

ENVIRONMENTAL GUIDELINES FOR MINING IN PRODUCTION FOREST RESERVES IN GHANA

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FOREWORD

Ghana's Forest Reserves contain economically viable mineral resources, which have been identified in accordance with the Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies. However concerns have been raised regarding the progression from exploration to mining operations. Environmental Guidelines for Mining in Production Forest Reserves have therefore been produced to ensure that the negative environmental impacts of mining specifically in Production Forest Reserves are fully addressed and all significant issues are fully taken into account in the decision making process for each potential mining project.

These Environmental Guidelines distil both national and international best practice principles of Mining and Environmental Management and I am grateful to the many parties who have supported this initiative and contributed ideas and specific suggestions. The central themes of the Guidelines are the focus on issues relevant to these Reserves and involvement of stakeholders in the evaluation and permitting process from the outset. The adoption of Environmental Guidelines to specifically focus on Mining in Production Forest Reserves is therefore crucial to economic development, which is sustainable and benefits Ghana, the Forest Reserves and the local communities.

Minister of Lands, Forestry & Mines

Minister of Environment, Science &
Technology

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GLOSSARY AND DEFINITIONS

Acid Mine Drainage	Acidic run-off generated by oxidation of sulphide minerals in exposed rock, mine waste dumps and tailings.
Berm	Protective, engineered ridge
Black Star Species	Plant protection designation indicating that urgent attention is required for their conservation. Rare internationally and at least uncommon in Ghana.
Contingency Plan	Plan defining actions to be taken in an emergency or non-programmed situation, also often referred to as an Emergency Response Plan.
Conversion Area	Area of Forest Reserve, which has undergone degradation and has been targeted for replanting.
Cyanide	Chemical containing nitrogen and carbon used to dissolve gold and silver from ore.
Decommissioning Plan	A decommissioning plan sets out the technical measures and programmes to be employed to close the mining and associated operations and vacate the site in an orderly manner. The plan will be produced in line with statutory regulations and guidance and in conjunction with the accompanying Reclamation Plan (See separate definition).
Environmental Permit	Permit required from EPA for commencing the undertakings listed in L11652 ¹ .
Exploration	Surveys, sampling, mapping, drilling and other work associated with searching for ore.
Free dig	Material that is mineable without drilling or blasting.
Forest Reserve	Area of land designated under the Forests Ordinance (CAP 157).
Galamsey Mining	Illegal mining operations
Infrastructure	Basic facilities required for a mine to operate e.g. roads, electricity accommodation etc.
Laydown area	Areas associated with construction work where materials and equipment are stored prior to use.
Mine wastes	Solid and/or rock materials from mining operations, with no economic value to the mine company.

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Open Pit	A mine that is totally on the surface. Also called open-cut or open-cast mine.
Ore	Rock which contains the valuable minerals which can be extracted economically.
Ore body	An area of ore.
Production Area	Area of Forest Reserve in which controlled logging activities are permitted.
Protection Area	Contiguous area of designated Forest Reserve within which no logging is allowed.
Reclamation	The restoration of a site to an agreed land-use.
Reclamation Bond	Financial mechanism by which security is provided for reclamation based on approved work plan for reclamation.
Reclamation Plan	A reclamation plan describe the technical measures and programmes to be undertaken as part of the closure of a mining development to effect ultimate release of the site. It will address costs and end-use and include appropriate plans and schedules.
Reserve	That part of a mineral resource that can be mined profitably.
Resource	The calculated amount of material in a mineral deposit, classified as measured, indicated or inferred, based on the density of the drill hole information used.
Stakeholder	Any individual or group with an interest in the mine development, including the mine company, local leaders and communities, Government Agencies etc.
Stockpile	Broken ore awaiting processing.
Sump	An excavation where water accumulates to allow settlement of suspended solids prior to discharge into the environment.
Tailings	Waste material resulting from mineral processing after valuable minerals have been extracted.
Tailings Storage Facility	Engineered structure for storage of tailings and reclamation of process solutions.

1. INTRODUCTION AND BACKGROUND

1.1 BACKGROUND

During the surge in mineral exploration activity in Ghana during the 1990's some Mineral Prospecting Licences, which included portions of Forest Reserve, were issued. Mining companies were permitted to proceed with exploration programmes within the Forest Reserve portions of their licenses under strict guidance and control.

Rapid depletion of Ghana's Forest Reserves has mainly been in the transitional zone as a result of wild fires. Increased awareness of these issues and concerns on the effects of mining on the environment and inadequate guidance and regulation of the activities of mineral explorers, resulted in the Ministry of Lands, Forestry and Mines placing a moratorium on further exploration in March 1996. It was however acknowledged that some mining companies had proceeded with exploration in good faith and had already invested considerable sums, identified significant mineral resources and not contravened any of terms of the Forest Entry Permits under which they operated.

Consequently, it was decided to limit the area permitted for exploration to cover 2% of Forest Reserves with the exception of protected areas. Previously permitted companies were ranked according to the stage of exploration they had achieved and on the level of investment already incurred. A total of 17 companies, whose cumulative permitted area was less than the allowable 2% of Forest Reserves, were selected on this basis. "Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies" were produced and put in place to regulate exploration activities. A copy of these is provided in Appendix A. The selected companies were then invited by the FSD to re-apply for Forest Entry Permits and to proceed with their exploration activities in accordance with the Guidelines.

Some mining companies have now reached the stage where their exploration investments have identified economically viable mineral resources in Forest Reserves. Mining companies in Ghana are already obliged to operate mining projects in full compliance with existing Ghanaian legislation (see Section 2) under Best Practice principles. Additional concerns do exist about proceeding from exploration to mining operations in Forest Reserves (see Section 1.3.1) Therefore, it is widely agreed that additional guidance is required for mining in Forest Reserves.

These Guidelines have been developed to meet the aforementioned requirement. The production of the Guidelines has required the full commitment of all stakeholders at the outset to address the need for specific guidance for mining in Forest Reserves. They have been produced through a collaborative effort among all the relevant government agencies, departments and the mining industry, followed by extensive consultation (see Section 1.3.2).

1.2 THE PURPOSE AND STRUCTURE OF THE GUIDELINES

1.2.1 Purpose of the Guidelines

The purpose of the guidelines is to:

- Provide a framework for an agreed balance which benefits Ghana, the mining company and the local community;
- Enable continued exploration and mining, not extending beyond 2% of the production areas of Forest Reserves;
- Provide uniform criteria to address environmental constraints and issues specifically relating to mining within Forest Reserves;
- Ensure that the negative impacts of mining are minimised and that mining ultimately benefits the forest and local community;
- Identify environmental management tools which promote environmental protection and stakeholder confidence.

1.2.2 Structure of the Guidelines

These guidelines identify, and where appropriate clarify, those aspects of mining and environmental management practice which are key to operations within a Forest Reserve. They are designed to be non prescriptive and set a framework within which to define best practice principles on a case-by-case basis.

The Guidelines are structured into five distinct Chapters as illustrated in Figure 1.

Chapter 1 provides a background to mining in Forest Reserves in Ghana and the reasons for the production of these Guidelines. The principal concerns to mining in the Reserves, which have been raised during the production of this document, are identified and the purpose of the Guidelines is stated.

Chapter 2 provides a brief summary of key legislation, standards and guidelines. Mining companies must undertake all aspects of their operations in compliance with the existing relevant environmental regulations, guidelines and standards. These Guidelines therefore do not seek to revisit these existing requirements but rather to highlight those aspects that are of specific concern in managing the environmental performance of a mining operation in a Forest Reserve.

Chapter 3 provides an introduction and historical perspective to Forest Reserves, including those factors, which have led to a decline in flora and fauna. Wildlife protection and designations, which operate in the Reserves, are explained.

Chapter 4 and 5 describe the best practice principles which relate to mining in Forest Reserves. Each Chapter addresses a distinct area of mining practice and is structured in accordance with the life of a mine, i.e. from pre-construction through to post closures.

Chapter 4 addresses the engineering design and operational management of a mine.

Chapter 5 examines key environmental principles applicable to managing a mining operation in a Forest Reserve.

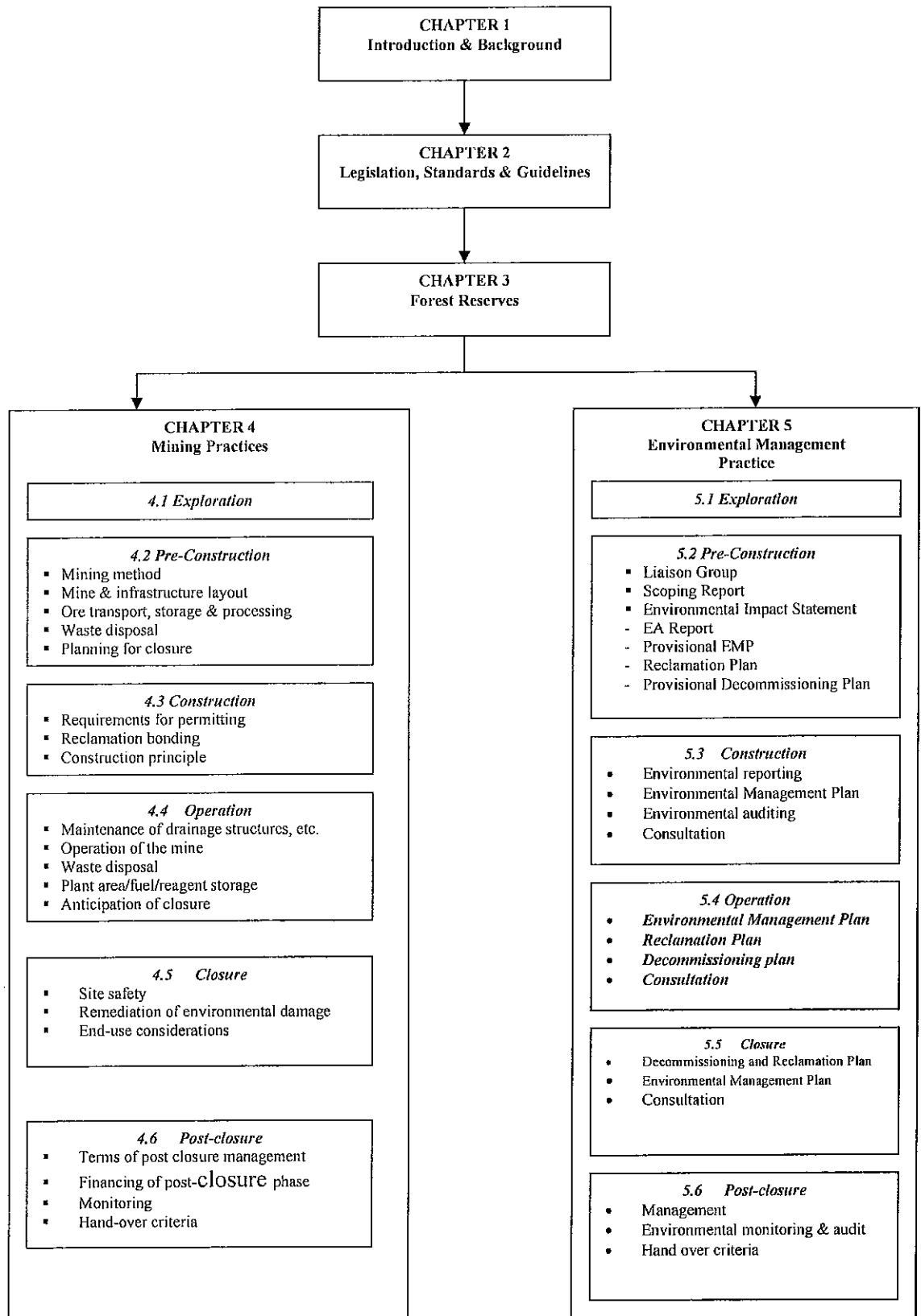
The Guidelines also contain the following Appendices.

Appendix A provides a copy of the “Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies”

Appendix B provides a listing of useful contacts and references.

Appendix C provides a checklist of key actions required through each of the phases of a potential project to mine in production Forest Reserve in Ghana.

Figure 1: The Structure of the Guidelines



1.3 PREPARATION OF THE GUIDELINES

1.3.1 Summary of principal concerns

It is apparent that there are certain fundamental issues that have to be addressed to ensure that these Guidelines fulfil their stated purpose (Section 1.2.1). These issues are identified and described below:

Environmental Impact

It is recognised that mining operations create potential for environmental impacts. Although such impacts may not be realised, due consideration has been given to preventing such effects as fire hazards, contamination of air, water and soils, community concerns (including nuisance and impacts on sacred areas) and visual impacts.

Land-take

The area of land which would be taken up by a mine operation was considered a key issue, along with the associated temporary loss of flora and fauna.

Environmental Management Practices

Environmental management practices must be comprehensive, practical and adequately monitored to ensure compliance with the relevant legislation and standards, and the approved goals.

Socio-economic loss and benefit

A number of issues were identified under this broad heading, namely the loss of timber and non-timber products from the forest, potential detrimental effects on other land users (e.g. plantation growers). This needs to be set against the economic benefits such that there is a net economic gain, which benefits Ghana, the Forest and the local community.

1.3.2 Methodology

This document comprises the agreed guidance for mining in production Forest Reserves in Ghana, which was developed through extensive consultation with interested parties and stakeholders. The iterative approach adopted for the production of the Guidelines involved the following key inputs;

- a Working Group, formed by the Chamber of Mines dedicated to the development of the Guidelines;
- a technical committee, overseen by a steering committee, representing government agencies;
- two Study Trips within Ghana to gain an appreciation of mine operations, progressive rehabilitation achievements and exploration within a Forest Reserve;
- an international Study trip to see examples of best practice mining within environmentally sensitive locations in other parts of the World.

- Reference to international best practice principles for exploration and mining in environmentally sensitive areas, which make reference to the various mining technologies.

The Ghana Chamber of Mines, who formed a working party dedicated to this study, initiated the Guidelines. Subsequently a technical committee, overseen by a steering committee, was formed to develop the Guidelines and ensure agreement on approach adopted. The committees comprised representatives from stakeholders, namely the Ghana Chamber of Mines, EPA, FSD, Forestry Commission, Minerals Commission, Mines Department, Ministry of Lands, Forestry and Mines and Wildlife Division.

Knight Piesold Consulting was commissioned by the Ghana Chamber of Mines to provide technical input to the production of the Guidelines and was also represented on both these committees.

Three Study Trips were arranged for the Technical Committee members. The first was organised to gain an appreciation of mining in operations in Ghana. This included visiting the Open Cut and CIL processing operations of Bibiani Gold Mine; Kubi (which comprises an open cut pit located adjacent to Supuma Shelterbelt Forest Reserve); and Opon Mansi Forest Reserve within which exploration has been undertaken and a resource has been identified. A second trip was organised within Ghana to the Bogoso Gold Mine to see examples of progressive revegetation. The third trip was designed to provide an appreciation of international best practice within environmentally sensitive area and comprised trips to Richards Bay in South Africa and Boddingtons and Alcoa operations in Western Australia.

The completed Guidelines, following input from the technical and steering committee and the participants on the study visits, were subject to an independent technical review by SGS and wider consultation involving regional offices of the EPA and FSD, regional ministers and other government departments.

2. LEGISLATION AND GUIDELINES

These Guidelines have been produced with reference to relevant existing Ghanaian legislation and guidelines. The following documents form the core framework for regulating mining operations in Forest Reserves, and they should be referred to for detailed clarification of statutory requirements, legal issues and advice.

The document listing is valid at the time of preparation of these Guidelines, however, it is recommended that additional clarification is sought from the appropriate government agency to identify if revisions and/or amendments to legislation or guidance have been made.

A list of useful contacts is provided in Appendix B

LEGISLATION

- *The Environmental Protection Agency Act (1994)*²

Establishes the authority, functions, structure and funding of the EPA.

- *Environmental regulation 1999 (LI 1652)*³

These Regulations set out the requirements for environmental permitting, environmental impact assessment, the production of preliminary environmental reports, and subsequent environmental impact statements, environmental certificate, environmental management plan and reclamation bonding.

- *Explosive Regulations (1970) LI 666*

These Regulations set out the requirements for conveyance after landing, storage and permit to purchase etc., explosives.

- *Forestry Commission Act 571 (1999)*

This Act confirms the constitutional position of the Forestry Commission and reaffirms it as the sole implementing agency of government policy in the forestry sector.

- *Forest Ordinance (CAP. 157)*

This Ordinance provides for the creation and protection of Forest Reserves.

- *Forest Protection Decree 1974 (NRCD 243) & Forest Protection (Amendment) Law 1986 (PNDCL 142)*

This decree, and subsequent amendment, sets a list of activities that are prohibited in a Forest Reserve without prior authority and the associated penalties.

- *Minerals and Mining Act, March 2006, Act 703*

This Act sets out statutory requirements for ownership of minerals and government right of pre-emption, administration, mineral rights and other licences, the mining lease surrender suspension and cancellation of mineral rights and surface rights.

- *Mining Regulations (1970) LI 665*

These regulations set requirements for mining and include the general duties of mine owners, management and control, protection from surface, surface working and inspection.

- *Water Resources Commission Act (1996)*

This act establishes the Water Resources Commission and provides for its composition and functions in the regulation and management of the utilization of water resources in Ghana and for related matters.

- *Wild Animals Preservation Act (1961)*

This Act provides for the protection of selected animals through restrictions on export and hunting of scheduled species. It also provides for the creation of Wildlife Reserves.

- *Wildlife Reserve Regulation (1971) LI 710*

This establishes a total of six Wildlife Reserves in which animals must not be captured or killed. In addition fires polluting of waters, littering and cultivation are also prohibited.

Subsequent Amendments to the Regulations have designated a further 10 reserves.

- *Wildlife Conservation Regulations (1971) LI 685*

These Regulations provide schedules of animal species with varying degree of legal protection. In addition, they provide restrictions for the granting of Game Licences and Game and Trophy Export Permits.

POLICY DOCUMENTS

- *Forest and Wildlife Policy (1994)*

This document provides the basis for development of a national forest estate giving the full range of benefits required by society, in a manner that is ecologically sustainable and conserves the environmental and cultural heritage of Ghana.

- *National Land Policy (1999)*

This policy provides; land policy, a background to Land Administration and Land Delivery System in Ghana, Problems and Constrains of the Land Sector, the Policy Framework, Guidelines and Actions.

GUIDELINES

- *Environmental Assessment in Ghana, A Guide (1996)*

This document produced by the EPA provides detailed guidance on the procedures to be adhered to when undertaking EA.

- *Environmental Impact Assessment Procedures (1995)*

This document produced by the EPA details the procedures to be adhered to when undertaking an EA.

- *Environmental Quality Guidelines for Ambient Air (EPA)*

This document provides advice on maximum permissible levels of a variety of air pollutants.

- *Environmental Quality Guidelines for Ambient Noise (EPA)*

This document provides advice on the maximum permissible noise levels.

- *Ghana's Mining and Environmental Guidelines (1994)*

This document provides guidance on environmental factors that should be considered by mine operators. It includes guidance on EIA/EIS content, EMP production and the contents of Reclamation and Decommissioning Plan. The Guidelines do not address mining in a Forest Reserve.

- *Operational Guidelines for Mineral Exploration in Forest Reserves for selected Companies¹*

Provides guidance for mineral exploration activities in a Forest Reserve. Notably they identify areas of Forest Reserves considered to be no-go areas. (See also section 3.2)

- *Sector Specific Effluent Quality Guidelines for Discharges in to Natural Water Bodies (EPA)*

Provides maximum permissible effluent discharge concentrations for a number of parameters. Two sets of guidelines exist, i.e. general and sector specific, the latter including specific mining and mineral processing discharge standards.

3. FOREST RESERVES

3.1 INTRODUCTION

The pressure on Ghana's Forests has been recognised for many years, with some concern for deforestation. Agricultural changes have been partly responsible over many centuries for the forest loss, but this century has seen additional pressures from infrastructure development and mining. In recognition of these increasing pressures a Forest Ordinance was established in 1927 which gave the then newly formed Forestry Department, powers of the reserve areas for management by the state⁴.

However, although provided with a protected status, Forest Reserves continued to undergo a decline in quality. The direct factors that have caused this decline have been identified as:

- forest fires;
- excessive logging;
- encroachment by expanding population;
- illegal mining (galamsey);

Indirect socio-economic factors, such as population growth and rural poverty, and the lack of adequate policing of protected areas have also contributed to this decline.

It should also be noted that with a decline in forest habitat, both in terms of quality and quantity, a decline in animal diversity can be expected.

3.2 DESIGNATION

The majority of Forest Reserves are divided into Conversion, Production and Protection Areas. Conversion areas are those which have undergone degradation and have been targeted for replanting. Production Areas are those from which timber extraction is permissible following strict logging and other controls. Mining will be permitted in the Production Reserves.

The Operational Guidelines¹ provides a list of protected forest areas within which exploration is not permitted. These guidelines require that an EA be undertaken to identify such Protection Areas. Exploration permits exclude these areas and it is unlikely that mining would occur outside an area that has been explored.

Protection Areas are contiguous blocks of forest set aside under the following designations;

- **Globally Significant Biodiversity Areas (GSBAs)**
A contiguous portion of the Forest Reserve set aside for the protection of biodiversity. These are usually areas with a high concentration of rare plants or of an unusual forest type.
- **Provenance Protection Areas**

These areas are set aside for the protection of specific species provenance (economic gene banks) or as a provenance of a threatened ecological zone.

- **Institutional Research Plot**
These are areas in Forest Reserves in which research is being undertaken.
- **Hill Sanctuary**
All contiguous forested areas with a slope greater than 15% are protected as Hill Sanctuaries, in order to reduce soil erosion etc. The threshold of a 15% slope is often extended to cover all watersheds or areas where a number of rivers are sourced.
- **Cultural Sites**
Sacred Groves or taboo sites.
- **Swamp Sites and Fire-Protected Blocks**

4. MINING PRACTICE

Mining companies must undertake all aspects of their operations in compliance with the existing relevant environmental regulations and guidelines. This Chapter therefore does not seek to revisit these existing requirements but rather to highlight those aspects that are of specific environmental concern to engineering design and operational management of a mine in a Forest Reserve.

This Chapter identifies the issues which require careful consideration in designing, constructing, operating and decommissioning a mining operation within a Forest Reserve and provides non-prescriptive guidance to address these issues, in order to achieve an agreed outcome. This guidance should be applied on a case-by-case basis appropriate to the environmental setting, the proposed operations and the agreed end-use of the site.

All such activities should also incorporate application of environmental management practices, guidance for which is provided in Chapter 5. It is therefore recommended that Chapter 4 is not read in isolation, but in conjunction with Chapter 5.

4.1 EXPLORATION

Operational guidelines¹ are already in place to regulate the exploration activities of companies in Forest Reserves. A copy is attached as Appendix A. The general principle is that a maximum of 2% of the production areas of Forest Reserves will be made available for exploration activities in-line with the agreed operational guidelines.

4.2 PRE-CONSTRUCTION

This section provides guidance for the pre-construction stage of mining, i.e. mine planning and design. The guiding aim is, at the outset, to minimise the potential for impact and disturbance to the environment and maximise opportunities for protecting and enhancing the Forest. The following matters are covered:

- Security measures;
- Selection/optimisation of mining method;
- Optimisation of mine and infrastructure layout;
- Ore transport, storage and processing;
- Wastes disposal;
- Planning for closure;
- Contingency planning;
- Permitting;
- Bonding

Companies should also take full advantage at this pre-construction stage of the advice available from relevant government agencies. Consultation is a compulsory part of the EA process³ and it is strongly recommended that this is used to its fullest and that a company/government department liaison group is set up by the project proponent. Consultation and the liaison group are further explained in Section 5.2.1 and 5.2.2.

4.2.1 Security Measures

Security measures must be considered at the pre-construction phase as mining activities will potentially open up the Forest Reserve to encroachment, such as by galamsey operators. Therefore there is the need to identify appropriate security measures to ward off intrusion (section 5.2.1).

4.2.2 Mining Method

In considering the range of options available to access and extract the identified ore reserve, the company must take due consideration, together with technical and economic constraints, of the following criteria in selecting a preferred mining method:

- minimisation of the area of Forest Reserve to be disturbed by project construction and operation;
- minimisation of effective land take for support infrastructure;
- avoidance of disturbance to surface drainage features;
- avoidance, to the extent practicable, of loss of high value forest and habitats;
- avoidance of mining practices which, in themselves, may create undue instability or disturbance having regard to surface features, wildlife and human communities;
- adoption of a design which is amenable to reclamation to provide for an acceptable end-use (see Section 4.5.3).

Consideration of these criteria should be documented within the EA Report (see also Section 5.2.3).

4.2.3 Mine and Infrastructure Layout

Having regard to other environmental and economic factors, all facilities other than the mine workings, i.e. process plant, accommodation, offices and waste repositories should be sited outside the Forest Reserve.

Care should be taken to ensure that the forest habitat is not unduly impacted by insensitive routing of roads and service corridors such that barriers to wildlife movement are created.

Where practicable, layout of the site will be sensitive to forest values, maximising land take in degraded/logged areas and avoiding and protecting high value forest.

Where practicable, land take within the forest will be minimised by optimising the use of land, e.g. use of land which must, in any case be cleared to provide access to the ore body, e.g. in sitting laydown areas for construction, routing of haul roads and locating temporary structures.

Site layout shall also be designed having due regard to visual impact (views into the site from populated areas and roads) and landscape values (the intrinsic value of the land as a landscape feature). In this regard, use of natural screening features (e.g. ridges and vegetation stands) should be maximised.

4.2.4 Ore Transport, Storage and Processing

Where practicable, and subject to consideration of all relevant environmental factors^a, extracted ore should be transported outside the Forest Reserve for storage (as necessary) prior to processing in a plant which should also be located outside the Reserve.

Primary processing of mined ore prior to transport from the mine workings (e.g. crushing and screening) shall, where practicable, be carried out within the mine working area (i.e. within the open pit or underground).

4.2.5 Waste Disposal

Unless an agreed benefit can be demonstrated, and subject to appropriate consideration of all relevant environmental factors^a, the following facilities shall be located outside the Forest Reserve:

- process waste (tailings) treatment/handling facilities and repositories;
- liquid effluent treatment/handling facilities;
- refuse landfill facilities;
- surface waste rock dumps, unless in-pit storage facility.

In regard to the decision on siting waste rock dumps, in addition to seeking to minimise disturbance within the Forest Reserve, due regard must be given to provision for mine closure. This should include facilitating the backfill of voids, achieving stable and well-contoured final landform and avoiding disturbance, which may be caused in transport over long distances.

^a All relevant factors will be identified in EA Scoping (see Section 5.2.1)

4.2.6 Planning for Closure

All design stages of a mine should make appropriate provision for project closure in-line with best conserving the resources of the Forest Reserve affected.

The following criteria for conservation should be addressed in this regard:

- conservation of the bio-diversity of the Forest Reserve;
- integrity of the Forest Reserve as a self-sustaining forest ecosystem;
- achievement of an end-use for the project site which is sustainable in the short and long term (see Section 4.5.3).

4.2.7 Contingency Plan

Experience gained in working mines under a variety of environmental settings and utilising different mining technologies indicates that from time to time, unforeseen occurrence will be encountered, e.g. as a result of unexpected ground conditions, weather events and accidents. For this reason, mine operators have available, based upon experience, a range of mitigation measures which may be utilised to counter such unprogrammed or accidental occurrences.

In regard to mining within a Forest Reserve, attention is drawn in particular to provision of mitigation against the following occurrences, or results of the occurrences, as part of contingency planning;

- spillage of fuel or ore material;
- outbreak of fire;
- failure of engineered slopes and structures (e.g. pit walls or waste rock dumps);
- failure of pumps and pipelines;
- failure of drainage lines/systems;
- failure/overflow of pollution prevention structures (e.g. settling lagoons).

4.2.8 Requirements for Permitting

Legal requirements for mine permitting are in place in Ghana. Prior to the operation of any mine the company is legally obliged to obtain;

- environmental permit;
- mining lease; and
- an operating permit (also referred to as a mining permit)

However, these do not specifically address the issue of a mine located within a Forest Reserve, therefore, it is recommended that in the permitting process where such lands are involved, attention is focused on the following:

- early and effective consultations with those government agencies having any remit over Forest Reserve (see Section 5.2.1 and 5.2.2);
- Forest Reserve issues included within the supporting documentation for the permit, e.g. EA report and Reclamation Plan (see Section 5.2), to the satisfaction of EPA/FSD

This should be achieved by submitting the EIS to FSD, before formal submission of the EIS documentation to the EPA. Written approval sanctioning the development or written notification of the objections should be provided to the proponent by FSD. Once written approval has been obtained the EIS should be formally submitted to the EPA in-line with statutory procedures³. If accepted the environmental permit will be issued.

The mining company should also obtain a mining lease from the Minister of Lands, Forestry and Mines, in consultation with the Minerals Commission. For a proposed mine in a Forest Reserve area the Minerals Commission will seek comments for the operation from the FSD. The issuing of a mining lease will be based on the submission of the full feasibility report. EPA approval of the EIA and the subsequent issuing of the environmental permit.

Once the environmental permit and the mining lease have been issued, an operating permit should be obtained from the Mines Department. This should then be renewed on an arrival basis.

4.2.9 Reclamation Bond

As part of any mine permitting process in Ghana, a Reclamation Bond is required to be submitted to the EPA (see Section 2). This bond is required to provide financial surety against non-compliance under the approved Reclamation Plan and must be in place before commencement of the project. The Reclamation Plan should provide the information required to calculate the Bond, for example the land areas, reclamation schedule and costs (see Section 5.2.5)

The EPA may accept a reclamation bond structured in accordance with the nature of the project and judged status of the project proponent structured in-line with the following options, and agreement should be sought on a case-by-case basis:

- financial bond set on a per-hectare basis for total land disturbed or un-reclaimed at any one time, reviewed on an annual basis and adjusted progressively to reflect operation and reclaimed areas;
- financial bond set on an agreed total area basis for the life of the project;
- Surety note bank credit note with respect to the value of the agreed bond;
- Corporate guarantee of compliance, subject to accepted demonstration of past compliance for other relevant projects and annual review of the site;
- Provision of a “no-claim” bonus system for those companies that demonstrate adherence to reclamation plans.

In regard to mining within a Forest Reserve, the following aspects are highlighted for consideration in the establishment and management of a bond:

- minimisation of land take within Forest Reserve;
- adoption, where practicable, of progressive reclamation practices;
- establishment, in liaison with EPA/FSD, of practical and realistic compliance criteria to measure achievement of reclamation goals, e.g. re-establishment of native species.

4.3 CONSTRUCTION

Construction Principles

Although generally adopted as best practice for any mining operation, the following basic principles are highlighted as having particular relevance to construction within Forest Reserves:

- avoidance of increase in land take occasioned by construction works, over and above that required for operation of the mining project (e.g. for construction laydown);
- recovery of cleared forest materials (soils, forest litter, seeds, timber and stumps) for storage and re-use or disposal under prior written agreement with the EPA/FSD
- provision for adequate drainage and erosion control during site works, particularly in respect of avoiding impact on surrounding forest areas;
- unless otherwise agreed with the FSD as part of the project permitting process (e.g. for the purposes of bulk haulage and as permanent project access ways), construction of tracks in-line with the Exploration Guidelines¹;
- provision of a fire plan detailing prevention, control and suppression measures;
- assembly, maintenance and fuelling of mobile plant undertaken outside the Forest Reserve.
- creation of safe and stable slopes having regard to potential access by the public and authorised workers;
- creation of water bodies having regard to safety of the public, authorised workers and wildlife;
- creation of any approved residual structures having regard to long-term access (e.g. shafts, buildings, roads);
- where appropriate, provision for resourcing to assure long-term management of the site having regard to safety of public, workers and wildlife.

4.5.2 Remediation of Environmental Damage

The following key issues should be fully addressed in formulating and implementing a Reclamation Plan involving a Forest Reserve (see also Section 5.4.2).

- as far as practicable, establishing conditions close to those of the site pre-mining;
- where the latter is not possible, ensuring that reclamation works provide for creation of an acceptable end-use, as approved by relevant stakeholders;
- where net loss of forest is occasioned following reclamation, in the long or short term, consideration should be given (in consultation with the FSD) to offsetting this by forest planting an area, at least equivalent to the size and type lost, outside the impacted area;
- full consideration must be given to the long-term viability of the de-commissioned site end-use, including provision for post-closure management (see section 4.6).

4.5.3 End-use considerations

Identifying an appropriate end-use for the decommissioned project area will be carried out on a site-by-site basis having regard to the following;

- topographic and hydrological/hydrogeological constraints;
- broader environmental setting, i.e. inclusive of the whole Forest Reserve and surrounding area;
- socio-economic considerations (i.e. having regard to communities and the Nation's well-being)

Nevertheless, it is emphasised that establishment of an end-use within a Forest Reserve must be in-line with the management objective of the Reserve, to the satisfaction of the EPA/FSD.

and consultation, the end of the passive care stage will be determined by a measure of re-growth, or other quantifiable indicators of successful reclamation. The indicators will be dependent on the agreed final end use for the site.

In addition to these passive care activities, it is likely that having regard to re-establishment of a viable end-use, longer term *after-care* works will be required, in-line with the nature of the reclaimed site and activities carried out within it. The term of the after-care works is indefinite, in principle. However, it is recommended that an agreement is drawn up between the project owner and the EPA/FSD or the agreed end user to define a hand-over point in regard to elapsed time and reclamation results (Section 4.6.4)

The matrix shown in Figure 2, sets out the types of works relating to passive care and after care and a range of end uses which may be considered appropriate for a Forest Reserve.

AFTER-USE	POST-CLOSURE MANAGEMENT PHASE	
	Passive Care	After Care
Forest re-establishment	Monitoring of species establishment	
	Thinning; grass/scrub control	
	Supplementary planting	
	Attention to recalcitrant species	
	Maintenance of access tracks	
	Erosion control works, as necessary	Monitoring of erosion
Wildlife conservation and habitat creation	Monitoring of species establishment and habitat development	
	Regular monitoring of water quality (wetland) having regard to a range of chemical and biological indicators	Periodic monitoring of selected parameters only
	Vegetation maintenance (as for forest establishment)	
	Erosion control works, as necessary	Monitoring of erosion
Creation of tourist and amenity facilities	Maintenance of built structures, including access roads and car parks	
	Monitoring as for wildlife conservation and forest establishment with particular emphasis on public health and safety for accessible areas.	

- staff environmental training;
- environmental monitoring and reporting.

The requirement for the EA of proposed developments was introduced into Ghanaian Legislation with the enactment of the EPA Act 1994² and formalised in the Environmental Assessment Regulations 1999 (LI 1652)³. These Regulations provide detail on the administration on the EA procedure, specify the draft terms of reference for the Environmental Impact Statement (EIS) and introduce the requirement for lodging of a reclamation bond and an Environmental Management Plan (EMP)

Schedule 1 of the Regulations³ specifies that all mining operations in Ghana require an environmental permit to operate. All mining operations of more than 10 hectares fall under Schedule 2 of the Regulations and automatically require the undertaking of an EA to obtain a permit. Mining operations of less than 10 hectares firstly require the submission of an application of an environmental permit to the EPA who will determine whether the EA process has to be undertaken to obtain a permit. Details of the environmental permitting process are provided in the Regulations³.

The EA process requires the preparation of two main reports;

1. **Scoping Report/Terms of Reference**
2. **Environmental Impact Statement (EIS), which comprises:**
 - EA report;
 - EMP;
 - Reclamation Plan
 - Provisional Decommissioning Plan

The following provides guidance on the key criteria that should be considered for environmental impact assessment and reporting for a mine planned in a Forest Reserve.

5.2.1 Scoping

The Scoping Report

The first stage of the EA process involves undertaking a scoping exercise and preparing a scoping report. Scoping is essential in identifying key environmental issues and setting priorities, which are to be addressed in the subsequent full EA study.

The scoping should include the draft Terms of Reference (TOR) for the EA study. The Regulations³ provide a listing of the minimum draft TOR, which should be included in the Scoping Report. The draft TOR must indicate that the EIS will include among others:

- baseline information, including flora and fauna and soil types;
- impact assessment, including health, socio-economic and socio-cultural impact assessment, these aspects must be clearly identified and appropriate mitigation measures developed to address them;
- appropriate security measures to be adopted to ward off intrusion must be identify in the EIA, as mining activities will potentially open up the Forest Reserve to encroachment.

Consultation

Early community involvement makes the EA process more transparent and enables the mining company to look at alternatives before committing substantial time and money to a proposal or a site⁶. Consultation is a compulsory part of the EA process³, including scoping. In the case of a project involving a Forest Reserve, consultation will have increased importance and coverage due to the number of potential stakeholders and the significance of such resources to Ghana. It is important that consultation is maintained throughout both the EA process and the life the mining project, including the closure phase.

It is therefore recommended that a company/government agency liaison group is set up by the proponent to include the appropriate stakeholders and, amongst a number of other roles, facilitate the consultative process at the scoping stage (see Section 5.2.2). This consultation will serve to guide the formulation of project parameters and aid achievement of an agreed scope of works at the pre-construction stage of the project.

The consultation requirements for each project will be dependent on its environmental setting and the issues raised. The following list of potential consultees is intended to provide an initial focus for the consultative process, but should not be considered to be a exhaustive. A listing of useful contacts is provided in Appendix B.

- Government agencies including Ministry of Environment, Science and Technology, Ministry of Lands Forestry and Mines, Environmental Protection Agency, Forestry Commission, Minerals Commission and Water Resources Commission;
- Mines Department;
- EPA Regional and District Offices (as appropriate);
- District Assemblies and Chief Executives
- Traditional Leaders including Paramount and Village Chiefs;
- Local Land Owners
- Local Community Representatives (“the public”)
- Ghana Investment Promotion Centre
- Ghana Chamber of Mines;
- Community Based Organisations
- Environmental Non-Governmental Organisations (NGOs)

5.2.2 Liaison Group

For mining projects in Forest Reserves it is recommended that a Liaison Group be set up in the early stages of the pre-construction phase of the project.

Funding

For projects in Forest Reserves the Mining Company will be responsible for paying a 0.6% increase in royalties applying to a mining operation. 50% of these additional funds will be managed by the Forestry Commission and will be used to cover the expenses of the work of the Liaison Group. The other 50% of the additional funds will be managed by the Liaison Group and will be used to provide compensation to local communities. Payments to the fund will follow the same conditions as Royalties.

Role

The role of this group would be to:

- liaise with the mining company throughout the mining process and play an active role in the formulation of the environmental procedures;
- ensure relevant institutions take an active role in assuring a satisfactory environmental outcome for mining projects in Forest Reserves;
- ensure the project's environmental management procedures are developed and implemented, with due regard to the Guidelines;
- provide input during the preparation of environmental documentation, and review the EIS and on-going monitoring records;
- generate a site specific MOI form for the purpose of monthly monitoring returns (see also Section 5.3.1 and Appendix C).
- allocate monies from the Fund to the communities affected by the mining project, as identified by the EIA;
- liaise with the mining company on any modifications to plans that may be necessary through the life of the project;

Members

The Liaison Group must include, but not be limited to, representatives from the following organisations:

- Environmental Protection Agency
- Forestry Commission;

- FSD;
- Minerals Commission;
- Ministry of Lands, Forestry and Mines;
- Mines Department;
- Ghana Chamber of Mines;
- District Assembly

Appointees to the group should be senior in position with relevant knowledge in this area.

5.2.3 Environmental Assessment Report

The EA Regulations³ require that a clear assessment of the proposed undertaking on the environment be made and included in the EIS (i.e. an EA report) The design of the assessment should be based on the findings of the Scoping report. This section provides guidance on the following tasks that should be undertaken in the production of the EA report, with specific regard to the forest environment;

- consultation;
- collection of baseline data;
- cumulative effects;
- identification and analysis of environmental impacts on Forest Reserves;
- mitigation of potential impacts

Consultation

Consultation should be maintained throughout the EA process, with continued utilisation of the company/government agency liaison group, if formed at the scoping stage (see Section 5.2.2)

Collection of baseline data

The collection of baseline data for the EA should ensure that sufficient information is collated to characterise the environmental setting of the proposed project, sufficient for the purpose of forecasting and assessing environmental impacts and designing an effective impact mitigation strategy and EMP.

In best practice EA, the mining company begins the collection of this data early in the life of the project. Benefits, such as the early identification of environmental constraints, can be reaped from collection before formally deciding to proceed with the project, i.e. in the exploration and pre-construction phases.

Of central importance in the Forest Reserve is the potential impact a mine operation may have on the status of the Reserve designation. It is noted that collection of flora and fauna data is required prior to exploration within Forest Reserves¹. It is recommended that a suitably qualified and experienced person undertakes these initial surveys (and all subsequent surveys). Additional and/or more detailed flora and fauna baseline data may also need to be collected to determine the species present within the area of interest and the overall Reserve value.

Emphasis should be placed upon gathering key data on ecosystems, recognising the importance of gaining an understanding of the forest as an interlinked system.

Comprehensive baseline data should also be obtained with respect to the physical components of the proposed mine's environmental setting. These will include:

- underlying geology and soils;
- surface water quality and quantity;
- groundwater quality and flow;
- landscape/visual setting;
- ambient air quality;
- ambient noise level;
- socio-economic factors

Cumulative effects

Cumulative effects arise when two or more effects combine to produce a resultant effect, which is greater than either of the single effect. Particular note should be taken of such effects when considering the development of a mine operation in a Forest Reserve.

Cumulative effects can occur in combination with other past, present and future activities in the forest, such as galamsey mining, and although insignificant individually may be significant collectively. Such activities may or may not be related to mining.

Cumulative effects can impact on the forest in five ways, as follows⁷.

- **Sensory Propagation** – noise, lights, smells or visual intrusion from one action may combine with those from another (e.g. ongoing or historic logging areas);

- **Contaminant Transport** – contaminants emitted from one action may travel through suitable medium and combine or interact with those from another;
- **Habitat Loss Through Fragmentation** – habitat is destroyed and patches of remaining habitat become smaller and more distantly separated, thus becoming vulnerable to deterioration;
- **Visual impact** – alteration to the landscape features resulting in the degradation of scenic views;
- **Experiential Degradation** – use of the reserve for other activities drops because of perceived collective disturbances from many actions.

Further guidance on measuring and assessing cumulative effects is given in British Columbia Parks Impact Assessment Process⁷.

Identification and analysis of impacts

Analysis of mining impact on a Forest Reserve must take due regard to both the intrinsic values of the forest itself (the forest fauna and flora and landscape values), and the use of the forest by the people of Ghana (whether as local communities or commercial operation).

In regard to intrinsic values, numerical and qualitative analysis of impact must take due regard of effects upon the following:

- population of rare, endangered and protected flora and fauna species (see Section 3.2);
- habitat viability and vulnerability, considering fragmentation and isolation as well as over all land take.
- visual and landscape values;
- value as a biodiverse “storehouse” of flora and fauna;
- value as a cultural heritage resource;
- special Protection Areas (see Section 3.2);
- fringe forest communities
- physical features (e.g. slopes and water courses)

With regard to analysing impact upon people’s use of the forest, loss of merchantable timber may be relatively easy to determine and a quantitative value placed upon the loss in comparison to that remaining as accessible. However, mining may reduce the access of local communities to a Forest Reserve. This may prevent people from collecting sustainable non-timber forest products, for example, snails, game, food and medicinal

plants. Due compensation arrangements should be developed and agreed, on a case-by-case basis.

Mitigation of Potential Impacts

Sub-section 12(h) of the Regulations³ requires mitigation measures to be identified in the EIS. Mitigation measures should be designed to ensure that the potential for environmental impact of mining on the Forest Reserve is minimised and opportunity for beneficial effects realised.

EA provides the tool to identify potential impacts and appropriate mitigation measures, which should then be documented in the EA report and incorporated within the project plan and mine design. Guidance for mine design to mitigate impacts is provided in Section 4.3. The key aspects, which should be examined in the EA process, are as follows:

- mitigation against land take by reduction, as far as is practicable of areas to be cleared, through, for example, optimisation of layout, selection of appropriate mining methods, siting of project facilities outside the Reserve;
- mitigation of loss of forest through design of an effective reclamation scheme and compensatory forest plantings outside the mine area, as appropriate;
- mitigation against impact on surrounding forest through effective site design (e.g. drainage works, water treatment, erosion control) and appropriate monitoring of biological and physical parameters;
- mitigation against visual impact through optimisation of mine design and layout with regard to the exploitation of natural screening facilities (topography and vegetation)

5.2.4 Environmental Management Plan

Sub-section 12(m) of the Regulations³ requires that a provisional Environmental Management Plan (EMP) be submitted as part of the EIS. The EMP should detail how the mine operator intends to achieve environmental targets and objectives stated in the EIS.

At the time of drafting these guidelines, detailed guidance on the Environmental Management Plans is in preparation by the EPA. This guidance should be referred to prior to undertaking preparation of an EMP.

It is noted that the detailed contents of the EMP will vary on a case-by-case basis, but should always contain sufficient information for mine employees to understand their duties and responsibilities in regard to safeguarding the environment, and moreover to comply with the EPA guidelines. In-line with internationally accepted Best Practice, direction is provided for the following key elements, which should be documented in an EMP for a mine located in a Forest Reserve:

- policy statement
- management structure;
- performance targets;
- environmental action plan (EAP);
- environmental monitoring;
- reclamation planning;
- staff and community awareness.

The Regulations state that a comprehensive EMP should be produced within 18 months of operation start up. However, a mine may only have an operating life a few months. Where this is the case then a comprehensive EMP should be submitted with the EIS.

Policy Statement

A Policy Statement providing a clear commitment to minimising environmental impacts of the proposed operations on the Forest Reserve should be included in the EMP.

Management Structure

The mining company should demonstrate that there is a system in place to manage environmental aspects of the proposed operations. All sites should have a named Environmental Officer (or similar) who is directly responsible to the Managing Director for environmental matters.

A person suitably qualified and experienced in forest ecology or forest management should support the Environmental Officer, as advised by the EPA/FSD.

Performance Targets

Environmental performance targets should be set which relate to their Forest Reserve setting. These should not necessarily be limited to legislation, licence and permit requirements. Setting of performance targets should follow the following three steps:

- identify legal and other requirements applicable to the environmental aspects (particularly relating to forest value) of the planned operations, e.g. Forest Protection Decree NRCD 243³;
- set internal performance targets and periodically assess achievements to reinforce policy commitments and to enable demonstration of continual improvement;

- ensure that legal requirements and internal performance targets are effectively communicated to the employees who are accountable for the relevant activities.

Environmental Action Plan (EAP)

The EAP should form an identifiable sub-section of the EMP such that it may form a stand alone reference document. It should be a quantifiable plan developed to provide as a minimum, in relation to Forest Reserves, the following:

- identification and magnitude of specific forest issues, e.g. the area of land take by the mine footprint and the associated habitat loss;
- environmental management activities, e.g. active management of reclaimed areas;
- environmental management targets (milestones) to be achieved for affected forest areas, e.g. reclamation of given areas of mine impacted land;
- timeframe for implementation and target achievement;
- budget breakdown of the environmental management activities to be undertaken and an indication of source of funding;
- management structures in place, or planned, to ensure implementation.

Environmental Monitoring

Sub-section 12(1) of the Regulations³ requires that a programme is developed to monitor predicted environmental impacts. The systematic gathering and evaluation of information relating to the environmental performance of a mine is a critical component of environmental management for any mine. Such regular reviews of the mine's environmental performance are necessary during construction through to post-closure phases of the project.

Following consultation (see Section 5.2.1), it may be necessary to expand the core monitoring programme to assess other environmental parameters. This should be decided on a case-by-case basis but could include, for example:

- periodic general fauna surveys, or specific monitoring of an identified species;
- blast over-pressure and vibration;
- soil chemistry;
- bio-monitoring for evidence of food-chain transfer of potential contaminants.

Reclamation Planning

Reclamation plans should be summarised in the EMP (see also Section 5.2.5 and 5.4.2). The information provided should include the following information:

- type and distribution of areas to be reclaimed, or already reclaimed;
- details on the affected area and how rehabilitation is to be achieved;
- the type of materials including plant species and stages of their introduction;
- any other management inputs required.

Staff and Community Awareness

Staff awareness is fundamental to the success of environmental management. It is emphasised that environmental management is a responsibility of all employees, and management. All staff in an environmental management role should be provided with a copy of the EMP. In addition, all staff should receive training in the Environment and Health and Safety matters. At smaller sites, it may be possible and worthwhile to provide summary information to all people. The following are of particular important for staff awareness for mines operating in a Forest Reserve.

- awareness of potential environmental impacts;
- identification of environmentally unsound practises;
- development of a environmentally sensitive working ethos;
- fire hazard minimisation and control;
- spillage control and decontamination

Mine operators, in conjunction with the FSD, should also establish community awareness initiatives. These initiatives should be started early in the mine's life and structures to ensure the local community is aware of;

- public safety issues relating to the mining operations;
- mine/community co-operation (e.g. provision of drinking water and health cares);
- forest management issues.

5.2.5 Reclamation Plan (see Section 4.2.8, 4.5.2 and 4.6.4)

Sub-section 14(4) of the Regulations³ requires that a Reclamation Plan be submitted as part of the EIS. Those proposing to develop a mineral resource within the Forest Reserve must assume the liability and obligation to repair resulting environmental damage, in accordance with an agreed Reclamation Plan. The detail of the Reclamation Plan should be developed on a case-by-case basis in consultation (see Section 5.2.1).

Mine closure and reclamation should be planned for at the commencement of operations, and must have as its objective the recovery of the degraded area so that it can be used again, in accordance with an agreed post-closure land use for the site (see Section 4.6.4). Such plans must be determined on a case-by-case basis. Mine sites often have established transport links and other infrastructure that may be suitable for a range of post-mining activities. Where reclamation to a pre-mining condition is required then such infrastructure should be removed and the site subject to managed revegetation.

A Reclamation Plan is submitted with the EIS, which should include:

- the location and size of areas to be reclaimed;
- nominated end use for lands affected by mining, and any areas to be improved outside the immediate mine area;
- nominated end use for any buildings and other infrastructure;
- identification of the fate of fixed equipment;
- identification of reclamation methods and materials;
- identification of any progressive reclamation works to be undertaken;
- description of any activities required to limit public access and to make the site safe,
- identification of any post-closure management and monitoring programme;
- reclamation schedule and budget.

However, a mine may only have an operational life of a few months. Where this is the case then a comprehensive Reclamation Plan should be submitted with the EIS.

Mine operators should ensure that the FSD determine the species selection and mixture for where planting is to be undertaken. Consultation with the EPA/FSD should also address the following topics:

- exotic species selection, use and management;
- native species selection, use and management;
- monitoring techniques (e.g. forest maturity indices);
- hand-over criteria (see also Sections 4.6.1 and 4.6.4);
- it is noted that the ultimate aim of reclamation activities in a Forest Reserve as much as possible is to return the land to its original usage.

5.2.6 Provisional Decommissioning Plan

A provisional decommissioning plan should be prepared for inclusion within the EIS. The recommended content of the document is provided in Ghana's Mining and Environmental Guidelines¹⁰. However, a mine may only have an operational life of a few months and in this case, a final Decommissioning Plan should be submitted with the EIS.

5.3 CONSTRUCTION

Mining operations start from the first action in project development. Environmental obligations, which are specified in the Regulations³ to be timetabled from the start of operations, should start at the commencement of the construction.

This section provides guidance on the following;

- Environmental Reporting;
- Environmental Management Plans;
- Environmental Audit.

5.3.1 Environmental Reporting

Monthly Monitoring Returns

The EPA requires submission of monthly returns, by completion of EPA Form M01, to document the results of environmental monitoring. This provides an on-going indication of the environmental performance of the mine during construction and subsequent operations and closure.

Additional reporting requirements are required for a mine in a Forest Reserve. The Liaison Group should modify Form MO1 on a case by case basis for this purpose. This revised form should specifically identify the areas of Forest Reserves affected by mining, areas being reclaimed and their agreed end-use, and the species used in any ongoing reclamation work.

Annual Environmental Report

Sub-section 25(1) of the Regulations³ requires submission of an Annual Environmental Report in respect of the undertaking after 12 months of commencement of the Operation and every 12 months thereafter to the EPA. The Report will be in a form determined by the EPA and the detailed contents of an Environmental Annual Report should be agreed with the EPA in consultation with FSD.

The objectives of the Annual Environmental Report are to:

- document major mining activities for the reporting year and proposed activities for the following year;

- document environmental management and rehabilitation activities for the reporting year and proposed activities and developments for the following year;
- assist companies in monitoring their own environmental performance with relation to conservation of the Forest;
- provide for the preparation of revised reclamation plans and the detailed decommissioning plan on cessation of operations;
- provide summary information on the extent of mining operations in Forest Reserves and the standard of environmental management being achieved.

5.3.2 Environmental Management Plan

The EMP is an evolving, dynamic document that should change to reflect the current and planned operational status of the mine. As such it should undergo a regular process of review and revision. The provisional EMP will have been produced as part of the EA process (see Section 5.2.3).

Sub-section 24(1) of the Regulations³ states that the EMP should be reviewed after 18 months from the start of site operations and thereafter every 3 years. The first EMP revision is therefore due no later than 18 months after the start of construction.

With particular reference in Forest Reserves, the following aspects are highlighted as important to consider for the EMP covering construction:

- most land take occurs at this stage with greatest potential for disturbance and loss of vegetation cover, soils, etc. placing emphasis upon robust implementation of the mitigation strategy and application of monitoring;
- employees and management are new to the site and setting and particular emphasis must be placed upon staff training, e.g. in fire prevention and adherence to site boundaries, authorised access routes, conservation of soils and seed materials etc;
- optimisation of the site layout to ensure that to the degree practicable clearance of land for temporary construction purposes only is avoided.

5.3.3 Environmental Audit

This section provides guidance on the implementation of Environmental Audit and is designed to integrate with the existing legislative requirements, sub-section 24(1) of the Regulations³, for production and revision of the EMP (see above).

The Environmental Audit is essentially a management tool for the evaluation of the environmental management, equipment and organisation of a mine. An Environmental Audit will be, in general terms, the same for any mine, however specific guidance is provided here on the timing and conduct of an audit for a mine in Forest Reserve. In addition, Best Practice guidance for Environmental Audits of mine operations can be found in *Environmental Auditing – Best practice Environmental Management in Mining*⁹.

Audit timing is not provided in the Regulations, but it is advisable that the first audit is conducted prior to submission of the first revised EMP, i.e. within 18 months from project start-up. This will allow any problems identified during the audit to be addressed in the revised EMP. Subsequent audits should be undertaken on a three-yearly basis, prior to and to coincide with, each required revision of the EMP³.

The Environmental Audit should be carried out by a qualified consulting company, which must include a forestry specialist.

In addition to the formal audit described above, it is good environmental practice for suitably skilled and qualified personnel undertake regular internal audits. For a mine in a Forest Reserve these internal audits should be undertaken at intervals as agreed with the EPA/FSD.

5.3.4 Consultation

It is restated that consultation should be continued through the life of the project, particularly during construction when actual experience of site conditions is gained. As recommended in Section 5.2.2, a company/government agency liaison group should be used to facilitate this process. This group should be used to facilitate good relations with neighbouring settlements and provide a vehicle to hear any complaints and deal with issues such as interruption of community use of forest resources.

5.4 OPERATION

This section provides guidance on the environmental management aspects of a mine during its operational phase. Specifically, the section addresses:

- Environmental Management Plans;
- Reclamation and Decommissioning Plans;
- Consultation.

5.4.1 Environmental Management Plan

The most significant Forest Reserve issues that may be required to be addressed in an EMP are discussed in Section 5.2.4, together with the timetable for EMP revisions, and are not restated here.

The EMP should be updated and revised to reflect the transition from the construction phase through to operational phase at the mine site. Furthermore it should be revised to include any change in the operational practices at the mine and ensure that all the key components are still adhered to. Notable changes may have occurred and these should be accommodated during the EMP revision. Such changes will vary on a case-by-case basis but core considerations are given below.

Use should also be made of the site-specific experience gained in the construction stage, particularly with regard to conservation, protection and re-use of forest resources, re-

vegetation of land not required for mining, precautions against fire and minimisation of erosion and impact on adjacent land.

Changes to mining method

The original EMP would have been developed based on the mining plan proposed to be implemented. This in turn would be dependent upon, amongst other factors, the expected geological and geotechnical conditions and the available mining technology. Encountered geological and geotechnical conditions may require that a modification of mining method is made, e.g. underground mining as opposed to open pit. This may require, in turn, appropriate modification of the EMP.

Technological advances may also allow new mining and transportation practices to be adopted and this may require modifications to the EMP.

It should be noted, however, that such changes may require a revised EIS to be submitted to the EPA. Clarification should be sought from the EPA before any significant changes are made to the mining method.

Mining operational areas

As a mine develops, the area of influence is likely to change, especially for surface mines. The location of environmental monitoring equipment and sampling points should be reviewed on a regular basis and if no longer appropriate they should be re-located. The EMP should allow for at least three years of mining activity and provide a monitoring location strategy plan to ensure that those areas that may be affected by mining activity are being monitored.

Staff Awareness

The environmental awareness training and information dissemination should be an ongoing process and all staff should receive the appropriate revised EMP documents or summary (see also Section 5.2.4). Any new employees should be made aware of the environmental management practices in operation and receive relevant documentation and training. Staff members should be encouraged to identify, to management, any operational procedures that may be detrimentally affecting the environment.

5.4.2 Reclamation and Decommissioning Plans

The general principles apply to any mining operation, however specific issues of specific concern to mines in Forest Reserves are highlighted.

Guidance on the preparation of the initial Reclamation Plan and the provisional Decommissioning Plan is given in Sections 5.2.5 and 5.2.6. These documents should be used as the basis for revising the Reclamation Plan and for preparing the final Decommissioning Plan. Revisions to the Reclamation Plan are required to be produced on either an annual or bi-annual basis as agreed with the EPA. The final Decommissioning Plan should incorporate the Reclamation Plan and should be submitted no later than 2 years before the planned cessation of mining¹⁰.

The exact details of the Reclamation Plan will vary from site to site and will be dependent on the planned after use and the environmental setting of the mine. However, the core components identified in Section 5.2.5 should be included and the necessary detail added to ensure that the reclamation of the site is achieved in a cost-effective, timely and sustainable manner.

The following components are considered of specific relevance to the revision of a Reclamation Plan for a mine located in a Forest Reserve;

- detailed reclamation methodology procedures and materials to be used, species lists etc;
- detailed design of any landscape works to be undertaken;
- detailed reclamation schedule including type, size and distribution of working areas;
- detailed management plans for exotic plants, to include monitoring and removal schedules;
- Progress goals and monitoring

5.4.3 Consultation

It is again restated that during operations consultation and liaison should be maintained with those identified during the project-planning phase (see Section 5.2.1)

5.5 CLOSURE

Note: at the Closure (and following Post-Closure) stage, environmental management and mining operation objectives and activities converge. This Section should therefore be read in conjunction with the preceding in Section 4.5.

Decommissioning of a mining project must be carried out in-line with the agreed Decommissioning and Reclamation Plan and with due reference to the conditions in the relevant Reclamation Bond. This section provides guidance on those environmental aspects of mine closure that are of importance for a mine operating in a Forest Reserve. The following aspects are covered:

- Decommissioning and Reclamation Plan;
- Environmental Management Plan;
- Consultation

5.5.1 Decommissioning and Reclamation Plan

In order to ensure that the desired outcome is achieved at the end of mining, mine companies should ensure that they follow the agreed Decommissioning and Reclamation Plan. With the possible exception of small mine operations, it is likely that some level of progress in reclamation work will have already been made during the operational phase. Therefore the transition to closure should represent an increase in on-going reclamation activity.

Guidance on the content of the Decommissioning and Reclamation Plans has been provided in Section 5.2.5, 5.2.6 and 5.4.2.

5.5.2 Environmental Management Plan

Detailed guidance on the content of the EMP has been provided earlier (Section 5.2.4). Review and revision of the EMP should continue through the closure phase of the mine. This section provides guidance on the specific modifications to the EMP that may be required in the closure phase of a mine in a Forest Reserve.

The EMP at the closure stage should contain sufficient detail to ensure that all closure operations are carried out in an environmentally sound manner, and not to the detriment of the surrounding forest. In particular, key features of the mine that are to be retained after the cessation of mining to facilitate the long term closure objectives of the site should be adequately maintained. Such features could include:

- access routes;
- buildings and infrastructure;
- water diversions;
- monitoring equipment

The overall requirement during the closure state should be a timely conclusion to the operations and a commencement of post-closure activities. However, it is noted that closure operations should not be carried out with undue haste, but to an agreed timetable.

5.5.3 Consultation

It is again restated that consultation should be actively sought with the stakeholders identified during the project-planning phase (Section 5.2.1). During mine closure this is of key importance since it will inevitably facilitate the smooth hand-over of the post-mining responsible agency.

5.6 POST-CLOSURE

The overall objective of environmental management in the post-closure stage is to ensure, to the degree practicable, that the agreed end-use is achieved. This section highlights the environmental management tasks that should be carried out in order to meet this objective

Guidance on post closure works is provided in Section 4.6.

5.6.1 Management

Provision for environmental management in the post-closure phase should be set down as part of the project EMP. This provision may comprise an outline specification at commencement of the project with this outline being refined through the term of the operation, culminating in a detailed specification by closure stage. Nevertheless, it is emphasised that environmental management through post closure should comprise a continuation of procedures established from the construction stage with emphasis upon achieving environmental objectives set down in agreed Reclamation Plan.

5.6.2 Environmental Monitoring and Audit

For the post-closure stage, consideration must be given to modification of the operational and closure stages environmental monitoring regime to best provide for demonstration of attainment of (or progress towards) long term closure objectives. Parameters which should be considered in judging success are identified in Section 4.6.1 and these also provide the basis for selection of an appropriate long-term after-care monitoring programme. This programme is likely to be set up by the mining company and in line with a hand-over agreement, will be maintained by the post-mining responsible agency, modified with time, as appropriate to the data gathered.

The following broad specification for after-care monitoring is recommended for consideration on a case-by-case basis:

- surface water quality at sampling points located within and outside the impacted Forest Reserve area and appropriate to the protection of sensitive receptors (wildlife and communities);
- surface drainage conditions;
- slope and structure stability;
- vegetation establishment and health;
- species re-introduction/re-establishment;
- health and diversity of species surrounding site

5.6.3 Hand-over criteria

The prime objective of the Decommissioning and Reclamation Plan will be to provide for the sustainable achievement of the agreed end-use for the decommissioned mining project site. In this regard it is important that criteria are agreed between the mining company and the stakeholders which will provide a measure of the attainment of that object.

While it is important that hand-over criteria be developed on a case-by-case basis as appropriate to the environmental setting and the agreed end-use, the following Figure 3 provides a starting point for consideration.

It should be noted that the above table sets out, in the main, qualitative criteria. However, these may form the basis for quantitative and detailed criteria which set down time scales, species numbers and types, water quality standards, etc., as appropriate to the site and the end-use.

Figure 3: Possible hand-over criteria

End-use component	Basis for hand-over criteria
Indigenous forest	<p>Demonstrated survivability of planted trees.</p> <p>Establishment of recalcitrant species.</p> <p>Demonstration of natural re-colonisation of indigenous species</p> <p>Establishment of stable and safe landforms and surface drainage.</p>
Lake/wetland – wildlife	<p>Satisfactory water quality maintained.</p> <p>Marginal vegetation established.</p> <p>Satisfactory evidence of establishment of aquatic fauna/flora</p>
Lake – Water supply	<p>Satisfactory water quality standard maintained.</p>
Lake – amenity (fishing, water sports, wildlife)	<p>As for “Lake-wildlife” end-use, plus:</p> <p>Fish introduced and breeding/survivability confirmed.</p> <p>Safe access and margins for public.</p>
Cliff/rock features	<p>Safe and stable rock features confirmed</p> <p>Establishment of appropriate signs/fences.</p>

6. REFERENCES

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- ²Anon, 1994, Environmental Protection Agency (Act 490). The Parliament of the Republic of Ghana.
- ³Anon, 1999, Environmental Assessment Regulations (LI 1652). The Parliament of the Republic of Ghana
- ⁴Hawthorne, W.D. & Abu-Juam, M 1995 Forest Protection in Ghana with Particular Reference to Vegetation and Plant Species, IUCN Switzerland 203 pp.
- ⁵Anon, 1994. Rehabilitation of Mines – Guidelines for Proponents, Ministry of Northern Development and Mines, Ontario – “The Ontario Guidelines”.
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- ⁷Anon, 1998. British Columbia BC Parks Impact Assessment Process Part 2 Users Guide, Ministry of Environmental, Lands and Parks Canada.
- ⁸Anon, 1974. Forest Protection Decree NRC D 243. The National Redemption Council, Ghana.
- ⁹Anon, 1996. Environmental Auditing-Best Practice Environmental Management for Mining. Environmental Protection Agency Australia.
- ¹⁰Minerals Commission and Environmental Protection Council, 1994. Ghana’s Mining and Environmental Guidelines.

Appendix A

Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies

“Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies”

Ministry of Lands, Forestry & Mines
The Forestry Department
The Mineral Commission
The Chamber of Mines

October 1997

EXPLORATION IN THE FOREST RESERVES

INTRODUCTION

Before March 1996 some companies had been permitted to carry out mineral exploration within Forest Reserves.

Arising out of a growing concern for the depletion of Forest reserves and degradation of mining environmental generally, the Ministry of Lands, Forestry and Mines in March 1996 placed a ban on mineral operations in Forest Reserves.

It was recognised however that some of the companies who had permits to operate in the Forest Reserves had actually spent substantial sums of money, reached advanced stages in their exploration activities, and had identified a significant resource. They had moreover not been shown to have contravened any of the terms of the Forestry Permits under which they were operating.

A series of meetings involving representatives of the Ministry of Lands, Forestry and Mines, the Forestry Department, the Minerals Commission, the Chamber of Mines and Mining Companies were held to discuss the most appropriate way of solving the problem.

It was agreed that those companies who had indeed reached an advance stage in their exploration in the Forest Reserve should be allowed to complete their exploration programme. Companies identified to have reached an advanced stage in their exploration programme are listed in the attachment marked ad Appendix A. A list of the companies with their addresses is also attached as Appendix B.

It was also agreed that operational guidelines be put in place to relate the activities of the listed companies.

At a meeting held at the Minerals Commission on the 26th of September 1997 involving the above-mentioned agencies under the chairmanship of Hon. Dornu Nartey, the Deputy Ministry for Lands and Forestry, it was agreed that the operational guidelines which are set out in detail hereunder be adopted to regulate exploration activities in the Forest Reserves. These guidelines are specific to the (16) sixteen companies indicated in Appendix (B) and cover specific forest reserves and are limited to areas under "Advanced Exploration as a percentage of Total Reserve" as shown in appendix A.

**OPERATIONAL GUIDELINES FOR MINERAL
EXPLORATION IN FOREST RESERVES**

In these Guidelines the following definitions shall have the following meaning:

- a. Unauthorised persons Persons without authority from either the permit holder or the Forestry Department.
- b. Sump An excavation hole or low area into which liquid or slurry, Drains.
- c. Black star species¹ Rare and endangered plants of Ghana.

GENERAL

1. Exploration in Forest Reserves may only be carried out by Companies that possess valid mineral exploration Licences.
2. Before a Mineral Licence for field exploration in Forest Reserves is granted by Ministry of Mines and Energy to a Company, the Company must first acquire a permit from the Chief Conservator of Forests (CCF) authorising exploration work in the Forest Reserve.
3. After acquisition of a Forestry Permit and the grant of an exploration licence, the company should undertake an environmental assessment to confirm the condition of the Forest Reserve. This will include identifying and recording of the general flora and fauna in the reserve; the presence or absence of rare or endangered species and the preparation of an Environmental Management Plan (EMP) during exploration.

The EMP must be approved by the Environmental Protection Agency.

4. The environmental assessment should determine the presence or absence of the following².
 - i. Special protected biological areas
 - ii. Protection Provenance areas
 - iii. Institutional research plots
 - iv. Community sacred groves
 - v. Black star species
 - vi. Gregarious stand of black star species
 - vii. Hill sanctuaries for protection of watersheds

1. List of Black star species are available in Forestry Department Planning Branch, Kumasi and any district office in the High Forest Zone.
2. The Location of these are specified in Forest Management plans obtainable from all Forest Department district offices in the high forest zone.

5. Exploration will NOT be permitted within Forest Reserve large grain protect areas namely;
 - i. Special biological protected areas
 - ii. Protected Provenance area
 - iii. Institutional research plots
 - iv. Community sacred groves
 - v. Hill sanctuaries for protection of watersheds
6. Work camps and temporary shelters for the storage of geological samples, fuel, oils and other chemicals will not be permitted in the Forest Reserve.
7. The company or its sub-contractors should not extract water for exploration purposes from any river or stream in a forest in a forest reserve which may damage the ecology of the river or stream.
8. Timber harvesting should not be obstructed unduly by the company or its sub-contractors.
9. No forest products i.e. flora and fauna of any kind, should be collected or removed from the Forest Reserve by the company, its sub-contractors or employees.
10. At least one month before the commencement of each phase of exploration work, the company must inform the CCF and DFO of:
 - The impending phase of work
 - The area of land to be explored
 - The expected effects on vegetation, land use and water quality
 - The number of labourers and goods and services required
 - The location of any sacred groves, burial ground or other fetish lands
 - The location of any areas of environmental sensitivity to local people
 - The address and telephone number of the company's locally based representative.
11. The company is required to allow FD personnel to inspect the exploration area upon being given at least 24 hours prior notice.
12. All correspondence between the DFO and the company should in writing.

GEOLOGICAL GEOCHEMICAL AND GEOPHYSICAL EXPLORATION

13. Grid lines for geological, geochemical and geophysical surveys should not be bulldozed or cleared in forest reserve areas. Grid lines should be marked by wooden pegs and/or biodegradable flagging tape.
14. Cutting of shrubs and other vegetation must be kept at an absolute minimum (not exceeding 0.5 meter in width) in cases where lower storey to ground vegetation has to be cut to provide a line of sight.
15. The use of chain saws is not permitted in the Forest Reserve. Cut lines for access in selecting access, should not exceed one metre wide and may only be established using hand tools.
16. A company must liaise with the District Officer at least one month prior to the construction of new access routes/bridges, tracks or drill pads. The access route or place selected must avoid areas of local environmental and/or cultural sensitivity, and must conform with Forestry Department guidelines on the construction of forest roads, bridges and log storage sites (refer to FD Logging Manual). Downstream water quality effects must also be minimised.
17. The GWSC, guidelines for rural water supply should be observed.
18. Rather than clear cutting and bulldozing for access, the company should attempt to drive over flattened vegetation so as to preserve rootstock and prevent soil erosion.
19. Trees, larger than 5cm diameter breast height (dbh) or taller than 2-3 meters should be preserved where practicable but no merchantable tree should be felled or damaged.
20. Wherever possible tracks should be constructed along ridge tops or on the bottom of slopes at a reasonable practical distance from streams and rivers. No construction/or drilling of any type should take place within 100 meters of a river or stream shown on current Survey Department 1:50000 topographic maps series.
21. The company should endeavour to construct drill pads and other access routes during dry seasons.
22. The company should carry out earthworks using sound engineering practices (refer to logging manual) with the aim of minimising erosion. The company should also schedule construction progressively so that no land is cleared of vegetation more than six months in advance of when it is required.
23. The natural courses of perennial and seasonal rivers and streams must not be obstructed at any time. When necessary appropriate structures should be installed to maintain the flow.

24. where steep access roads are necessary but is not feasible to follow natural contour, water bars and/or culverts cross drains shall be constructed to prevent concentration of drainage in the uphill ditch and to divert run-off water at appropriate intervals into the natural drainage and adjacent undergrowth. Maximum grade should not exceed 10% over 50 metres at any one point.
25. Overburden material from road construction or stripping or test pits should be conserved for backfilling. Under no condition should it be cast downhill. As far as possible, excavated material should be segregated into two piles; topsoil and subsoil by making two or more passes to segregate the material at the edge of the road or drill pad area.

EXCAVATIONS AND DRILLING

26. The company must avoid areas which are environmental or culturally sensitive when positioning drill holes and excavations.
27. The adverse impact of trenching should be minimised where possible by excavating across rather than down a slope.
28. One end of a trench should be sloped to avoid trapping of silt and debris.
29. All trenches must be filled within 90 days after use by backfilling with overburden and capping with topsoil.
30. All drill rigs and other machines should be maintained in good condition so as to prevent oil leaks and spillages. They should also be equipped with functional fire extinguishers and efficient exhaust pipes fitted with spark arresters.
31. All fuel, oils and drilling fluids should be stored outside the Forest Reserve at either a central storage location or satellite storage area. Only sufficient supplies for daily operations will be allowed in the reserve.
32. The company should construct drill pads in such a way that the storage area for daily fuel, hydraulic oil and, drilling fluid supplies, will drain to a sump. The company must maintain standard safety practices for the storage and handling of all fuel and chemical storage areas.
33. The company should recycle drilling fluids and use biodegradable fluid, where possible.
34. Disposal of oil based drilling fluids should be by incineration or other environmentally acceptable means.
35. The company should allow uncontaminated water based drilling fluid to settle before discharge into the natural drainage.
36. Settling should take place in a sump located down slope of the drill rig. Depending on the geology and/or the need for drilling additives, it may be

necessary to line sumps with plastic sheeting. Sumps should be allowed to dry before removal of the lining and filling with earth.

37. No uncontrolled discharge of drilling fluids to the natural environment is permitted within the forest reserve.
38. The company must remove all litter, rubbish, steel drums etc, on moving from one drill pad to another and dispose of such waste in an approved manner outside the Forest Reserve.
39. Any area which has been contaminated by fuel, oils or other chemical spills must be restored after excavating, the contaminants removed and disposed in an approved manner outside the Forest Reserve.

SHAFT/DECLINE DEWATERING

40. The company must not dewater an old shaft/or decline unless a recent water quality analysis carried out within one month of the proposed dewatering has shown that the shaft water is not contaminated. Uncontaminated water which meets EPA guidelines may be discharged to the natural environment.
41. If water is contaminated, i.e. does not meet EPA standards then the company must inform the EPA and devise a suitable treatment plan for approval by the EPA.

SHAFT/DECLINE CONSTRUCTION

42. Where the company can demonstrate to the satisfaction of the Minerals Commission that shaft and/or decline construction is necessary to complete an exploration programme, the company will be allowed to construct same.

ABANDONMENT AND REHABILITATION

43. A company is required to rehabilitate an abandoned exploration area to conform with its environmental management plan.
44. The environmental management plan must specify the area to be rehabilitated. This will include areas to be disturbed by exploration activity; the method of rehabilitation and the type and number of native plant species which will be planted.
45. It will be the managerial and financial responsibility of the company to implement the rehabilitation programme.
46. The company is solely responsible for implementation of the rehabilitation programme to the satisfaction of the CCF and Environmental Protection Agency.

47. The company should inspect all excavations and drill holes made during the course of the exploration and backfill and/or seal them before abandonment.
48. All roads and access routes opened by the company must be closed and replanted after the completion of the exploration.
49. Rehabilitation of the area must be completed with three months of cessation of exploration, in accordance with the EMP.

SUBCONTRACTING RESPONSIBILITY

50. The company to which the prospecting/exploration licence has been issued but which sub-contracts the exploration to another company is wholly responsible for ensuring that the latter conducts its operation in accordance with these guidelines.

SAFE-GUARDING THE FOREST RESERVE

51. The Forest Reserve will be protected from intrusion by unauthorized persons in the following manner:
 - a. The Forest Warden (FW) will continue to be in charge of policing the Forest Reserve.
 - b. The FW will be assisted in performing his role by the company who will among others supply all their employees and person under their authority with some form of identification, e.g. badges. The company shall promptly warn off or inform the FW or DFO of the presence of suspected unauthorised persons in the forest.

BONDING

52. In order to ensure that the company acts in a responsible manner while exploring in a Forest Reserve and to ensure that rehabilitation is accomplished according to the approved environmental management plan, the company will post a bond. The release of a bond will follow a declaration that the Forestry Department is satisfied with the completed rehabilitation programme.
53. The value of the bond will be determined by the Forestry Department taking into consideration:
 - the phase of the exploration
 - the area (hectares) being explored
 - the Condition of the Forest as determined jointly by the Forestry Department and the Environmental Baseline Study
 - timber and non-timber revenues foregone.

54. The bond will be valid for a minimum period of twelve calendar months.
55. One month before the expiry of the bond the company is required submit a report to the Minerals Commission from the CCF evidencing the Company's compliance with or satisfactory efforts to comply with the approved environmental management plan.
56. The value of the bond will be progressively increased with advancement in the exploration programme approved by the Minerals Commission.
57. The company should also declare to the Minerals Commissions the names of any of its officers who have previously forfeited a bond in Ghana or any other country.

CESSATION OF EXPLORATION

58. Exploration will be considered to have ended when exploration licences expires or the company ceases to carry out further exploration activities or informs the Minerals Commission and the Forestry Department of its decision not to carry out any further exploration within the Forestry Reserve.
59. All exploration equipment must be removed from the Forest Reserve two weeks after completion of exploration and rehabilitation.

DRILLING AND TRENCHING IN FOREST AREAS COVERED AND CORRESPONDING EXPENDITURE

Name of Company	Region	Name of Forest Reserve	Area Under Advance Exploration, Drilling & Trenching in the Reserve (ha)	Area Under Advance Exploration as a percentage of Total Forest Reserve	Expenditure to Date (US\$)
Kenbert Limited	Eastern	Ajenjua Bepo	250	0.02	\$627,858
Oro Resources Limited	Ashanti	Tano Offin	845	0.05	\$1,505,580
Chirano Goldfields Ltd	Western	Tano Suraw	120	0.01	\$443,428
Johnsons Limited	Western	Tano Suraw Ext.	490	0.03	\$1,000,000
Adansi Assaasi Mining Co. Ltd	Ashanti	Dampira Range	313	0.02	\$1,394,746
Anglogold America Prospecting Services	Ashanti	Jimira	2800	0.17	\$359,641
Cluff Resources Inc.	Western	Opon Mansi	270	0.02	\$500,000
Birim Goldfields Limited	Western	Opon Mansi	1643	0.10	\$1,419,000
(Mining Lease) G.A.G	Western	Neung North	942	0.06	\$400,000
Riyadh Mining Company	Western	Bowiye Range	391	0.02	\$206,442
BRGM	Brong Ahafo	Bonkoni/Ayum	321	0.02	\$600,000
Satellite Goldfields Limited	Western	Subir River	1416	0.09	\$2,000,000
Obuom Goldfields Limited	Ashanti	Bosumtwi Range	1000	0.06	\$700,000
Gemap Mining Company Ltd.	Western	Upper Wassaw	1000	0.06	\$450,000
Abosso Goldfields Limited	Western	Bonsa Ben/Ben West Block/Bonsa River	1800	0.11	\$248,350
Flagbase Mining Company	Western	Bowiye Range	440	0.03	\$411,633
Nevsun Resources	Western/Central	Supuma Shelterbelt	2000	0.12	\$6,500,000
Total Forest Reserve (Countrywide) – 700,000 hectares					
% of Total Reserve Countrywide (Under Advanced Exploration) – 20%			16041	1	\$18,802,678

APPENDIX 'B'

- | | |
|--|--|
| 1. Kenbert Ltd.
P. O. Box 116
Ministries
Accra | 2. Oro Recourse Ltd.
P. O. Box 8804
Accra-North |
| 3. Johnsons Ltd.
P. O. Box 9138
Accra-Accra | 4. Adansi Asaasi Mining Co. Ltd.
P. O. Box 5348
Accra-North |
| 5. AngloGold American Prospecting Services
P. O. Box C 2388
Cantonments, Accra | 6. Ashanti Goldfields Co. Ltd.
P. O. Box 5728
Accra-North |
| 7. Birim Goldfields Ltd.
P. O. Box C2652
Cantonments, Accra | 8. Tournigan/Orovi Gh. Ltd. (Riydh Mining Co)
P. O. Box 19
Nsuta-Wassaw
Tarkwa |
| 9. BRGM
P. O. Box 7686
Accra-North | 10. Satellite Goldfields Ltd.
142 Nortci Ababio Loop
Ambassadorial Est.
Roman Ridge, PMB
Airport-Accra |
| 11. Obuom Goldfields
P. O. Box 65
Trade Fair Site
La-Accra | 12. Gemap Mining Co. Ltd.
P. O. Box 01394
Accra |
| 13. Abosso Goldfields Ltd.
P. O. Box C2264
Cantonments, Accra | 14. Flagbase Mining Co.
P. O. Box 11151
Accra-North |
| 15. Nevsun Resources
P. O. Box C723
Cantonments, Accra | 16. Chirano Goldfields Co. Ltd.
P. O. Box 9138
Airport-Accra |
| 17. Ghanaian Australian Goldfields
P. O. Box 9255
Airport-Accra | |

Appendix B

Listing of Useful contacts And References

APPENDIX B: USEFUL CONTACTS AND REFERENCES

Environmental Protection Agency
Head Office
P. O. Box M326
ACCRA
Tel: (021) 664697/8
Fax: (021) 662690
Email: epainfo@ncs.com.gh

Environmental Protection Agency
Volta Region
P. O. Box 513
HO
Tel: (091)8241

Environmental Protection Agency
Western Region
P. O. Box 304
SEKONDI
Tel: (031) 46417
Fax: (031) 46142
Email: epawestern@epa.gov.gh

Environmental Protection Agency
Upper East Region
P. O. Box 80
BOLGATANGA
Tel: (072) 3187

Environmental Protection Agency
Brong Ahafo Region
P. O. Box 1505
SUNYANI
Tel: (061) 7115

Environmental Protection Agency
Northern Region
P. O. Box 620
TAMALE
Tel: (071) 22294
Fax:-
Email: epanorthern@cpa.gov.gh

Environmental Protection Agency
Eastern Region
P. O. Box 725
KOFORIDUA
Tel: (081) 22572
Fax: n/a
E-mail: epaeastern@epa.gov.gh

Environmental Protection Agency
Central Region
P. O. Box 870
CAPE COAST
Tel: (042)32221/4
Fax: n/a
Email: n/a

Environmental Protection Agency
Tarkwa Area
P. O. Box 1
TARKWA
Tel: (0362) 20526
Fax: (0362) 20348
Email: n/a

Environmental Protection Agency
Ashanti Region
P. O. Box M 1945
Suame, Kumasi
Tel: (051) 20052
Fax: (051) 27768
Email: support@epa.gov.gh

Environmental Protection Agency
Upper West Region
P. O. Box 179
WA
Tel: (0756) 22094
Fax: n/a
Email: epaupper@epa.gov.gh

APPENDIX B: USEFUL CONTRACTS and REFERENCES

Forestry Commission

P. O. Box M434
ACCRA
Tel: (021)221315
Fax: (021) 2200818

Forestry Research Institute of Ghana

(Council for Scientific and Industrial Research)
University P. O. Box 63
KUMASI
Tel: (051) 60122
Fax: (051) 60121

Forest Services Division

Head Office
P. O. Box 527
ACCRA
Tel: (021) 77614/6
Fax: (021)772728

Forest Services Division

Forest Management Support Centre
P. O. Box 1457
KUMASI
Tel: (051)28525/22376/7
Fax:(051)22687

Ghana Chamber of Mines

Minerals House, No. 10 6th Street
Airport Residential Area
Box 991
ACCRA
Tel: (021) 760652
Fax: (021) 760653

General Investment Promotion Centre (GIPC)

P. O. Box 193
Ministries,
ACCRA
Tel: (021) 665125-9
Fax: (021) 663801

Mines Department

Minerals House, No. 10 6th Street
Airport Residential Area
P. O. Box 3634
ACCRA
Tel: (021) 775376,776802
Fax: (021) 772903

Minerals Commission

No.9 Switchback Road
P. O. Box 248
Ministries
ACCRA
Tel: (021) 772783/772786/773053
Fax: (021) 773324

**Ministry of Environment, Science and
Technology**

P. O. Box 232, Ministries
ACCRA
Tel: (021) 666049
Fax: (021) 666828

Ministry of Mines, Lands and Forestry

P. O. Box 212, Ministries,
ACCRA
Tel: (021) 666801
Fax: (021)772728

Water Resources Commission

P. O. Box M239
Ministries
ACCRA
Tel: (021) 662360
Fax: (021) 666476

Wildlife Division

P. O. Box m239
Ministries
ACCRA
Tel: (021) 662360
Fax: (021) 666476

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- **Environmental Guidelines for Mining Operations, United Nations** (1999) Compiled by United Nations Department of Economic and Social Affairs (UNDESA) & United Nations Environment Programme – Industry and Environment (UNEP)
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- **Forest Protection (Amendment) Law, PNDCL 142** (1986) (Ghana)
- **Forest Protection Decree, NDRC 243** (1974) (Ghana)
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- **Ghana's Mining and Environmental Guidelines** (1994) Minerals Commission and Environmental Protection Council (Ghana)
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- **Guidelines for Assessing the Impacts of Mining on the Environment** (1991) Macleod A & Rouse M, Resource Allocation Section, Energy Resources Division, Ministry of Commerce (New Zealand)
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- **Guidelines for Minerals Exploration and Mining within Conservation Reserves and Other Environmentally Sensitive Lands in Western Australia** (1998) Department of Minerals and Energy, Western Australia (Australia)
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APPENDIX B: USEFUL CONTACTS and REFERENCES

Appendix C

Checklist of Key Tasks

APPENDIX C : CHECKLIST OF KEY TASKS

		Relevant Sections
EXPLORATION		
1.	Requirements for exploration are dealt within the <i>Operational Guidelines for Mineral Exploration in Forest Reserves for Selected Companies, 1997.</i>	Appendix A
PRE-CONSTRUCTION		
2.	Select mining method, mine and infrastructure layout, and sites for ore transport, storage, processing and waste disposal	4.2.1, 4.2.2, 4.2.3, 4.2.4
3.	Develop mitigation measures as contingency against unprogrammed or accidental occurrences	4.2.6
4.	Apply for Environmental Permit, Mining Lease and Operating Permit. Environmental Permit is subject to the approval of the EA Report by the EPA	4.27
5.	Set up a Liaison Group to provide input and assistance in consultation and environmental planning activities	5.2.2
6.	Undertake consultation with relevant government agencies and community, in support of and as part of the Scoping and EA process	5.2.1, 5.2.2
7.	Prepare and submit an EA Scoping Report to the EPA for approval	5.2.1
8.	Prepare an Environmental Assessment Report (EA) following EPA approval of the Scoping Report	5.2.3
9.	Prepare a provisional Environmental Management Plan (EMP)	5.2.4
10.	Prepare the Environmental Action Plan and include within the EMP	5.2.4
11.	Prepare the Company Environmental Policy and include within the EMP	5.2.4
12.	Appoint Environmental Officer and define corporate structure for environmental management and responsibilities. Include details within the EMP	5.2.4
13.	Prepare a Reclamation Plan, which should include consultations with the FSD with respect to species selection for replanting.	5.2.5
14.	Prepare a provisional Decommissioning Plan	4.2.5, 5.2.6
15.	Compile the EA, EMP, Reclamation Plan and Decommissioning Plan to form the Environmental Impact Statement Report (EIS) For the project.	5.2
16.	Submit EIS to FSD, before formal submission to the EPA, for written approval sanctioning the development or written objection. Address FSD objections, and revise	4.2.7
17.	Submit the EIS, together with written approval from FSD, to the EPA	4.2.7, 5.2
18.	Obtain Environmental Permit following EPA approval of the EIS	4.2.7

19. Agree A Reclamation Bond with the EPA, based upon the Reclamation Plan. The Bond must be in place before the commencement of the project 4.2.8

CONSTRUCTION

20. Adopt best practise engineering principles 4.3
21. Prepare a fire plan detailing prevention, control and suppression measures 4.3
22. Renew Operational Permit on an annual basis 4.2.7
23. Prepare a site-specific MOI form for Monthly Monitoring Returns. This will be completed by the Liaison Group 5.2.2, 5.3.1
24. Initiate Environmental Monitoring 5.3.1
25. Submit Environmental Monthly Monitoring returns to EPA 5.3.1
26. Agree contents for Annual Environmental Reports with the EPA and in consultation with FSD 5.3.1
27. Submit an Annual Environmental Report after 12 months of commencement of construction, and thereafter every 12 months, to the EPA 5.3.1
28. Submit a revised EMP to the EPA no later than 18 months of construction and thereafter every three years. (The provisional EMP will have been included within the EA Report). 5.3.2
29. Undertake an Environmental Audit within the first 18 months of construction and thereafter every three years. 5.3.3
30. Implement regular internal audits at intervals agreed with EPA and FSD. 5.3.3
31. Continue consultation, facilitated by the Liaison Group 5.2.1, 5.3.4

OPERATION

32. Maintain drainage, slopes and engineered structures 4.4.1
33. Operate mine in accordance with the approved mining plan 4.4.2
34. Renew Operation Permit on an annual basis 4.2.7

Appendix C: Checklist of Key Tasks

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| 35. | Carry out all process operations, maintenance of plant and fuel storage unless otherwise authorised | 4.4.3 |
| 36. | Initiate reclamation activities in anticipation of closure, for example training of reclamation methods and approaches. | 4.4.4 |
| 37. | Review and refine detailed Reclamation Plan in liaison with stakeholders | 4.4.4 |
| 38. | Submit Environmental Monthly Monitoring returns to EPA | 5.3.1 |
| 39. | Submit an Annual Environmental Report to the EPA every 12 months in accordance with the timetable established during construction. | 5.3.1 |
| 40. | Submit a revised EMP to the EPA every three years in accordance with the timetable established during construction. | 5.2.4, 5.4.1 |
| 41. | Submit a final Decommissioning Plan, which should incorporate the Reclamation Plan, for approval by the EPA, no later than 2 years before the planned cessation of mining. | 5.4.2 |
| 42. | Undertake an environmental audit every three years in accordance with the timetable established during construction | 5.3.3 |
| 43. | Continue consultation, facilitated by the Liaison Group | 5.2.1, 5.4.3 |

CLOSURE

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| 44. | Complete closure activities in line with the Decommissioning and Reclamation Plan, and the conditions of the Reclamation Bond. | 4.2.8, 4.5,
5.2.5, 5.4.2
and 5.5.1 |
| 45. | Undertake works necessary to assure site safety, particularly with respect to slopes, bodies of water, ground openings and residual structure. | 4.5.1 |
| 46. | Remediate environmental damage in accordance with Decommissioning and Reclamation Plan, Consideration and be given (in consultation with FSD) to offsetting any net loss of forest by planting an equivalent area and type outside the impacted area. | 5.2.3 |
| 47. | Agree an end-land use with FSD, which must be in-line with management objectives of the Forest Reserve. | 4.5.3 |
| 48. | Submit Environmental Monthly Monitoring returns to EPA | 5.3.1 |
| 49. | Submit an Annual Environmental Report to the EPA every 12 months in accordance with the timetable established during construction. | 5.3.1 |
| 50. | Submit a revised EMP, reflecting closure, to the EPA. | 5.2.4, 5.5.2 |
| 51. | Continue consultation, facilitated by the Liaison Group | 5.3.1, 5.5.3 |

POST-CLOSURE

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|-----|---|---------------------|
| 52. | Implement passive care and after requirements. | 4.6.1 |
| 53. | Continue application of environmental management principles as set down in the EMP | 4.6.1, 5.6.3 |
| 54. | Initiate financing for post closure. | 4.6.2 |
| 55. | Confirm hand over criteria have been met. | 4.6.4, 5.6.3 |
| 56. | Environmental monitoring and audit to demonstrate the attainment of long-term closure objectives. | 4.6.1, 4.6.3, 5.6.2 |