Wastewater Infrastructure

- The site's wastewater treatment system complies with EPA (2021) guidance.
- Annual inspections confirm system functionality, and no additional loading is proposed under this application.

- Sediment and Settlement Lagoon Management

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	○ The quarry utilises floor sumps and a primary and secondary lagoon system, maintained in accordance with SOPs. ○ Only the primary lagoon typically requires cleaning due to effective solids capture. ○ Monitoring confirms suspended solids remain below detection limits in many cases. ● Post-Closure and Restoration ○ Site restoration will be phased and progressive, with revegetation to enhance stability and landscape integration. ○ Overburden stockpiles will be protected by silt fences, and restored areas vegetated. ○ Upon cessation, groundwater rebound will form a lake habitat of ~28 million m³ by c.2065, with controlled overflow via the existing sump-lagoon-discharge system. ○ The access track to the lagoons provides a gravity overflow path in case of storm events, ensuring no flood risk. ● Monitoring and Compliance ○ All systems (water, dust, hydrocarbons) are subject to regular monitoring and maintenance. ○ Annual Environmental Reports (AERs) and daily internal records ensure transparency and regulatory compliance. ○ All mitigation measures will be implemented as standard operating procedures and reviewed regularly to ensure continued effectiveness.
Climate	To minimise greenhouse gas emissions and improve overall energy efficiency, the following mitigation measures will be implemented: ● Plant and Vehicle Efficiency: All machinery and vehicles will be regularly maintained and serviced to maximise fuel efficiency and minimise emissions. Operators will follow best practice, including switching off engines when not in use. ● Energy Optimisation: ○ Use of variable speed drives (VSDs) on crushers and conveyors to reduce energy wastage. ○ Investigation of renewable energy options (e.g. solar, wind) to power site operations. ● Transport Efficiency: Transport routes will be optimised to reduce empty return trips and improve load efficiency, reducing overall fuel consumption.

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	• Excavation Planning: Overburden movement will be minimised through careful planning of excavation sequences. Where feasible, overburden will be reused on-site for restoration or landscaping, avoiding off-site transport. Biodiversity and Carbon Sequestration Mitigation • Restoration and Planting: A Restoration Plan (Figure 3.2) will be implemented to mitigate vegetation loss and improve biodiversity. Screening berms will be planted with native species to enhance ecological value and contribute to carbon sequestration. • Carbon Offset Projects: The potential for on-site carbon offset initiatives such as habitat restoration or wetland creation will be explored. • Forestry Compensation: The 6.8 ha of commercial forestry to be removed will be replaced with equivalent forestry at an off-site location, ensuring no net loss of carbon storage capacity.
Air Quality	There are a number of mitigation measures in place on site to prevent significant dust emissions from on-site activities. These measures include: ○ A wheel wash is in place on site which trucks must pass through prior to exiting onto the public road. ○ All fine materials are covered when leaving the site to prevent dust escaping. ○ Dust suppression in the form of a sprinkler system is in place. ○ Speeds restrictions are in place on site and to be imposed on the proposed private road. ○ On-site roads are paved and dampened.
Noise & Vibration	Complaints Management • A formal Enquiries and Complaints Procedure will be maintained on-site. All complaints relating to noise, vibration, or air overpressure will be: ○ Logged in a dedicated Complaint Form. ○ Investigated promptly by the operator. ○ Reported to the Environment Section of the Local Authority on request. ○ Accompanied by records of corrective actions taken. ○ Included in quarterly environmental reports submitted to the Local Authority. Blasting Vibration Control To minimise the effects of ground vibration from blasting activities: • Free faces will be maximised and special care taken in constrained blast areas (e.g. corners). • Appropriate burden distances will be maintained to avoid over-confinement.

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- Rock face surveys will be undertaken prior to each blast, and designs revised as needed.
- Maximum Instantaneous Charge (MIC) will be minimised through:
 - Decked or sequenced charges,
 - Reduced bench heights and borehole depths,
 - Narrower borehole diameters.
- Blasts will be designed with built-in safety margins.
- Vibration monitoring will continue at the nearest sensitive receptors.

Air Overpressure Mitigation

To control and reduce air overpressure impacts:

- Ongoing monitoring will be carried out at the nearest properties.
- Geological anomalies will be recorded during drilling and communicated to the blaster.
- Blast design will:
 - Be informed by face burden measurements and face inspections.
 - Optimise charge placement in areas of weakness.
 - Use suitable stemming material (angular chippings only, not fines) and correct ratios.
- Detonation techniques will minimise overpressure:
 - In-hole initiation will be the default method.
 - Surface detonating cord will be avoided unless necessary and will be covered if used.
- Secondary blasting will be avoided where possible; if required, pop-shooting will be used instead of mudcapping.

Training and Awareness

- All relevant personnel will receive site induction covering:
 - Noise, vibration, and air overpressure hazards,
 - Control measures from the Blasting Management Plan and planning conditions,
 - Working methods integrated into site method statements and risk assessments.
- Induction training will address:
 - Construction hours and emergency works,
 - Locations of sensitive receptors,
 - Required mitigation practices.
- Toolbox talks will be provided regularly to reinforce awareness and responsibilities.

Monitoring Records

- Records of vibration and air overpressure monitoring will be retained for a minimum of 7 years.
- Records will include:

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	○ Time and date of each event, ○ Monitoring location details, ○ Equipment specifications and calibration certificates, ○ Measured results and summary data.
Landscape	Mitigation by Avoidance • The primary mitigation by avoidance strategy is the strategic siting of the proposed development adjacent to existing quarry operations and the highly modified corridor of the M9 motorway. This reduces landscape and visual intrusion by co-locating similar land uses. • Peripheral field boundaries will be retained, maintaining existing vegetation and field structure. • A woodland planting scheme is proposed along new screening berms, comprising a native thicket and woodland mix of local provenance. The planting will include: ○ High canopy (dominant) species ○ Low canopy (sub-dominant) species ○ Understorey and fringe (higher shrub) species ○ Understorey and edge (lower shrub) species • A combination of advanced nursery stock and whip planting will be used, allowing the woodland to grow to full maturity, enhancing both visual screening and biodiversity value. • Once established, this planting significantly reduces visibility of the development, as demonstrated in visual simulations (see Figure 12.9).
Traffic	Junction and Road Capacity: The proposed development is expected to have only a slight impact on the capacity of the R700 and its junction with the site Access Road. Due to the minor scale of this impact, no specific capacity-related mitigation measures are deemed necessary or feasible. Traffic Management: A Traffic Management Plan will be prepared and implemented to mitigate any impacts on other users of the Access Road. The plan will govern the movement of development-related traffic to ensure safety and minimise disruption. Wheel Cleaning and Soil Control: Measures will be put in place at the site egress to prevent the transfer of mud or debris onto the Access Road or R700. These will include appropriate wheel cleaning facilities and monitoring procedures to maintain road cleanliness. Weekly road sweeping is carried out internally and from the M9 bridge to sheastown lane. and a wheel wash is located onsite. Pavement Condition Monitoring: As the development is likely to have a permanent impact on the pavement structure of the R700 and Access Road:

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	• A baseline visual condition survey will be carried out before the development commences. • Periodic follow-up surveys will be undertaken in consultation with the Roads Authority. • The scope and frequency of surveys will be agreed with the Roads Authority. • If surveys reveal deterioration in pavement condition, appropriate assessment and remedial works will be implemented as agreed with the Roads Authority.
Material Assets	A comprehensive Waste Management Procedure will be implemented at the application site to ensure the proper handling, storage, transport, and disposal of all waste streams. The procedure will include the following key elements: - Waste Classification All waste will be categorised by type: ○ Hazardous / Non-hazardous ○ Recyclable / Non-recyclable ○ Compostable - Storage and Containment Waste will be: ○ Stored in clearly labelled containers appropriate to each category. ○ Placed on impermeable surfaces and protected against accidental spillage or leaks. - Transport and Disposal ○ Only authorised and appropriately licensed waste operators will be engaged. ○ Hazardous waste will be assigned a Hazardous Waste Identification Number (HWID) before removal. - Emergency Preparedness ○ Spill kits and other emergency response equipment will be maintained in accessible locations across the site. - Training and Awareness ○ All staff and contractors will receive training on the waste management procedures, including emergency response protocols. - Record-Keeping ○ Records will be maintained to demonstrate compliance with all aspects of the Waste Management Plan, including storage, transport, and disposal activities.

Proposed Environmental Monitoring

17.5 Proposed Monitoring requirements are provided in Table 17.2.

Table 17-2: Proposed Monitoring: Refer to Figure 17.1 for locations

Proposed Environmental Monitoring	
Dust Monitoring	Undertaken at the site with locations reviewed and revised as necessary.
Water Monitoring	Water monitoring is carried out and will continue to be carried out.
Meteorological Monitoring	Utilisation of data from Johnstown Castle weather station and there is a rain gauge on site.
Vibration Monitoring	Ground vibration monitoring is carried out for each blast and will continue to be carried out.
Noise Monitoring	Carried out at the nearest sensitive receptors quarterly with locations reviewed as necessary.
Stability and Settlement Monitoring	Visual inspections of quarry faces and screening berms, along with bi-annual geotechnical assessments.
Aftercare and Monitoring	5-year aftercare program for tree planting and monitoring of restoration success.
Landscape Monitoring	Construction Phase - A detailed landscape tender and specification document will be prepared to guide the implementation and maintenance of all landscape works in line with best practice. It will include protocols for: - Tree protection and works - Soil handling - Planting methods - Ongoing maintenance - Works will be supervised by a qualified landscape architect to ensure compliance with design intent and environmental standards. Tree protection measures will be installed at the start of construction and

	removed progressively as site phases are completed. • Planting works will be carried out in the next suitable planting season following completion of major construction activities. Operational Phase • A three-year establishment period will follow initial planting, during which the following will be monitored and maintained: ○ Weed control ○ Replacement of failed planting ○ Pruning and general upkeep • Regular monitoring will ensure that landscape features remain effective and contribute positively to the visual and ecological quality of the site.
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Proactive Monitoring and Compliance Verification

- 17.6 In line with the EPA guidelines, monitoring in the context of an EIAR should be a structured process to verify that the project adheres to EIA predictions and complies with consent conditions. Monitoring should ideally commence post-consent, ensuring that the project operates as intended and allowing early detection of any unforeseen effects.
- 17.7 Monitoring programs should avoid excessive reliance on reactive measures, as this can unintentionally alter project operations outside the scope originally assessed. Instead, monitoring should ensure compliance with defined performance criteria, emission limits, and other operating conditions. Importantly, monitoring should not defer essential information gathering that is critical for initial project assessments and consent.
- 17.8 All monitoring plans should follow an "if-then" approach, specifying the triggers that would prompt remedial actions and clearly defining roles. For instance, if air quality monitoring identifies that particulate emissions exceed the specified limit, then dust suppression measures will be immediately intensified, with oversight from the developer.
- 17.9 In scenarios where effects continue to exceed thresholds despite intervention, the developer and consent authority may jointly assess further measures or modifications needed to restore compliance.
- 17.10 It is recommended to adopt the specific limits from the 2006 EPA guidelines for dust deposition, noise, vibration, and air overpressure in quarry developments. The following limits and methods, based on these guidelines, will inform the monitoring and mitigation actions to ensure compliance and minimise environmental impact:

Water Quality Monitoring

- 17.11 Bennettsbridge Limestone operates an established Environmental Management System (EMS) aligned with best practice, including the Quarry Guidelines (2004), EPA Extractive Industry Guidelines (2006), the site's Section 4 Licence (ENV/W/78, 2017), and planning conditions attached to permission PL18/858. The EMS is supported by a suite of Standard Operating Procedures (SOPs) covering all site activities and potential environmental risks.

Groundwater Monitoring

- Groundwater levels are routinely monitored both on-site and in the surrounding area.
- Groundwater quality is indirectly monitored via compliance with the ELV conditions of the Section 4 Licence, which governs the integrated management of rainwater and groundwater discharges.
- Seven new boreholes drilled in the greenfield area in 2024 encountered no significant groundwater flow and are unsuitable for future monitoring. Therefore, no additional groundwater quality monitoring is proposed beyond existing monitoring at the Quarry Well and the discharge point.

Discharge Monitoring

- Discharge volumes are measured daily, and water samples are regularly collected and analysed by an accredited laboratory in accordance with the Section 4 Licence conditions.

Ongoing Effectiveness Monitoring

- The continued monitoring programme is designed to:
 - Detect any impact on hydrology and hydrogeology.
 - Verify the effectiveness of mitigation measures.

- Ensure compliance with environmental standards.

Infrastructure & Pollution Control

- Hydrocarbon and silt interceptors are regularly serviced by a licensed contractor.
- A designated site inspector carries out routine checks on:
 - Settlement ponds
 - Hardstanding areas
 - Drainage infrastructure
 - On-site wastewater treatment plant (WWTP)
 - Discharge locations

Training and Oversight

- All personnel receive training in environmental procedures, with reference to best practice including:
 - EPA (2006) Environmental Management Guidelines
 - CIRIA guidance (2005, 2011)
 - Environment Agency (UK) Pollution Prevention Guidelines
 - EI (2005) Oil Storage Guidelines
- Environmental oversight is led by the Quarry Manager and Environmental Manager, who work closely together to ensure operational compliance and environmental protection.

Trigger Limits:

17.12 If water quality parameters approach threshold limits outlined in the site's discharge licence or relevant water quality regulations, immediate investigation and mitigation will be initiated, including possible adjustments to the site's water management system.

Remedial Measures:

17.13 Elevated suspended solids, for instance, will prompt enhanced sediment control measures such as additional silt traps, while hydrocarbon detections may necessitate oil interceptor maintenance or upgrades.

Dust Deposition

- **Measurement Method:** The Bergerhoff Method (German Standard VDI 2119, 1972), as recommended by the EPA.
 - **Dust Deposition Limit:** 350 mg/m²/day, averaged over a 30-day period, measured at site boundaries.
- 17.14 This limit will help control dust nuisance, with exceedances triggering enhanced dust suppression measures, such as increased watering or windbreak installation at sensitive points.

Noise

- **Measurement Periods:**
 - **Daytime (08:00 - 20:00):** Noise levels should not exceed 55 dB(A) LAeq (1h) at the nearest noise-sensitive receptor.

- **Night-time (20:00 - 08:00):** Noise levels should not exceed **45 dB(A) LAeq (1h)** at the nearest receptor.
 - **Allowable Exceedance:** 95% of all measured noise levels must meet these values, with no single measurement exceeding the limit by more than 2 dB(A).
- 17.15 Exceedances will lead to operational adjustments such as equipment relocation, timing modifications, or the installation of additional noise barriers.

Blasting: Vibration and Air Overpressure

- 17.16 For blasting activities, the following Environmental Limit Values (ELVs) apply at the nearest sensitive location (e.g., residential properties):
- **Ground-borne Vibration:** Peak particle velocity (PPV) should not exceed **12 mm/s** in any of the three mutually orthogonal directions, for vibrations below 40 Hz.
 - **Air Overpressure:** Should not exceed **125 dB (linear maximum peak)**, with a 95% confidence limit.
- 17.17 If measurements approach or exceed these ELVs, the blasting schedule or charge size will be adjusted, with further consultation with the consent authority if continued exceedances occur.

FIGURES

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Notes:	
Legend:	
—	Application Area
●	Noise Monitoring Locations
●	Dust Deposition Monitoring Locations
 Rory Brickenden B.A. MEngSc Unit 3, Cedar Crescent Westport Co. Mayo rbrickenden@quarryconsulting.ie	
Bennettsbridge Limestone Continuation of Use & Lateral Extension of an Existing Limestone Quarry at Kilkree, Bennettsbridge, Co. Kilkenny	
ENVIRONMENTAL MONITORING	
FIGURE 17.4	
Scale: Scale 1:10,000	Date: 11/07/2025