Environmental Management Guidelines

Environmental Management in the Extractive Industry (Non-Scheduled Minerals)

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

Environmental Protection Agency

AGENCY STATUS

The Environmental Protection Agency (EPA) is an independent public body established in July 1993 under the Environmental Protection Agency Act, 1992. Its sponsor in Government is the Department of the Environment, Heritage and Local Government.

The EPA is managed by a full time Executive Board consisting of a Director General and four Directors. Independence is assured through the selection procedures for the Director General and Directors and the freedom, as provided in the legislation, to act on its own initiative. The assignment, under the legislation, of direct responsibility for a wide range of functions underpins this independence. Under legislation, it is a specific offence to attempt to influence the Agency, or anyone acting on its behalf, in an improper manner.

The Agency is assisted by an Advisory Committee of twelve members, appointed by the Minister for the Environment, Heritage and Local Government.

RESPONSIBILITIES

The EPA has a wide range of statutory duties and powers under the Environmental Protection Act. In addition, the capacity of the EPA in relation to enforcement has been enhanced by powers contained in the Protection of the Environment Act 2003. The main responsibilities of the EPA include the following:

- licensing large/complex industrial and other processes with significant polluting potential;
- monitoring environmental quality, including the establishment of databases to which the public have access;
- publishing periodic reports on the state of the environment;
- promoting environmentally sound practices;
- promoting and co-ordinating environmental research;
- licensing all significant waste disposal and recovery activities, including landfills, and the preparation of a national hazardous waste management plan;
- implementing a system of permitting for the control of VOC emissions resulting from the storage of significant quantities of petrol at terminals;
- implementing and enforcing the GMO Regulations for the contained and deliberate release of GMOs into the environment;
- preparing and implementing a national hydrometric programme;
- drafting a National Allocation Plan for greenhouse gas emissions allowance trading; the establishment of a National Competent Authority for the issuing of trading permits and allowances to those covered by the scheme; the monitoring, overseeing and verification of emissions from participating companies; and the establishment of a National Emissions Trading Registry;

and, under the Office of Environmental Enforcement, established in 2003 and dedicated to the implementation and enforcement of environmental legislation in Ireland:

- improving overall compliance with environmental protection legislation in Ireland;
- raising awareness about the importance of enforcement of environmental protection legislation in Ireland;
- enforcing IPPC licences and Waste licences issued by the EPA;
- auditing and reporting on the performance of local authorities in the discharge of their environmental protection functions, including:
  - enforcement in respect of breaches of waste permits,
  - taking action in relation to illegal dumping,
  - implementation of waste collection permits, and
  - enforcement of producer responsibility initiatives (for example, in the area of packaging waste);
- taking action against local authorities that are not discharging their environmental protection functions in an adequate manner;
- prosecuting, or assisting local authorities to prosecute, significant breaches of environmental protection legislation, in a timely manner; and
- assisting local authorities to improve their environmental protection performance on a case by case basis, through the establishment of an enforcement network to promote information exchange and best practice, and by the provision of appropriate guidance.

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The project team comprised John Barnett & Associates Ltd – Chartered Mineral Surveyors, Environmental, Planning & Geotechnical Consultants in association with the Centre for Environmental Research, University of Limerick, the Geological Survey of Ireland and the Centre Terre et Pierre, Belgium. Mr Gerry Stanley (Geological Survey of Ireland) and Dr Frederic Brodkom (Centre Terre et Pierre, Belgium) as members of the project team, and Dr Jonathan Derham (EPA), Helen Walsh (EPA) and Stephen McCarthy (EPA) provided valuable review and comment on drafts of the guidelines.

A public consultation process was carried out as part of the preparation of the guidelines, and the comments/ constructive criticism on the consultation draft guidelines offered by the participating organisations are gratefully acknowledged.

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Purpose of these Guidelines

Since the formation of the Agency in 1994, it has been our experience that complaints from the public in relation to quarry activities have been all too frequent. The EPA has no statutory function in the regulation of aggregate and construction stone quarries and pits, yet it recognised that such operations have the potential to impact on the environment and amenity of a community. The Agency also recognised that there were no clearly articulated guidelines on environmental best practices for these operations, nor a consistent approach to the regulation of the sector. This was the basis for the ERTDI research project 2000-MS-11-M1 that, *inter alia*, yielded these guidelines.

In recent years the Irish Concrete Federation has produced excellent guidance for its member on matters of environmental performance of quarry and pit activities (see ICF *Environmental Code – Second Edition, October 2005*). In 2000, the State, through the amended Planning & Development Act included provision for the registration and environmental management of such activities (Section 261). This part of the Planning & Development Act came into effect in April 2004, and was accompanied by very useful guidance titled *Quarries & Ancillary Activities – Guidelines for Planning Authorities* (DoEHLG, 2004).

These EPA guidelines on Environmental Management in the Extractive Industry are intended to complement existing guidance and be of assistance to operators, regulatory authorities, and the general public. They are also complemented by a sister EPA publication *Environmental Management in the Extractive Industry – Guidelines for Regulators*. It is hoped that they will assist in the implementation of the Statutory Requirements under Section 261 of the Planning Acts, as well as lead to a harmonised regulatory approach to the authorisation and supervision of such activities. In addition, the EPA believes that these guidelines will contribute to a more environmentally sustainable quarry & pit industrial sector, greater protection for the environment and human health, and thereby a greater public confidence in such operations.

The Agency would be pleased to receive feedback on the guidelines that may assist in improving future editions.

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1 Introduction

1.1 General Background

Construction aggregates and dimension stone are basic materials essential for construction. Both materials are predominantly sourced from 'Non-Scheduled' minerals (refer to the definition in Section 1.2).

A recent review of the Irish construction materials sector indicates that approximately 100 to 110 million tonnes of aggregates are used annually (Irish Concrete Federation (ICF), 2000 and see Main Report for this project). This includes aggregates used in the production of concrete products, bituminous mixes and asphalt, and fill materials (Figs 1.1 and 1.2).

In addition, Irish dimension stone operators produce approximately 250 thousand tonnes of cut stone annually (private communication, Irish Dimension Stone Producers Association, 2000) (Figs 1.3 and 1.4). There is a significant export market in northern Europe for these products and up to 50% of the dimension stone produced in Ireland is exported to Belgium, Holland and Germany.

For the purposes of these guidelines, construction aggregates are sub-divided into two main categories:

Figure 1.1. Concrete batching plant (Shay Murtagh Ltd, Raharney, Co. Westmeath).

Figure 1.2. Extraction of sand and gravel (Keohane Readymix, Innishannon, Co. Cork).

i. Primary aggregates: naturally occurring rock and sand and gravel extracted directly from land or from marine sources

ii. Secondary/recycled aggregates: previously used materials that are capable of substituting for primary aggregates. These include waste materials arising from demolition of buildings and road surface planings, etc.

At present, in Ireland, most primary aggregates are sourced from land-based quarries. There is currently no commercial extraction of aggregates from marine sources. The use of secondary/recycled aggregates is at a relatively low level, but it is envisaged that this will increase over the next few years, particularly with the recent introduction of the Landfill Levy, the establishment of the National Construction and Demolition Waste Council and the recent development of a number of construction and demolition (C & D) waste recycling facilities at major urban centres, and the greater acceptance of the use of secondary/recycled aggregates. A number of these C & D waste recycling facilities have been located at existing quarry developments.

Due to the relatively low volume of C & D waste available for recycling in comparison to the overall demand for aggregates, land-based resources will remain as the principal future source of aggregates in Ireland.

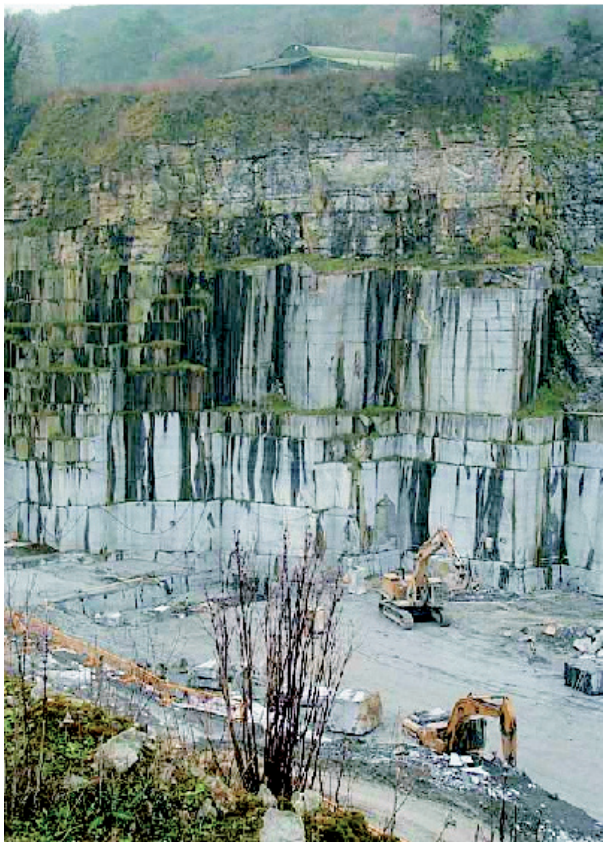

Figure 1.3. Extraction of dimension stone (McKeon Stone, Threecastles, Co. Kilkenny).

There are approximately 500 operating quarry developments in Ireland (Geological Survey of Ireland (GSI), 2001 and see Main Report for this project). At present, there is no national planning policy or strategy in Ireland for construction aggregates or dimension stone. Local authorities consider the land use and planning issues associated with quarries and the extractive industry in their county development plans. A recent review of these plans indicates that there is a requirement for a more consistent approach to land-use planning for provision of aggregates and dimension stone (see Main Report for this project).

The general objective in planning for provision of these materials is to ensure that the supply is managed in a sustainable way so the best balance is obtained between environmental, economic and social considerations.

1.2 Definition of 'Minerals'

In Ireland, minerals are defined in two different Statutes. In the Minerals Development Act, 1940, minerals are

Figure 1.4. Use of dimension stone at East Point Business Park (Feelystone Ltd, Co. Kilkenny).

defined as *All substances (other than the agricultural surface of the ground and other than peat or turf in, on or under the ground …. but without prejudice to the generality of the foregoing, the said word includes all scheduled minerals.* A list of 72 minerals is defined in the Schedule under the Act. These minerals known as 'Scheduled Minerals' include metalliferous and industrial minerals, and hydrocarbons. The Minerals Development Act, 1979, further clarified this issue and stated that the definition of 'minerals' *shall not include stone, gravel, sand or clay except to the extent that any such substance falls within the list of minerals mentioned in the Schedule to the Act of 1940.*

The planning code has a wider definition of minerals. *Viz.*, under the 2001 Planning & Development Regulations (SI No. 600) minerals are defined as meaning *all minerals and substances in or under the land of a kind ordinarily worked by underground or by surface working for the removal but does not include turf.*

1.3 Use of the Guidelines

These guidelines are principally aimed at surface developments within the extractive industry, other than those working minerals as they are defined in the Mineral Development Acts, 1940 to 1999. They apply to surface developments that are extracting and processing construction aggregates and dimension stone (i.e. quarries and ancillary facilities), i.e. typically those regulated by Section 261 of the Planning & Development Act 2000.

There may be other issues, beyond the scope of these guidelines, that need to be considered for underground workings.

These environmental management guidelines represent a summary of current environmental management practices for quarries and ancillary facilities (including manufacturing of concrete and bituminous mixes/asphalt products, and processing of dimension stone). They are based on a review of current environmental management practice in Ireland, the UK and Europe. Over 20 quarry locations in Ireland have been visited and inspected as part of the development of the guidelines. Key environmental management issues have been identified and addressed.

Consultation has been carried out with a wide range of organisations including industry bodies, local authorities, regional fisheries boards, government agencies, professional bodies and non-governmental organisations. A full list of consultees is provided in Appendix A.

Chapter 2 provides some background to environmental management practice and highlights the benefits that can be achieved by organisations that adopt good environmental practice. The use of environmental management systems (EMSs) is outlined together with the requirements for an EMS.

The environmental management practice guidelines are presented in Chapter 3. Under each of the key environmental issues, good environmental practice is summarised together with recommendations for emission limit values (ELVs), where appropriate.

A glossary of terms is provided in Appendix B. Further information on EMSs and settlement lagoons is provided in Appendices C and D.

The guidelines are intended to provide general advice and guidance in relation to environmental issues to practitioners involved in the planning, design, development, operation and restoration of quarry developments and ancillary facilities. It should be noted that each individual quarry location will have site-specific issues to be addressed.

No distinction is made between new and existing developments in this document. Some allowances in respect of ELVs may be provided for existing developments over an agreed time frame, to allow operators to put in place the relevant measures to meet the recommended ELVs.

Existing background levels for air quality, surface water, groundwater and noise should be taken into account when setting ELVs.

Parts of these guidelines relevant to quarry developments are referenced in the *Quarries & Ancillary Activities – Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government, under Section 261 of the Planning and Development Act, 2000 – Control of Quarries (www.environ.ie).

The regulations referred to in this document can be obtained from the Government Publications Office or from www.irishstatutebook.ie or www.irishlaw.org.

These guidelines do not specifically address health and safety, or socio–economic issues.

2 Environmental Management Practice

2.1 General

Inspections of over 20 operating quarries were carried out during 2001 and 2002 to assess current environmental practice. The quarries selected covered a broad distribution of size, type and geographical location. Each quarry has planning permission or pre-1964 planning status.

The following key environmental management issues were noted and are listed below in no particular order of priority.

- Noise, vibration and dust management were generally satisfactory, and compliant with ELVs where specified in planning conditions.
- There was a general lack of bunding to fuel/bitumen storage facilities.
- Companies are generally proactive in managing community relations and dealing with complaints.
- Those quarry operations with an EMS in place or in preparation addressed environmental issues in a more proactive manner.
- In a number of cases, mainly relating to pre-1964 developments, some ecological, archaeological and visual/restoration issues needed further review to mitigate existing or potential impacts.
- Management of unsuitable rock is an issue that requires further consideration by dimension stone quarries. In this respect, it is noted that some dimension stone quarries are processing unsuitable rock into construction aggregates.

A copy of the inspection report was provided to the quarry operators for their records and action.

The EPA maintains a complaints register and has recorded complaints at 38 quarries (1996–2003). The complaints relate to the full spectrum of environmental issues addressed within these guidelines. The majority of complaints related to noise and dust emissions, followed by issues relating to alleged illegal dumping and quarry blasting. In most cases, the EPA considered the issues raised were a matter for the relevant Local Authority.

Figure 2.1. Permanent blast monitoring station (Roadstone Provinces Ltd, Brownswood, Co. Wexford).

Since 1996, the Irish Concrete Federation (ICF) has developed and implemented an Environmental Code for the Aggregate and Concrete Product Industries (ICF, 2005). This voluntary self-regulatory code sets out environmental management practice and guidelines for ICF member companies, and covers all of the relevant environmental issues. The ICF is currently in the process of reviewing and updating its Environmental Code. An Environmental Code Checklist has been developed for member companies to use as a basis for environmental audits (ICF, 1997). In parallel to the Environmental Code, the ICF has also initiated an Environmental Award Scheme which assesses and recognises good environmental management practice. A number of the ICF award-winning entries have been used as examples of good practice in Section 3 of these Guidelines. An ICF/Department of the Arts, Heritage, Gaeltacht and the Islands joint initiative led to the implementation of a joint Code of Practice for the Protection of Archaeological Heritage in 2002.

Local authorities are responsible for the planning and environmental regulation of quarry developments (extracting non-scheduled minerals) and ancillary facilities (including concrete and asphalt manufacturing facilities). The current planning and environmental regulatory framework requires these developments to comply with the Planning and Development Act (2000) and related regulations. The local authorities and An Bord Pleanala attach conditions relating to environmental management of these developments to planning permissions granted.

In addition to obtaining planning permission, the following licences/permits may be required from local authorities where discharges, emissions or waste activities are carried out:

- A discharge licence is required under the Local Government (Water Pollution) Acts, 1977 and 1990, where a discharge of trade effluent or sewage effluent is made to waters
- A licence under the Air Pollution Act, 1987 (Licensing of Industrial Plant) Regulations, 1988, is required where there are specific point emissions from new asphalt plants erected on or after 1st November 1988
- A waste permit under the Waste Management (Permit) Regulations, 1998 may be required where soil or clay is imported to sites pending recovery for restoration purposes. The local authorities attach conditions (covering environmental issues) to waste permits granted for such activities.

It should be noted that even where an operation is not required to have a permit or single media licence there remains an obligation to comply with the provisions of the Acts.

2.2 Benefits of Good Environmental Management Practice

There are a number of key benefits to organisations that adopt good environmental management practice and EMSs. These include:

- Increased business competitiveness
- Ensuring regulatory compliance
- Reduced corporate liabilities
- Enhanced public and community relations.

2.3 Environmental Management Systems

The purpose of an EMS is to enable an organisation to establish procedures to set an environmental policy and objectives, to achieve compliance with them, and to ensure continuous improvement through regular updating of knowledge and demonstrate such competence to others (Bouchier *et al.*, 1998) (Fig. 2.2). There are international standards relating to EMSs – refer to ISO 14001 (1996) and EU EMAS (1993).

In many cases it is possible to integrate EMS requirements into an existing management system framework. In particular, for operations where a Quality Assurance System such as ISO 9000 is in place, it is not a major undertaking to develop and implement an EMS. For sites where an Environmental Impact Statement has been carried out, this will have generated all of the necessary environmental information for an EMS.

The main components of an EMS should include the following elements:

- Organisational commitment
- Environmental policy statement
- Environmental audits and site assessments
- Environmental monitoring
- Operational and emergency procedures

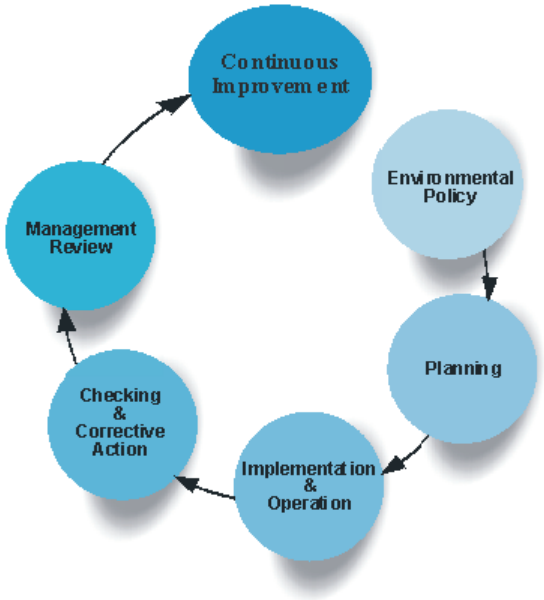

Figure 2.2. EMS implementation.

- Responsibility and reporting
- Training and awareness.

Guidelines for the requirements of an EMS are provided in Appendix C. It should be noted that these guidelines are general in nature and will need to be reviewed during the development of an organisation-specific EMS. An operator should develop an EMS that is appropriate to the scale of the operation, and that covers the key objectives outlined in Appendix C.

To be fully effective, an EMS must be fully integrated into the everyday operation of the quarry development and activities. An EMS requires periodic internal and external review to refine and optimise its operation and benefits.

Environmental management audits are an inherent part of an EMS. The audits assess the use and application of the EMS, progress in relation to achievement of the stated environmental objectives, and compliance with regulatory issues.

It is considered that implementation of an EMS will assist quarry operators and producers of construction materials in achieving and maintaining good environmental management practice. In addition, it will promote compliance with environmental conditions that are attached to planning permissions, discharge licences, air pollution licences and waste permits, and assist in community relations.

3 Environmental Management Guidelines

The following sections describe and summarise good environmental management practice guidelines under key environmental issues.

3.1 Ecology

Quarry developments by their nature are resource based and result in the removal of soil and rock. This results in disturbance and removal of original habitats. With sensitive and effective restoration, the original habitat can be replaced by another, new, and often more ecologically diverse, habitat that attracts new species of flora and fauna (Figs 3.1 and 3.2).

The biodiversity associated with quarry developments is recognised in the designation of a number of disused quarry developments as conservation areas (English Nature, Quarry Products Association and Silica & Mouldings Sands Association, 1999). One notable success story is the increase in the peregrine falcon population, which is often found to roost in quarries.

In some cases where protected species cannot be retained *in situ*, conservation techniques such as translocation/relocation may be the best available means of mitigating the loss of the ecosystem. Where required, such measures should be undertaken in consultation with the National Parks and Wildlife Service (DoEHLG) and under expert ecological supervision.

Figure 3.1. Quarry restoration – natural habitat: improved biodiversity.

Figure 3.2. Natural recolonisation.

Restoration schemes for quarry developments can provide a mechanism for enhancing biodiversity of local areas (refer to Section 3.6).

3.1.1 Environmental management guidelines

The following guidelines represent good practice in relation to ecological issues.

- Carry out ecological baselines studies and understand the ecological environment within and in the vicinity of the quarry.
- Mitigation measures:
  - Provide a minimum buffer zone of 10 m width (from edge of habitat to edge of extraction area) for designated ecological habitats defined under National and European legislation. The actual width will depend on the type of development and the habitat to be protected
  - Use translocation/relocation techniques, where necessary and appropriate.
- Link to restoration and afteruse: natural habitats, wetland areas.
- Protect and enhance existing habitats where appropriate as part of the landscaping and restoration scheme.
- Comply with regulations in relation to protected species, habitats and designated conservation areas.

- Plan for restoration at design stage of a quarry, and update/review the restoration scheme regularly during the life of the development.
- Retain topsoil and overburden materials on site to facilitate operational landscaping and restoration.

3.2 Surface Water

This section addresses issues relating to the surface water environment. It should be read in association with Section 3.3 on groundwater. The key objectives are to protect existing surface watercourses and to optimise the requirements for water abstraction through best water management practice. Discharges of effluent to surface waters are regulated under the Local Government (Water Pollution) Acts, 1977 and 1990. The associated regulations also specify water quality standards. There is an obligation for operators to comply with the provisions of these Acts.

3.2.1 Environmental management guidelines

- Consult the relevant Local Authority, Fisheries Board and, where applicable, Waterways Ireland about any alterations to existing surface watercourses, nearby river corridors and any discharges/abstractions.
- Consult with the Department of Communications, Marine and Natural Resources in relation to discharges to the foreshore.
- Obtain a discharge licence for discharges of effluent to surface watercourses.
- Where a discharge licence is required, undertake a surface water quality baseline study to assess the water quality and the assimilative capacity of the receiving surface waters.
- Undertake an aquatic survey (e.g. a biological survey to obtain a Q value) where discharge of effluent is to salmonid surface waters.
- Provide an appropriate drainage system to minimise surface water run-off into the quarry workings.
- Adopt an integrated approach to water management, including the following:
    - Control of suspended solids by settlement in sumps and lagoons (Fig. 3.3)
    - Ensure all surface run-off from hardstanding areas used for refuelling is directed to an appropriately sized hydrocarbon interceptor prior to discharge
    - Optimise use of water in processing plants and treatment of effluent including vehicle washing water
    - Where practical, provide closed water systems to reuse process and wheelwash water, and conserve water resources by abstracting water for 'top-up' only
    - Optimise use of water in dust suppression/control systems
    - Use of appropriate water recharge or other practical measures, where it is demonstrated that the quarrying activities have impacted on surface water levels in nearby streams, rivers, or lakes
    - Regular cleaning and maintenance of the water management system.
- Limit erosion by:
    - Rapidly vegetating exposed areas
    - Vegetating the surfaces of overburden and topsoil mounds
    - Progressively restoring worked-out areas, where practical
    - Limiting the areas of topsoil/overburden stripping exposed at any one time.
- Design sumps and lagoons to cope with all reasonable anticipated conditions, by ensuring that:
    - They are adequately sized
    - Scouring is avoided

Figure 3.3. Settlement lagoon.

- The retention time is adequate, and if necessary, enhancing settlement by use of flocculants or mechanical means
- Lagoons are adequately sealed with an impermeable material
- Regular cleaning and maintenance can be carried out
- Surface water monitoring stations are established both down and upstream of the site.

(Refer to Appendix D for specific guidance on the design, construction and maintenance of settlement lagoons.)

- Leave adequate margins/buffer zones around watercourses, and other sensitive areas.
- Control surface water run-off, e.g. minimise obstruction of flood flows by inappropriate placing of mounds of overburden or waste.
- Provide pollution control measures in relation to fuel and chemical storage (refer to Section 3.3).
- Where high concentrations of suspended solids are generated (e.g. in the processing of dimension stone) and where space limitations prevent the use of settlement lagoons, mechanical means of removal of suspended solids should be adopted.

3.2.2 Recommended ELVs

Where there are discharges of treated effluent from quarry developments to surface watercourses, the following ELVs are generally recommended:

- pH less than 9
- Biochemical oxygen demand (BOD): 25 mg/l
- Total suspended solids (TSS): 35 mg/l
- Nitrate (NO_3) 50 mg/l
- Chemical oxygen demand (COD): 100 mg/l O_2
- Total hydrocarbons: 1 mg/l.

It is noted that the specific ELVs will be determined by the nature of the treated effluent to be discharged and the receiving surface waters. These limits will be specified in the conditions attached to the associated discharge licence.

3.3 Groundwater

Groundwater is a significant natural resource in Ireland providing between 20% and 25% of drinking water supplies (GSI, 1999). In rural areas where there is no public water supply or group water scheme, groundwater is usually the only source of water. It is estimated that there are over 100,000 wells/springs in use around the country.

At present, groundwater resources are protected through the Local Government (Water Pollution) Acts, 1977 and 1990, at national level, and through the EU Groundwater Directive (80/68/EEC). These regulations control the discharge of specified substances to groundwater.

The GSI has prepared groundwater protection plans for a number of counties. These plans classify aquifers and aquifer vulnerability on a county basis, and some counties have incorporated this information into their county development plans.

Quarry developments by their nature remove topsoil and overburden materials within the extraction area and these activities may change aquifer recharge characteristics and increase the aquifer vulnerability. Depending on the depth of the quarry relative to the surrounding groundwater regime, groundwater control or dewatering measures may also have to be incorporated into quarry operations. The impact of these activities, if any, on the groundwater resource can be mitigated by appropriate quarry planning and design, together with the operational practices outlined below.

3.3.1 Environmental management guidelines

Groundwater control

- Where applicable, assess the hydrogeological regime around the quarry and its environs.
- Optimise the location and extent (plan area and depth) of the workings to ensure that there is no significant impact on groundwater resources.
- Implement groundwater monitoring where applicable, within EMSs.
- Provide for recharge of surface water regimes and aquifers, where such measures are necessary and practical.

- Provide replacement water supplies, where quarrying activity is found to adversely affect local water supplies.

- Provide an appropriate location for discharge of groundwater (where this is being abstracted and not reused).

- Obtain a discharge licence for any discharge of treated effluent to groundwater.

- Provide an appropriate buffer zone to ecological habitats that would be affected by any significant change in the groundwater regime.

Protection of groundwater (and surface water)

- Provide bunding to all fuel/chemical storage tank areas (refer to the EPA IPPC Guidance Note (EPA, 2005): 110% of the capacity of the largest tank within the area or 25% of the total volume of the substance which could be stored within the area, whichever is greater). Covering of bunded areas should be considered to minimise the requirement to dispose of contaminated rainwater collecting in the bund (Fig. 3.4).

- Use spill pallets to store drums of chemicals and oils (including waste oils) (Fig. 3.5).

- Assess and monitor the integrity and watertightness of all bunding structures.

Figure 3.4. Bunded fuel oil tanks (Arkil Ltd, Rathangan, Co. Kildare).

Figure 3.5. Spill pallets – storage of oils and chemicals.

- Provide spillage control equipment on site (booms and suitable absorbent materials, etc.) to contain any accidental spillage.

- Ensure blasting practice minimises the risk of occurrence of nitrate/ammonia residues by proper blast design and implementation, appropriate disposal of any excess explosives, and selection of the appropriate type of explosives (particularly in some limestone environments where significant karst features such as open cavities have been observed/encountered).

- Infiltration drainage (e.g. soakaways) should be designed in accordance with the principles outlined in CIRIA Report 156 (1996).

- Effluent treatment systems should be designed, constructed and maintained in accordance with the EPA Guidelines on Wastewater Treatment Systems (EPA, 1999a).

3.3.2 Recommended ELVs

Where there are point discharges of treated effluent from quarry developments to groundwater, the ELVs should be based on an assessment of the existing groundwater quality, the assimilative capacity and the appropriate legislation and environmental quality standards (e.g. the interim *Guideline Values for the Protection of Groundwater in Ireland* issued by the Environmental Protection Agency (EPA, 2003a)).

The specific ELVs will be determined by the nature of the treated effluent to be discharged and the receiving

aquifer. These limits will be specified in the conditions attached to the associated Discharge Licence.

3.4 Air Quality

Quarrying activities and ancillary facilities, by their nature, generate dust. The dust arises predominantly from inert soil and rock materials.

The main potential sources of dust include processing plant, stockpiles, traffic on internal haul roads, stripping, and overburden storage. They are generally dispersed sources rather than specific point sources, and this dictates the measures required to mitigate potential dust-related impacts.

The Air Quality Standards Regulations (2002 SI No. 271 of 2002) sets limit values for sulphur dioxide, nitrogen oxide, particulate matter and lead in ambient air. These regulations apply to ambient air quality in the local vicinity of land-use/development types including quarries and concrete/asphalt manufacturing facilities.

3.4.1 Environmental management guidelines

Minimise the creation of dust by planning and design

- Consider the use of conveyors rather than internal haul roads, where practical.
- Locate fixed/mobile processing plant within the quarry area, where practical.
- Locate haul roads, tips and stockpiles away from sensitive receptors and take into account prevailing wind directions.
- Lay out and construct stockpiles, tips and mounds to minimise dust creation.
- Use screening berms.
- Use crushing and screening plant within its design capacity.

Control the escape of dust from plant

- Enclose fixed conveyors and the processing plant.
- Where applicable, provide a dust removal system for the plant.
- Use water sprays and mists as dust suppression measures.
- Carry out regular maintenance on all plant.
- Use appropriate dust filter systems on asphalt and ready-mix plants.

Minimise wind-blown dust

- Compact, grade and maintain internal haul roads.
- Fit dust extractors, filters and collectors on drilling rigs.
- Use screening bunds to shelter plant and storage areas.
- Limit the drop of falling material.
- Reduce speeds and limit movement of vehicles, use upswept exhausts.
- Use water bowsers, sprays or vapour mists.
- Spray exposed surfaces, e.g. unsurfaced haul roads, stockpiles.
- Vegetate exposed surfaces, e.g. topsoil and overburden storage mounds.
- Carry out road sweeping, where appropriate (Fig. 3.6).
- Provide vehicle/wheel washing facilities and surface the road between the washing facility and the quarry entrance (Fig. 3.7).
- Use covered (closed or sheeted) vehicles, or spraying, for the transport of dry fine materials.
- Clean up any accidental spillages on public roads, as soon as such a spillage arises or is notified.

Figure 3.6. Vacuum road sweeper (Frank Harrington Ltd, Carrowscoltia, Co. Mayo).

Figure 3.7. Wheelwash facility (Loughnane Concrete, Birr, Co. Offaly).

New fixed or mobile asphalt plants constructed on or after 1 November 1988, require a licence under the Air Pollution Act, 1987, (Licensing of Industrial Plant) Regulations, 1988. This licence is issued by the relevant local authority and enables specific conditions in relation to air emissions to be applied to asphalt plants. The use of low sulphur fuels is recommended where practical.

Regular maintenance of vehicles should be carried out to control exhaust emissions.

3.4.2 Recommended ELVs

The impact of dust is usually monitored by measuring rates of dust deposition (DoE, 1995). There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert mineral dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standards (TA Luft, 1986) specify a method of measuring dust deposition – The Bergerhoff Method (German Standard VDI 2119, 1972) – with dust nuisance. It is the only enforceable method available. Where this method is deemed unsuitable for use, and only in these circumstances, an alternative method may be agreed with the local authority.

On this basis, it is recommended that the following TA Luft dust deposition limit value be adopted at site boundaries associated with quarry developments – total dust deposition (soluble and insoluble): 350 mg/m^2/day (when averaged over a 30-day period).

The following ELVs are recommended for emissions to air arising from asphalt plants regulated under the Air Pollution Act, 1987:

- Sulphur dioxide 500 mg/Nm^3
- Nitrogen oxide 450 mg/Nm^3
- Dust 50 mg/Nm^3

3.5 Noise and Vibration

People, property and animals are regularly exposed to vibration, both ground-borne and airborne. Noise and vibration are present in many normal everyday activities. Tables 3.1 and 3.2, respectively, describe the noise and vibration levels associated with these activities.

3.5.1 Environmental management guidelines

The following practical measures can be adopted to reduce noise and vibration levels at quarry sites.

Noise control

- Design of the workings and ancillary facilities: layout, sequence of working.
- Selection of locations for processing, storage and loading.
- Screening by bunds and working face (Fig. 3.8).
- Screening of haul roads and provision of suitable gradients.
- Consider noise characteristics as part of the overall assessment when purchasing new plant and equipment.
- Internal traffic routing: optimise vehicle reversing requirements (to minimise noise associated with reversing alarms).
- Use of rubber linings on chutes and transfer points
- Minimise height which material drops from plant and machinery.
- Enclosure and cladding of processing plant, where applicable.
- Regular maintenance for plant and machinery.

Vibration and air overpressure control

Efficient blasting ensures that as much of the explosive energy as possible is utilised for rock fragmentation, and

Table 3.1. Typical noise levels generated by everyday activities.

Description of activity	Noise level (dB(A))
Absolute silence	0
Very quiet room	25
Rural night-time setting (no wind)	35
Daytime, busy road 0.5 km away	55
Busy restaurant	70
Very busy pub, voice has to be raised to be heard	85
Disco or rock concert	100
Uncomfortably loud, conversation impossible	120
Noise causes pain in ears	140

Source: EPA (1996).

Table 3.2. Typical vibration levels generated by everyday activities.

Vibration level	Description of activity
1.0–2.5 mm/s	Walking measured on a wooden floor
2.0–5.0 mm/s	Door slam, measured on a wooden floor
12–35 mm/s	Door slam, measured over doorway
5–50 mm/s	Footstamp, measured on wooden floor
30–70 mm/s	Daily changes in temperature and humidity
120 dB	Constant wind of 5 m/s: Beaufort Scale 3, Gentle Breeze
130 dB	Constant wind of 8 m/s: Beaufort Scale 4, Moderate Breeze

Source: DETR (1998).

Figure 3.8. Landscaped screening berm.

by implication ground vibration and air overpressure is inefficient use of this energy. Air overpressure values arising from blasting operations fluctuate depending on the weather conditions, a factor outside the control of operators. The ELV is specified with a 95% confidence limit to address this issue. The following measures should be considered to reduce the effects of blasting:

- Optimise blast design
- Monitor blasts and revise blast design, as required
- Limit ground-borne vibration and minimise air overpressure by:
  - Taking care in unusual situations, e.g. corners
  - Including geological considerations in blast design
  - Minimising air overpressure through proper blast design, avoiding detonation of large unconfined charges, and by consideration of atmospheric conditions before blasting
- A blast must be carried out on a specified day as concerns over security do not allow for explosives to be stored on site. In exceptional or unforeseen circumstances (e.g. late delivery, security, meteorological conditions, etc.), a blast may be delayed or brought forward. Where possible the operator should endeavour to inform the public of the revised blasting timetable
- Adequate stemming of holes
- Ensure the correct blasting ratio is obtained. The blasting ratio is a measure of the amount of work per unit volume of explosives, i.e. tonnes/kg
- Notify nearest residences prior to the blast.

3.5.2 Recommended ELVs

The Environmental Protection Agency (EPA) has produced a *Guidance Note for Noise in Relation to Scheduled Activities* (EPA, 1996). It deals in general terms with the approach to be taken in the measurement and control of noise, and provides advice in relation to the setting of noise ELVs and compliance monitoring.

- In relation to quarry developments and ancillary activities, it is recommended that noise from the activities on site shall not exceed the following noise ELVs at the nearest noise-sensitive receptor:

  Daytime: 08:00–20:00 h
  LAeq (1 h) = 55 dBA

  Night-time: 20:00–08:00 h
  LAeq (1 h) = 45 dBA

(Note: 95% of all noise levels shall comply with the specified limit value(s). No noise level shall exceed the limit value by more than 2 dBA.)

- On-site activities should be permitted during night-time hours where they comply with the noise ELVs (e.g. heating up of asphalt plants, loading of materials).
- Where existing background noise levels are very low, lower noise ELVs may be appropriate.
- Audible tones or impulsive noise should be avoided at night.
- It is also appropriate to permit higher noise ELVs for short-term temporary activities such as construction of screening bunds, etc., where these activities will result in a considerable environmental benefit.
- In relation to blasting activities within quarry development, it is recommended that the following vibration and air overpressure ELVs are adopted and applied at the nearest vibration and air overpressure sensitive location (e.g. a residential property):

  Ground-borne vibration: Peak particle velocity = 12 mm/s, measured in any of the three mutually orthogonal directions at the receiving location (for vibration with a frequency of less than 40 Hz)

  Air overpressure: 125 dB (linear maximum peak value), with a 95% confidence limit.
- Normal hours of blasting should be defined (e.g. 09:00–18:00 h Monday to Friday), and provision should be included to permit blasting outside these hours for emergency or safety reasons beyond the control of the quarry operator.
- It is recommended that quarry operators provide advance notification of blasting to nearby residents through use of written notes, signage at site entrance, telephone, or warning sirens (or a combination of these methods).

3.6 Landscape, Restoration and Afteruse

Landscape change and visual intrusion are some of the key environmental issues associated with quarry developments. Because of the diversity of local landscapes, the potential impacts vary considerably in nature. The method of extraction and associated restoration scheme, where properly planned and implemented, can eliminate and/or minimise these potential impacts. The Landscape Institute/Institute of Environmental Management and Auditing has provided useful guidelines for landscape and visual assessment (IEMA, 2002).

There are a number of publications providing guidelines for the restoration of quarry developments and these are provided in the References (DoE, 1992, 1996; CTP, 2000). In addition, the EPA Landfill Manual – *Landfill Restoration and Aftercare* – (EPA, 1999b) provides useful information on the principles of restoration and on issues such as soil handling and afteruse options.

3.6.1 Environmental management guidelines

- Minimise impact on the landscape through proper planning and design:
  - Direction of working and phasing of extraction
  - Implement progressive restoration, where possible
  - Location of processing plant and stockpiles
  - Use of screening bunds (Fig. 3.8)
  - Use of pre-planting, where possible, to minimise the impact of future phases of extraction
  - Operational landscaping around site perimeter and at site entrance, where appropriate
  - Suitable choice of colours/finishes for plant and buildings
  - Retain and/or reinstate boundaries and boundary features where practical
  - Use of directional lighting, as appropriate during hours of darkness.
- Restoration and afteruse:
  - Consider and develop a restoration scheme at the earliest possible stage in the planning of quarry developments (Fig. 3.9)
  - Consult with interested parties regarding afteruse/restoration options
  - These are some of the afteruses that can be considered:

    Agricultural

    Forestry

Figure 3.9. Quarry restoration scheme.

Amenity (fisheries; golf courses)

Natural habitat (lake, wetland – nature conservation

Landfill – waste disposal

- Implement progressive restoration, where possible (Fig. 3.10)
- Maximise soil recovery during stripping operations, and store topsoil and overburden materials separately
- Retain topsoil and overburden to ensure the materials can be reused in restoration
- Provide an appropriate programme of maintenance and aftercare.

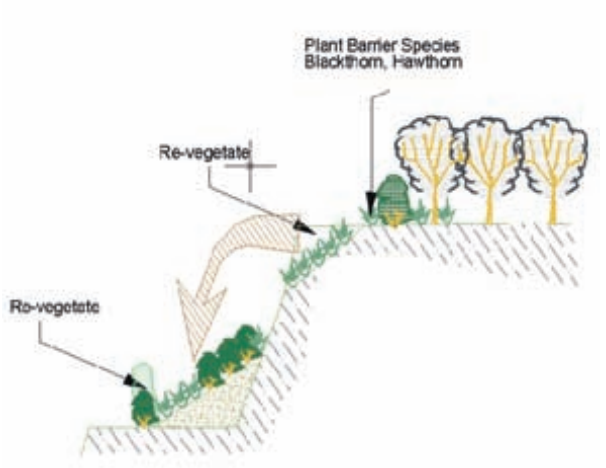

Figure 3.10. Face treatment on upper bench of quarry.

3.7 Waste Management

Quarrying and related value-added activities result in a number of waste streams. These may include waste associated with plant/vehicle maintenance and on-site canteens. The management of waste within quarries is regulated under the Waste Management Acts, 1996–2003, and associated regulations.

A waste permit under the Waste Management (Permit) Regulations, 1998, may be required where overburden materials are imported to site pending future recovery for restoration purposes.

In the past, some quarries have been subjected to illegal fly-tipping and disposal of waste by third parties. The industry is addressing this issue by providing improved security around site boundaries and entrances.

The guidelines provided below cover the management of waste in quarry developments.

3.7.1 Environmental management guidelines

- Eliminate and minimise the production of waste.
- Reuse and recycle unsuitable materials (such as poor-quality rock arising from dimension stone quarries, and clay/silt materials arising from settlement processes).
- Reuse and recycle rejected products from block making, concrete and asphalt production operations.
- Ensure appropriate disposal of excess/unused explosives, in accordance with the manufacturers guidelines and health and safety regulations.
- Use designated storage areas for particular waste types and authorised waste contractors for the collection, reuse and disposal of waste oils, batteries, tyres, domestic waste and scrap metal (in compliance with current waste management legislation) (Fig. 3.11).
- No burning, disposal or mixing of waste materials, or use of waste materials in boilers should take place without prior consent of the local authority.
- Appropriate security and signage around entrance(s) and boundaries to deter and prevent illegal fly-tipping of waste materials by third parties.
- Particular waste materials, such as oils, oil filters, batteries, empty oil drums, fluorescent lamps and

printer cartridges, are classified as hazardous waste materials. These materials should be stored on site in designated areas and collected and recycled or disposed of by an authorised waste contractor.

Figure 3.11. Segregated storage of wastes in a designated area (Roadstone Provinces Ltd, Bunratty, Co. Clare).

3.8 Archaeological Heritage

As archaeological heritage is a non-renewable resource, the presence of known archaeological sites or the anticipation of potential sites is a major consideration in the extension of existing quarries and the selection of sites for new quarry developments.

The Irish Concrete Federation, and the Department of Arts, Heritage, Gaeltacht and the Islands (DoAHGI) have developed a Code of Practice in relation to archaeological heritage (ICF/DoAHGI, 2002).

The purpose of the Code is to "*Provide a framework within existing legislation and policies to enable members of the Irish Concrete Federation to expand their operations whilst carrying out appropriate archaeological mitigation having regard to a set of principles and actions agreed by both parties.*"

The guidelines summarised below are based on information contained in the Code. It is understood that the Code of Practice will be reviewed by both parties 1 year after its adoption, and at regular intervals thereafter.

3.8.1 Environmental management guidelines

- Undertake archaeological investigations at initial site selection and planning stages (for both 'greenfield' developments and quarry extensions) to minimise the impact on known archaeological sites or areas of established significant archaeological potential (Fig. 3.12).

- Preserve by record all known sites being removed by development works (Fig. 3.13).

- Notify the National Monuments Section of the Department of Environment, Heritage and Local Government of, and preserve by record, any other monument or archaeological site of archaeological significance deemed worthy of preservation that may be uncovered during the operational phase of a quarry development.

3.9 Transport and Traffic

Construction materials have to be transported to the market place. In Ireland, the predominant mode of transport used is by road via the use of heavy goods vehicles including trucks, concrete lorries, and container lorries for dimension stone. Where quarries are adjacent to, or adjoin, existing railway lines, rail transport is sometimes adopted for transport of aggregates used in track maintenance.

Figure 3.12. Trial excavation under supervision of licensed archaeologist (Harrington Concrete (Sligo) Ltd, Ballysadare, Co. Sligo).

Figure 3.13. Archaeological excavation at Brownstown, Kilcullen, Co. Kildare (Kilsaran Concrete Products Ltd).

Construction aggregates are typically relatively low-value materials and it is generally only economic to use road transport for delivery to the market place within a 50-km radius from the quarry. For higher value materials, such as concrete and asphalt/bituminous mix products and dimension stone, the market can stand higher transport costs and therefore greater haulage distances.

On-site traffic within quarry developments typically arises from activities including stripping of topsoil and overburden materials, haulage of fragmented rock, cut stone or sand and gravel, and movement of site personnel and finished materials/value-added products.

Off-site traffic associated with quarry developments typically arises from transport of finished product/value-added products to the market, deliveries to the quarries (e.g. fuel, cement, bitumen, sand and explosives), and personnel movements.

The potential impacts of traffic associated with quarry developments can be mitigated by implementation of the guidelines outlined below and other guidelines related to on-site and off-site traffic given in Sections 3.4 and 3.5.

3.9.1 Environmental management guidelines

- Consider, where appropriate, alternatives to internal road haulage from excavation to processing plant or depot, e.g. conveyors.
- Careful design and layout of the site entrance, providing adequate visibility (Fig. 3.14).
- Regular maintenance and servicing of vehicles.
- Agree main traffic routes, where appropriate, to avoid sensitive areas and the use of large vehicles on narrow winding roads.
- Require drivers and others to use agreed routes.
- Use vehicle/wheel washing facilities and sheet vehicles (when transporting dry fine materials), where appropriate.
- Provide on-site truck parking to avoid queuing of trucks outside quarry entrances.

Figure 3.14 Splayed site access with landscaping (Loughnane Concrete, Birr, Co. Offaly).

3.10 Energy

Quarry developments and associated ancillary facilities are large users of energy (fuel and electricity). There are significant environmental and financial benefits from ensuring that the use of energy is optimised.

Energy consumption is associated with processing plant (crushing, screening and washing activities), on-site and off-site vehicles, asphalt, ready-mix concrete and concrete block/pipe manufacturing plants, and cutting/finishing processes used within the dimension stone sector.

The guidelines in Section 3.10.1 below outline measures to optimise energy consumption. Further advice on energy issues can be obtained from Sustainable Energy Ireland (www.sei.ie).

3.10.1 Environmental management guidelines

- Carry out energy efficiency audits (refer to *Guidance Note on Energy Efficiency Auditing* (EPA, 2003b).
- Identify opportunities and implement appropriate measures for energy use reduction and efficiency, e.g. use of variable speed drives.
- Consult with the electricity supplier in relation to tariff management and use of off-peak electricity.
- Provide regular maintenance for processing plant, pumps, and boilers, etc.
- Use photosensors to control and optimise the use of outside lighting.
- Provide insulation for storage bins: asphalt/ tarmacadam plants (Fig. 3.15).
- Consider using off-peak electricity for certain operations, e.g. pumping of water, heating of bitumen tanks, etc.
- Optimise layout and design of internal haulage routes and processing plant.

Figure 3.15. Energy efficient asphalt plant incorporating insulated bitumen tanks and aggregate bins (Roadstone Provinces Ltd, Bunratty, Co. Clare).

- Use automatic controls to ensure idling or shutdown of plant when not in use.
- Use float operated pumping systems.

3.11 Environmental Management and Monitoring

Each quarry operator should implement an EMS in accordance with the principles set out in Section 2.3.

The system should include an ongoing environmental monitoring programme. The purpose of the monitoring is to demonstrate compliance with any conditions attached to planning permissions, discharge licenses, etc. and to enable the operator to address any third-party complaints in relation to activities within the quarry. The monitoring programme should be agreed with the local authority and reviewed on an annual basis. Monitoring results should be submitted to the local authority on a regular basis and be available at the local authority offices for review by any interested third parties. A copy of the monitoring results should be retained on-site for a period not less than 7 years.

The monitoring programme should be carried out by trained company personnel or external companies with appropriate experience. Monitoring and analysis equipment should be operated and maintained as necessary so that monitoring results accurately reflect the emission or discharge.

Typically, an environmental monitoring programme will include:

- Measurement of dust deposition at a number of locations on the site boundary
- Measurement of noise levels at sensitive receptors
- Measurement of ground-borne vibration and air overpressure at sensitive receptor locations where blasting operations are carried out
- Measurement of groundwater levels, where applicable
- Measurement of discharge volumes and water quality, where applicable
- Regular monitoring of fuel and chemical storage areas
- Keeping a record of waste collections.

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Appendix A List of RTDI 2000-MS-11 Project Consultees

IFA (Irish Farmers Association)
Dúchas, The Heritage Service
An Taisce
Dept. Marine & Natural Resources – Exploration & Mining Division
Health & Safety Authority
Geological Survey of Ireland
OPW (Office of Public Works)
Irish Planning Institute
IBEC
Inst. Engineers of Ireland
Irish Concrete Federation
Irish Mining & Quarrying Society
East Coast Area Health Board
South Western Area Health Board
Midland Health Board
Mid-Western Health Board
North Eastern Health Board
Northern Area Health Board
North Western Health Board
Southern Health Board
Western Health Board
South Eastern Health Board
Carlow County Council
Cavan County Council
Clare County Council
Cork County Council
Donegal County Council
Dublin Corporation
Dun Laoghaoire–Rathdown Council
Fingal County Council
Galway County Council
County Borough of Galway
Kerry County Council
Kildare County Council
Kilkenny County Council
Laois County Council
Leitrim County Council
Limerick County Council
Longford County Council
Louth County Council
Mayo County Council
Meath County Council
Monaghan County Council
Offaly County Council
Roscommon County Council
Sligo County Council
South Dublin County Council
Tipperary North County Council
Tipperary South County Council
Waterford County Council
Waterford County Borough Council
Westmeath County Council
Wexford County Council
Wicklow County Council
Eastern Regional Fisheries Board
Northern Regional Fisheries Board
North Western Regional Fisheries Board
Shannon Regional Fisheries Board
Southern Regional Fisheries Board
South Western Regional Fisheries Board
Western Regional Fisheries Board
The Heritage Council
Department of the Environment and Local Government
Irish Dimension Stone Producers
Irish Asphalt Producers
Irish Creamery Milk Suppliers Association
Earthwatch (Friends of the Earth – Ireland)
Environmental Protection Agency
Wicklow Planning Alliance

Appendix B Glossary of Terms

A-weighting	Normal hearing covers the frequency (pitch) range from about 20 to 20,000 Hz, but sensitivity is greatest between about 500 and 5,000 Hz. The 'A-weighting' is an electrical circuit built into noise meters to mimic this human characteristic.
Admixtures	Chemicals which, except in special cases, are added to concrete or mortar in quantities no larger than 5% by mass of cement in order to modify the normal properties of concrete or mortar.
Aggregates	A granular product obtained by processing natural materials. It may be sand or gravel produced by natural disintegration of rock, or it may be manufactured by passing rock through a series of crushers.
Aggregate resource	A concentration of naturally occurring aggregates in such form that economic extraction is currently or potentially feasible.
Air overpressure	Intensity of air pressure wave caused by blasting, expressed as dB (Lin).
Aquifer	A permeable geological formation which is capable of storing and yielding water.
Asphalt	A natural or artificial mixture in which bitumen is associated with a substantial proportion of mineral matter.
Bench	A working level in a quarry.
Bench height	The height of the rock face between two benches in a quarry.
Berm	A man-made landscape feature comprising mounded soil.
Bitumen	A viscous liquid or a solid consisting essentially of hydrocarbons and their derivatives; it is substantially non-volatile and softens gradually when heated. It is black or brown in colour and possesses waterproofing and adhesive properties. It is obtained by refinery processes from petroleum and is also found as a natural deposit or as a component of naturally occurring asphalt, in which it is associated with mineral matter.
Bituminous mixes	A paving material consisting of crushed rock held together with bitumen.
Blasting	Fragmentation of rock by the use of explosives.
Blast vibration	Energy released by an explosion and transmitted through the ground.
Bund	An extended mound of soils, overburden or structure erected as a barrier to sight, sound or water.
Cement	Natural or synthetic material that binds rock particles together.
Clay	(i) A specific group of layered silicate minerals. (ii) Particles of size less than 2 μm, forming rock.
Concrete	Consists of sand and gravel, crushed rock or other aggregate, bound together by a paste of cement and water.
Crusher	A device for breaking rock in which the components contacting the rock follow a strictly controlled path.
Decibel (dB)	The unit of sound pressure level, calculated as a logarithm of the intensity of sound. 0 dB is the threshold of hearing; 140 dB is the threshold of pain. A change of 1 dB is detectable only under laboratory conditions.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A-weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessments of loudness. The background noise level in a living room may be about 40 dB(A), normal conversation 60 dB(A), heavy road at 60 m about 80 dB(A), the level near a pneumatic drill about 100 dB(A). A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.
dB $(Lin)_{max\ peak}$	Instantaneous Maximum Peak sound pressure level measured in decibels on a sound level meter, without the use of a frequency weighting system. It is the parameter used to quantify air overpressure.

Dimension stone	A natural stone product that has been cut or fashioned to a particular size and shape.
Fines	Material finer than 60 μm, i.e. the silt and clay-sized fraction, but in connection with aggregates it usually refers to material finer than 75 μm.
Flyrock	The projection of material from the blast site to any area beyond the designated danger zone.
Fragmentation	A term associated with hard rock quarrying to describe the degree of mechanical breakdown produced by blasting.
Gravel	In the British Standard particle size classification (BS 1377: 1975 and BS 5930: 1981), the term denotes granular material in the size range 2–60 mm.
Hertz (Hz)	Unit of frequency (pitch) of a sound. Formerly called cycles per second.
Impulsive noise	A noise which is of short duration (typically less than 1 s), the sound pressure level of which is significantly higher than the background.
L_{AeqT}	The equivalent continuous sound level – the sound level of a steady sound having the same energy as a fluctuating sound over a specified measuring period (T). Used to describe many types of noise, and can be measured directly with an integrating sound level meter.
L_{arT}	The equivalent continuous A-weighted sound level during a specified time interval, plus adjustments for tonal character and impulsiveness of the sound.
Lagoon (silt)	A contained volume of water providing time for the sedimentation of silt and, perhaps, clays to permit reuse or discharge of clean water.
Macadam	Crushed stone mechanically locked by rolling and cemented together by application of stone screenings and water. Bituminous macadam is crushed material in which the fragments are bound together by bituminous materials.
Marine aggregate	Sand and gravel, which is excavated by dredger from the seabed and taken ashore for processing and distribution.
Minerals	Means all minerals and substances in or under land of a kind ordinarily worked by underground or by surface working for the removal but does not include turf (Planning & Development Regulations 2001, SI No. 600 of 2001).
Noise	Unwanted sound. Any sound which has the potential to cause disturbance, discomfort, or psychological stress to a subject exposed to it, or any sound which has the potential to cause actual physiological harm to a subject exposed to it or physical damage to any structure exposed to it, is known as noise.
Noise-sensitive receptor	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires an absence of noise at nuisance levels.
Overburden	Rock, soil overlying aggregate to be extracted.
Pavement	The whole constructed thickness of a road or similar slab whether of concrete, asphalt, macadam, stabilised soil, etc.
Peak particle velocity	A measure of ground vibration magnitude which is the maximum rate of change of ground displacement with time, usually measured in millimetres/second. Velocity will vary from zero to a maximum value – the peak particle velocity. It is the parameter usually used to describe ground vibration in relation to blasting activities.
Precast concrete	Term used to describe concrete products that have been manufactured off-site in specialist precast production plants.
Primary blasting	Describes the initial blast, where more than one stage of blasting is needed to obtain the required fragmentation.
Quarry	An excavation or system of excavations made for the purpose of, or in connection with, the getting of minerals (whether in their natural state or in solution or suspension) or products of minerals, being neither a mine nor merely a well or borehole or a well and borehole combined.
Sand	In the British Standard particle size classification (BS 1377: 1975 and BS 5930: 1981) sand is a granular material in the size range 0.06 mm to 2 mm. In the sense of ‘concreting sand’, however, the nominal upper size limit is 5 mm and there are constraints on the particle size distribution (see BS 882: 1983).
Scheduled minerals	Minerals defined in the Schedule attached to the Minerals Development Act, 1940. The 72 minerals listed include metalliferous and industrial minerals, and hydrocarbons.

Screen	A particle sizing device like a sieve, consisting of a surface (usually flat) which is perforated by apertures of characteristic size and shape. Screening is a sizing operation effected by means of a screen.
Secondary blasting	The blasting of rock which has not been adequately fragmented by the primary blast. Also called plaster blasting.
Settling pond	A reservoir of still water in which very fine material is allowed to settle (see lagoon).
Silt	A deposit which has the average grain size between that of sand and clay (i.e. 0.06 mm and 0.002 mm, respectively).
Soil	In engineering geology: all unlithified material overlying the bedrock. In soil science: the natural medium for the growth of land plants and classifiable into soil types and soil horizons on characteristic physical properties such as structure, texture, colour and chemical composition including organic content, acidity, alkalinity, etc.
Toe	The base of a quarry face or the base of a slope of an accumulation of material. A remnant 'toe' comprising a mass of solid, unbroken rock at the base of the face projecting into the quarry may result from poor blast design. Also sometimes used to refer to the base of natural slopes where an abrupt change of gradient occurs.
Tonality	The degree to which a noise contains audible pure tones. Broadband noise is generally less annoying than noise with identifiable tones (noise with a narrow frequency composition). A pure tone is a sound in which the pressure varies regularly, at a single frequency over time.
Vibrograph	An instrument to measure vibration, e.g. blasting vibration.
Water bowser	Equipment incorporating a water tank used to spray a fine mist of water onto the surface over which it is towed.
Wet suppression	Control of dust levels during processing operations by the use of water sprays into crushers, onto screens or conveyor belt transfer points.
Wet screening	Screening employing water sprays directed onto the deck.

Appendix C Guidelines on Requirements for an EMS

Environmental Management System (EMS)

The system must provide for the preparation and implementation of documented system procedures and instructions.

A programme for achieving environmental objectives and targets needs to be established and maintained. This, in part, is achieved through the definition of corporate environmental policy.

Environmental Policy

Definition and documentation of an organisation's environmental policy. The policy should be in the form of a public statement of the company's intentions with respect to the environment. It should also inform the company's own employees with regard to environmental goals and the level of performance the company intends to maintain.

Organisation and Personnel

Responsibility, authority and resources

Definition and documentation of the responsibility, authority and interrelations of key personnel who manage, perform and verify work affecting the environment.

Verification resources and personnel

Identification of in-house verification requirements and procedures, provision of adequate resources and assignment of trained personnel for verification activities.

Management representative

Appointment of a management representative who has the defined authority and responsibility for ensuring that the requirements of the environmental standard are implemented and maintained. This appointment should normally take place at a senior level.

Personnel, communication and training

Establishment and maintenance of procedures to ensure that employees are aware of:

- the importance of compliance with environmental policy and objectives
- the potential environmental effects of their work activities and the benefits of improved environmental performance
- their roles and responsibilities in achieving compliance with the environmental policy and objectives
- the potential consequences of departure from agreed operating procedures.

Environmental Effects

Register of legislative, regulatory and other policy requirements

Establishment and maintenance procedures to record all legislative regulatory and other policy requirements relating to the environmental aspects of the organisation's activities, products and services.

Communications

Establishment and maintenance of procedures for receiving, documenting and responding to communications from relevant interested parties concerning its environmental effects and management (e.g. complaints).

Environmental impact assessment

Establishment and maintenance of procedures for examining and assessing the environmental effects, both direct and indirect, of activities, products and services and the production of an environmental impact assessment (EIA). The EIA is an essential component of company strategy with respect to minimising environmental impacts arising from its operations.

Environmental Objectives and Targets

The objectives and targets should be consistent with the environmental policy and should quantify, wherever practicable, the commitment to continual improvement in environmental performance over defined timescales, relative to data collected during the EIA and associated audits.

Definitions

i. Environmental objectives: The goals, in terms of environmental performance, which an organisation sets itself to achieve and which should be quantified wherever practicable, e.g.

   - performance levels specified in the EIA
   - compliance with regulatory limits
   - reduction of environmental impacts
   - public satisfaction with company responses to complaints or inquiries.

ii. Environmental targets: Detailed performance requirements, quantified wherever practicable, applicable to the organisation or parts thereof, which arise from the environmental objectives and which need to be met in order to achieve those objectives, e.g.

   - compliance with recommendations from site audit or regular checklist inspections
   - internal waste reduction
   - internal savings targets.

Environment Management Plan

The Environment Management Plan should be designed to illustrate how the company will achieve its objectives and targets. It should also set out the environmental performance indicators that will be used to measure progress. Environmental performance indicators are defined by the International Standards Organisation as "*a type of environmental indicator used in relation to the organisation's management and operations*".

Environmental Management Manual and Documentation

Manual

Establishment and maintenance of a manual to:

- collate the environmental policy, objectives, targets and programme
- document the key roles and responsibilities of personnel
- describe the interactions of system elements
- provide direction to related documentation and describe other aspects of the management system, where appropriate.

Document control

Establish and maintain procedures for controlling all environmentally related documents.

Environmental management records

Establishment and maintenance of a system of records in order to demonstrate compliance with the requirements of the environmental management system.

Operational Control

General (management responsibilities)

Management responsibilities should be defined.

Control

Identification of functions, activities and processes that affect, or have the potential to affect, the environment. These functions and activities should be planned to ensure that they are carried out under properly controlled conditions.

Verification, measurement and testing

Establishment and maintenance of procedures for verification of compliance with specified requirements and for establishing and maintaining records.

Non-compliance and corrective action

The responsibility and authority for initiating investigation and taking corrective action in the event of non-compliance with specified requirements shall be defined.

Environmental Management Audits

General

Establishment and maintenance of procedures for audits to be carried out in order to determine:

- whether or not the environmental management activities conform to the environmental management programme, and are implemented effectively
- the effectiveness of the environmental management system in fulfilling the organisation's environmental policy.

For this purpose, an audit plan should be established and maintained.

Audit plan

The audit plan should deal with the following points:

- the specific activities and areas to be audited
- the frequency of auditing of each activity area based on the nature and environmental importance of the activity concerned, and the results of the previous audit
- who has the responsibility for auditing each activity area
- personnel requirements
- the protocol for conducting the audits, which may involve the use of questionnaires, checklists, interviews, measurements and direct observations, depending on the nature of the function being audited
- the procedures for reporting audit findings to those responsible for the activity area audited and who shall take action on reported deficiencies
- the procedures for publishing audit findings if the organisation has undertaken such a commitment.

Environmental Management Reviews

At appropriate intervals, the environmental management system adopted needs to be reviewed to ensure it satisfies the organisation's requirements and to ensure its continuing effectiveness. Management reviews should include an assessment of the results of environmental management audits, which are a systematic, documented and objective evaluation of the performance of the organisation, environmental management and control systems currently in place with the aim of protecting the environment.

Appendix D Guidelines for Settlement Lagoons

Introduction

The traditional site treatment of process water (from aggregate washing plants) and surface run-off to reduce suspended solids is by means of settlement lagoons. Other methods of suspended solids removal are available, such as silt presses and cyclones, but settlement lagoons are generally the most cost effective for quarry developments.

The design of on-site settlement lagoons is based on proven practices of sedimentation and flow control developed for the water treatment and sewage treatment sectors (Miller, 1994).

There is increased awareness in relation to reuse/recycling process water (in closed systems) and conserving the use of water. Where trade effluent is discharged to surface waters, the discharge licence generally specifies an ELV for suspended solids. The design, construction and maintenance of settlement lagoons associated with quarry developments are critical to addressing these issues.

The following guidelines describe the key factors in the design, construction and maintenance of settlement lagoons for use in quarry developments.

Design Issues

The design of settlement lagoons is based on Stokes Law that defines the critical settling velocity with which suspended solids in a fluid fall under gravity. Stokes Law has a number of assumptions as follows:

- Particles are spheres
- Particles act independently of each other
- The fluid within which settlement takes place is tranquil.

In addition, there is a minimum particle size below which Stokes Law does not apply (typically clay-size particles <0.002 mm diameter). However, in practice, clay particles tend to flocculate naturally into larger composite particles which can settle.

On site, the above assumptions are not strictly valid but practical experience indicates that the application of Stokes Law provides a reasonable basis for sizing settlement lagoons.

Retention time

For practical values of water temperature and particle specific gravity (density), and a settlement lagoon depth of 1 m, the following theoretical retention times are calculated:

- 11 h to settle out particles of 0.006 mm (medium silt) or greater
- 24 h to settle out particles of 0.004 mm (fine silt) or greater.

The retention time varies with temperature and particle specific gravity but ±2 h covers the normal temperature range (5–15°C) and specific gravity range (2.60–2.65).

Where the process water and surface water run-off to be treated contain a higher proportion of sand size particles (0.06 mm or greater) then the settlement time will be faster than the retention times stated above, and the retention time will be reduced. Use of chemical flocculants may be appropriate in some cases to accelerate the settlement process.

Flow conditions

One of the main design problems is achieving uniform horizontal flow at the inlet to the lagoon. Although it is possible to design radial flow settlement lagoons, they are not practical for on-site operation within quarry developments and therefore linear flow lagoons are adopted.

Sizing settlement lagoons

The sizing of settlement lagoons requires consideration of the design flow rate and minimum size of particle to be fully removed.

The depth of water in the settlement lagoons is not a variable in the equation relating capacity flow rate to minimum settling velocity (i.e. making lagoons deeper does not improve their efficiency or performance). In practice, it has been shown that settlement lagoons are

efficient if the water depth in the lagoon is not less than 1 m.

The overall depth of the lagoons should also consider the maximum depth of sediment that will be allowed to collect before removal (typically 0.5–1.0 m) and provision of freeboard (typically 0.5 m between maximum water level in the lagoon and the crest of the lagoon).

Construction of Settlement Lagoons

Within quarry developments, settlement lagoons are generally excavated with overburden material or created by a combination of impounding embankments and excavation. The size, shape and layout can be limited by the areas available on site.

The primary consideration is the maintenance of uniform horizontal flow. For this, the lagoons should be rectangular in shape with parallel sides in the directions of flow. The floor and sides of the lagoon should be as smooth as practicable to minimise turbulent flow. Where turbulence is created, currents can create scour conditions and negate the settlement process.

The settlement lagoons should be lined with impermeable material, either compacted clay or PVC liner, to eliminate any seepage from the lagoons.

Operational Practice

The lack of maintenance is the primary cause of poor efficiency of settlement lagoons. Typical problems arising include instability of lagoon side slopes, blocked pipes that can affect flows, and reduction in efficiency arising from settled materials forming shallows within the lagoon. Typically, settled materials will need to be removed from primary lagoons every 3–6 months. Regular maintenance can prevent these types of problems occurring.

Provision should be made to allow settlement lagoons to be cleaned/maintained without affecting the overall settling process (i.e. by using over-pumping or installing pipes to bypass individual lagoons).

The most difficult suspended solids to remove from drainage waters are clay-size particles. These often originate from excavated topsoil and overburden materials/stockpiles. Minimising surface water run-off from these materials through shaping, optimising locations, and re-vegetation of stockpiles can reduce the generation of suspended solids at source.

An Ghníomhaireacht um Chaomhnú Comhshaoil

STÁDAS NA GNÍOMHAIREACHTA

Is comhlacht poiblí neamhspleách í an Ghníomhaireacht um Chaomhnú Comhshaoil (EPA) a bunaíodh i mí Iúil 1993 faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil, 1992. Ó thaobh an Rialtais, is í an Roinn Comhshaoil agus Rialtais Áitiúil a dhéanann urraíocht uirthi.

Déanann Bord Feidhmeach lánaimseartha comhdhéanta d'Ard-Stiúrthóir agus ceathrar Stiúrthóirí bainistíocht ar an EPA. Cinntítear neamhspleáchas trí nósanna imeachta roghnaithe i gcás an Ard-Stiúrthóra agus na Stiúrthóirí agus an tsaoirse, de réir mar a sholáthraítear sa reachtaíocht, gníomhú as a stuaim féin. Tá an sannadh, faoin reachtaíocht, maidir le freagracht dhíreach as réimse leathan feidhmeanna mar bhonn taca ag an neamhspleáchas sin. Faoin reachtaíocht, is cion sainiúil é iarracht a dhéanamh tionchar a imirt ar an Ghníomhaireacht, nó ar aon duine a bhíonn ag gníomhú thar ceann na Gníomhaireachta, ar bhealach míchuí.

Cuidíonn Coiste Comhairleach ar a bhfuil dhá chomhalta déag arna gceapadh ag an Aire Comhshaoil, Oidhreachta agus Rialtais Áitiúil leis an nGníomhaireacht.

FREAGRACHTAÍ

Tá réimse leathan dualgas agus cumhachtaí reachtúla ag an EPA faoin Acht fán nGníomhaireacht um Chaomhnú Comhshaoil. Chomh maith leis sin, tá curtha le hacmhainn an EPA maidir le forfheidhmiú le cumhachtaí san Acht um Chaomhnú an Chomhshaoil 2003. Áirítear orthu seo a leanas príomhfhreagrachtaí an EPA:

- ceadúnú a dhéanamh ar phróisis thionsclaíocha mhóra/choimpléascacha a bhféadfadh cumas truaillithe suntasach a bheith ag baint leo;
- monatóireacht ar chaighdeán comhshaoil, lena n-áirítear bunachair shonraí a bhunú ar a mbeidh rochtain ag an bpobal;
- tuarascálacha tréimhsiúla maidir le staid an chomhshaoil a fhoilsiú;
- sárchleachtais comhshaoil a chur chun cinn;
- taighde comhshaoil a chur chun cinn agus a chomhordú;
- gníomhaíochtaí diúscartha dramhaíola agus aisghabhála suntasacha, lena n-áirítear láithreacha líonta talún a cheadúnú agus plean bainistíochta guaisdramhaíola náisiúnta a ullmhú;
- córas a chur i bhfeidhm a cheadaíonn rialú astaithe VOC a bhíonn mar thoradh ar scaoileadh GMOanna isteach sa chomhshaol in aon turas;
- rialacháin GMO a chur i bhfeidhm agus a fhorfheidhmiú ó thaobh GMOanna a choinneáil agus a scaoileadh amach sa chomhshaol in aon turas;
- clár hidriméadrach náisiúnta a ullmhú agus a chur i bhfeidhm;
- dréacht a chur le chéile de Phlean Leithroinnte Náisiúnta do thrádáil liúntas astaithe gáis ceaptha teasa; Údarás Inniúla Náisiúnta a bhunú le ceadanna trádála agus liúntais a eisiúint orthu siúd atá clúdaithe ag an scéim; monatóireacht, léargas, agus fíorú maidir le hastuithe ó chuideachtaí rannpháirteacha; agus Clár Trádála Astuithe Náisiúnta a bhunú;

agus, faoin Oifig Forfheidhmiúcháin Comhshaoil, a bunaíodh i 2003 agus atá tiomanta as reachtaíocht comhshaoil a chur i bhfeidhm agus a fhorfheidhmiú in Éirinn;

- feabhas a chur ar chomhlíonadh reachtaíocht cosanta comhshaoil in Éirinn;
- feasacht a ardú maidir leis an tábhacht a bhaineann le forfheidhmiú i gcás reachtaíochta cosanta comhshaoil in Éirinn;
- ceadúnais IPPC agus ceadúnais Dramhaíola a eisíonn an EPA a fhorfheidhmiú;
- iniúchadh agus tuairisciú ar fheidhmíocht údarás áitiúil maidir lena bhfeidhmeanna cosanta comhshaoil a chur ar bun, lena n-áirítear:
  - forfheidhmiú maidir le ceadúnais dramhaíola a sháraítear;
  - gníomh maidir le dumpáil mhídhleathach;
  - ceadanna bailithe dramhaíola a chur i bhfeidhm, agus
  - tionscnaimh a bheidh mar fhreagracht ar an táirgeoir a fhorfheidhmiú (mar shampla, sa réimse a bhaineann le dramhaíl pacáiste);
- gníomh in aghaidh údarás áitiúil nach bhfuil ag comhlíonadh a gcuid feidhmeanna cosanta comhshaoil ar bhealach cuí;
- an dlí a chur nó cuidiú le húdaráis áitiúla an dlí a chur ó thaobh sháraithe suntasacha reachtaíochta cosanta comhshaoil ar bhealach caoithiúil; agus
- cuidiú le húdaráis áitiúla a gcuid feidhmíocht cosanta comhshaoil a fheabhsú ar bhonn cás ar chás, trí ghréasán forfheidhmithe a bhunú le malartú eolais a chur chun cinn chomh maith le sárchleachtas, agus trí threoir chuí a sholáthar.

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