ENVIRONMENTAL IMPACT ASSESSMENT

GUIDELINES FOR THE CONSTRUCTION SECTOR IN ZAMBIA
FOREWORD

In Zambia, the construction sector has been recording steady growth, mainly due to the building of residential housing, investments in the mines, road construction and other civil works. The government has continued to implement a series of infrastructure development projects such as schools and universities, hospitals and various road projects. The output of the construction industry has a major potential adverse impact on the environment and on the ability to maintain a sustainable economy.

The need for sector specific guidelines for conducting environmental impact assessment (EIA) for construction projects has been felt for some time with the view to bringing clarity on the conduct of EIA for the sector. This need has been further reinforced by the Environmental Management Act No 12 of 2011 which explicitly makes EIA as a requirement for all projects that may have an impact on the environment. It is felt that the guidelines in the construction sector would help to standardize the quality of EIA reports dealing with construction projects.

The aim of these guidelines is to provide information and guidance on EIA in general and specifically for construction related projects. It also acts a resource for EIA practitioners. Further, the guidelines are meant to highlight the importance of consideration of alternatives in the preparation of EIAs in the construction sector and in the implementation of such projects to ensure green construction or environmental sustainability. Therefore the guidelines provide concepts, procedures and tools that could be used when preparing EIA reports.

These construction sector EIA guidelines have therefore been developed to fulfil the important need of streamlining the EIA practice in the construction sector in Zambia without which we, as a country, may not achieve sustainable development. These guidelines will mostly benefit project developers, contractors, EIA consultants, government agencies and ministries.

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**ABBREVIATIONS**

<table>
<thead>
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<th>Description</th>
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<tr>
<td>CPM</td>
<td>Critical Path Method</td>
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<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EIS</td>
<td>Environmental Impact Statement</td>
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<td>EPB</td>
<td>Environmental Project Brief</td>
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<td>EMA</td>
<td>Environmental Management Act</td>
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<tr>
<td>GRZ</td>
<td>Government Republic of Zambia</td>
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<tr>
<td>HIV/AIDS</td>
<td>Human Immuno Virus/Acquired Immune Deficiency Syndrome</td>
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<td>HS</td>
<td>Health and Safety</td>
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<tr>
<td>IAP</td>
<td>Interested and Affected Parties</td>
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<td>NCC</td>
<td>National Council for Construction</td>
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<tr>
<td>NAMSSC</td>
<td>National Association for Medium, Small Scale Contractors</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
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<tr>
<td>NTU</td>
<td>Nephelometric Turbidity Units</td>
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<td>MLGH</td>
<td>Ministry of Local Government and Housing</td>
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<tr>
<td>PM</td>
<td>Particulate Matter</td>
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<tr>
<td>RAP</td>
<td>Resettlement Action Plan</td>
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<tr>
<td>SAR</td>
<td>Sodium Absorption Ratio</td>
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<td>UN</td>
<td>United Nations</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>ZABS</td>
<td>Zambia Bureau of Standards</td>
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<td>ZGJP</td>
<td>Zambia Green Jobs Program</td>
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ABOUT THE GUIDELINES

The Environment Management Act No. 12 of 2011 and the Environmental Impact Assessment (EIA) Regulations, Statutory Instrument No. 28 of 1997, makes it mandatory to obtain environmental clearance for projects listed under the First and Second Schedules of the EIA Regulations. The EIA Regulations classifies projects into two categories. Projects under the First Schedule require that an Environmental Project Brief (EPB) is prepared while projects under the Second Schedule require an Environmental Impact Statement (EIS).

The existing guidelines on Environmental Impact Assessment (EIA) embedded within the EIA Regulations generally apply to all the sectors that require prior environmental clearance. However, considering the diversity that exists in all sectors related to infrastructure and industrial development projects, the Zambia Environmental Management Agency (ZEMA) in collaboration with relevant stakeholders and with assistance from the Zambia Green Jobs Programme through the United Nations Environment Programme (UNEP), embarked on a programme to develop EIA sector specific guidelines.

In developing these guidelines, a consultative process was employed. Key stakeholders were identified and invited for an inception meeting to define the scope and content of these guidelines. Subsequently, a Technical Working Group was constituted. Targeted consultative meetings were held as an input to the development of these guidelines.

The construction sector guidelines will help all those who are involved in EIA practice to play their roles effectively in the EIA process. Specifically, these guidelines are primarily meant for project developers, consultants, contractors, regulatory authorities and interested and affected parties. They apply to all activities that promote the development of infrastructure from conception to operation. Through the application of these guidelines, it is envisaged that better quality assessments that are easily understood by relevant parties will be produced and that such assessments will provide the necessary information for effective decision making. These construction guidelines are complementary to national legislation and are specifically meant to address environmental concerns in the construction sector in Zambia.
**1.0 BACKGROUND**

**1.1 INTRODUCTION**

These guidelines provide information and guidance on Environmental Impact Assessment (EIA) for construction related projects and are intended as a resource for those who are involved in EIA practice. The guidelines are further meant to encourage the consideration of alternatives when implementing such projects to ensure environmental sustainability. Particular emphasis is given to concepts, procedures and tools that are used currently or are potentially relevant in preparing EIA reports for clearance by the Zambia Environmental Management Agency (ZEMA).

In broad terms, EIA is an exercise that predicts environmental impacts, assesses their significance, and provides recommendations for their mitigation. It covers a wide range of disciplines and areas such as noise and vibration, air quality, ecology, contamination, water quality & hydrology, archaeology & cultural heritage, landscape & visual character, sustainability and socio-economics. The EIA report describes how the project has been improved and what alternatives were considered.

**1.2 GENERAL CONTEXT**

Construction activities in Zambia have generally been carried out without giving much attention to issues related to the environment in spite of their positive contribution to the economy. This has resulted in undue pressure being exerted on limited available natural resources thus impacting negatively on the environment. For instance, unplanned and unsustainable urban development has led to severe pressure on the environment impacting on green areas and recharge areas for groundwater resources. Buildings constructed in Zambian cities and towns mostly use on site sanitation leading to groundwater pollution. Further, mining activities such as smelting that use obsolete facilities discharge emissions that have in some cases led to the release of toxic gases like sulphur dioxide resulting into acid rain negatively impacting on vegetation and wellbeing of the community.

Furthermore, projects such as roads, dams and housing projects potentially impact negatively on the environment by causing damage to sensitive eco-systems, soil erosion, changes to drainage pattern, surface and ground water pollution, interference with wild life movement, loss of productive agricultural lands, displacement of people, demographic changes and accelerated urbanization among others.

In order to address this wide array of environmental challenges, consideration should be given to among others; environmentally friendly site planning, appropriate choices of materials and products, sustainable use of energy and water, provision of clean water, indoor environment quality and sanitation, waste water and solid waste management, proper operation and maintenance.

Additionally, environmentally friendly construction calls for an effective inter-disciplinary team with good project management skills bearing in mind of cross-cutting approaches that include; Integrated Design Process, Life Cycle approaches, decreasing resource intensity, bio-
climatic design, adopting traditional and local architectural practices and the use of renewable resources (UNEP, 2006).

1.3 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS IN ZAMBIA

The term ‘environmental impact assessment’ (EIA) is a generic term for all project assessment processes used to facilitate sound, integrated decision-making in which environmental considerations, that is both biophysical as well as socio-economic factors, are explicitly and systematically taken into account in the development process. The purpose of conducting an EIA is to enhance planning process through the quality of decision making by identifying and assessing the impacts on the environment of a given development at the earliest stage of project conceptualisation and planning. Through an interactive and iterative process these impacts can be avoided or mitigated. Thus the specific objectives of environmental impact assessment are to:

a) Integrate environmental considerations into development planning and management;
b) Ensure that the potential negative impacts are foreseen and taken into consideration at an early stage in the planning process;
c) Identify and enhance the positive impacts of the proposed development activity;
d) Examine the trade-offs and possible alternatives;
e) Ensure that all the interested and affected parties (IAPs) such as rural communities, government authorities, developers, investors, NGOs etc. actively participate in the decision making process;
f) Ensure that development activities are people-centred and promote sustainable livelihoods in keeping with the integrity of the natural environment on which they depend;
g) Identify the necessary mitigation and monitoring measures required to minimise and control the identified impacts;
h) Identify responsibilities to support EIA preparation and implementation; and
   Promote inter-sectoral linkages to capture cumulative impacts.

This section provides key aspects of the EIA process in the Zambian context as elaborated below.

1.3.1 Screening

Screening is the first stage in the environmental impact assessment process to determine whether an EIA is required for a particular project or not. The Zambian legislation provides project categories to define the level of assessment. In a situation where the proposed project is not defined by the categories, ZEMA shall determine the level of assessment. However, ZEMA can move a project from the first schedule to the second depending on the sensitivity of the environment.

1.3.2 Scoping

Scoping is the process of determining the spatial and temporal boundaries and key issues to be addressed in an environment impact assessment. The main aims of scoping are:

- To inform the interested and affected parties (IAPs) about the proposed project and all
realistic alternatives;

- To identify all relevant environmental and socio-economic issues relating to the proposed project and the identified alternatives, based on professional opinion, the field appraisal survey and public views;
- To provide early input to the design team regarding potentially significant environmental impacts;
- To help determine the scope of the work for the specialist studies;
- To develop terms of reference for the EIA which focus on key issues and reasonable route and alternatives.

### 1.3.3 Terms of Reference (ToRs)

The terms of reference (ToRs) are pertinent to the preparation of EIA study reports for the construction related projects. The ToRs relevant to individual projects shall be developed by the developer and submitted to ZEMA for review and consideration for approval. The EIA study can only commence after the ToRs have been duly approved.

### 1.3.4 Review and Approval of EIA Report

Following the approval of the ToRs, an EIA study should be conducted and an EIA report prepared for subsequent submission to ZEMA. ZEMA then reviews the report leading to either approval or disapproval of the project through the issuance of a Decision Letter.

### 1.3.5 Validity of a Decision Letter

The decision letter granted for any construction related project is valid for a period of three years. ZEMA may extend this validity period if, following the preparation of a project brief or environmental impact statement, the decision letter that was issued has not led to land preparation or construction work within the stipulated three year period. The developer shall be required to apply for extension of the validity of the decision letter. The extension of validity of the decision letter shall be granted subject to the baseline conditions obtaining at the time of the application.

### 1.3.6 Transferability of A decision letter

A prior environmental clearance granted for a specific project or activity to an applicant may be transferred during its validity to another legal person entitled to undertake the project or activity on application by the transferor or the transferee with a written “no objection” by the transferor, to, and by the regulatory authority concerned, on the same terms and conditions under which the prior environmental clearance was initially granted, and for the same validity period.

### 1.3.7 Compliance monitoring and auditing

In executing the project, the developer shall take all practicable measures to ensure that the conditions attached to the decision letter are complied with. The developer shall undertake an environmental audit of the project within a period of not less than twelve (12) months and not more than thirty six (36) months after the completion of the project or the commencement of its operations, whichever is earlier. However, ZEMA may ask the developer to undertake an
environmental audit at any time, where the audit is necessary. The environmental audit shall be carried out by at least two appropriately qualified persons from those who prepared the environmental impact statement and where this is not possible, by persons whose names and qualifications have been approved by ZEMA for the purpose.

1.3.8 Environmental Impact Assessment report structure

The EIA report outline should conform to the ZEMA stipulated report structure given below:

- Executive Summary
- Table of Contents
- Introduction
- Policy, institutional and organizational framework
- Project Description
- Description of the Baseline Environment
- Analysis of Project Alternatives
- Anticipated Environmental Impacts & Mitigation Measures
- Environmental and Social Management Plan
- Decommissioning and Rehabilitation Plan
- Bibliography
- Declaration of authenticity of report content
- Appendices

Residential housing taking into account the environment
1.3.9 Identification of Developer

The profile of the developer, contact address with e-mail, fax, phone number etc shall form part of the information provided in an EIA report and that should be furnished to ZEMA. All correspondence with ZEMA shall be made by the authorized signatory only. The authorized signatory shall also submit a document in support of his claim of being an authorized signatory for the specific project.

1.3.10 Project Description

A brief description of the project should be provided and should include details of nature of the project, size, location and the justification of the need for the project. Project details such as site description; district, province & extent of the land, latitude & longitude of the boundaries should be provided.

1.3.11 Institutional and Organizational framework

In undertaking the environmental impact assessment, the developer is expected to comprehensively review the institutional and organizational framework and present this as part of the environmental assessment report.
2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter in the EIA report shall include the following aspects:

- Detailed description of the project that includes location, project components, implementation schedules, human resource requirements and material inputs.
- Purpose of the project, goals and objectives of the proposed project; and
- Overall suitability of the site and
- The proposed activity in light of the existing environment.

2.2 DESCRIPTION OF THE PROJECT

2.2.1 Location

The project location should provide among others the following information:

- Maps showing general location, specific location (Road/street and stand/plot number), project boundary, proximity to environmental sensitivity areas and project site layout;
- Major topographic features where appropriate;
- Geographic coordinates including error margins;
- Satellite image of the area if necessary; and
- Digital elevation model/contour map.

2.2.2 Project Components

When describing the project components, the developer should state the nature of the project and describe the different components of the project at all stages of development (i.e. preparation, construction and operation).

2.2.3 Implementation Schedule

The proponent should also submit the detailed project implementation schedule in form of a bar chart, Critical Path Method (CPM) / Project Evaluation and Review Technique (PERT) chart etc., duly bringing out interrelationship of major activities.

2.2.4 Material inputs

A description of all the material inputs to the project and their potential effects on the environment should be provided. Furthermore, the nature of inputs and processes required for the project should be stated. The Developer should give the details of compliance of Acts/Standards related to usage of such material inputs.
2.2.5 Investment cost
The proponent should provide the total estimated investment cost related to the proposed project taking into account all major components of the project.

2.2.6 Human Resource Requirements
The developer should indicate the requirements of various categories of human resource such as skilled, semi-skilled, unskilled workers, technicians, engineers, and managers during the construction phase.

The developer should give the details of compliance of Acts related to employees' service and their welfare as provided for by the Zambian laws. This is because the construction industry is characterized by its casual nature, temporary relationship between employer and employee, uncertain working hours, lack of basic amenities and inadequacy of welfare facilities.

2.3 PROJECT PURPOSE, GOALS AND OBJECTIVES
The project purpose, goals and objectives for the study should be stated and discussed in the environmental impact assessment (EIA) report. This should include among others the need for the proposed project, what the project aims to achieve and the benefits it seeks to bring to the environment and the community.

2.4 SITE SUITABILITY
The site suitability for the project should be evaluated based on the existing laws, compatibility of the project with respect to the gazetted structure or local plans, surrounding land-use, provision of set-backs or buffer zones, the capacity of the area to receive additional pollution load, and waste disposal requirements.

2.5 PROJECT ACTIVITIES
The Developer should provide a description of the anticipated project activities for the proposed development at all stages i.e. site preparation (vegetation marking, clearance, stripping of top soil, trenching, etc.), construction, operation and decommissioning phases. This is necessary because project activities have the potential to alter the physical and socio-economic environment in the vicinity of the project.
3.0 DESCRIPTION OF THE BASELINE ENVIRONMENT

3.1 INTRODUCTION
Baseline conditions define the characteristics of the existing environment and shape projected future conditions, assuming no project is undertaken. They provide the basis from which project impact comparisons are made. Baseline analysis should take into account past trends in environmental quality and other current or proposed development programs in the project area.

Environmental components to be considered are physical, biological and socio-economic environment.

3.2 STUDY AREA
The project study area is critical in defining the surrounding area that may potentially be affected by project activities.

The study area should be defined by:

- A description of the actual area earmarked for development;
- A description of the area surrounding the actual project site; and
- The spatial extent of the area potentially affected by the project activities with respect to safety distances specific to proposed developments.

3.3 BASELINE DATA COLLECTION
Description of the environment should involve collection of both primary and secondary data. This should be based on primary investigations and secondary sources. When secondary data is used the source of data is to be cited appropriately both within the text and under the list of references.

3.4 COMPONENTS OF THE ENVIRONMENT
Description of the environment can be categorized into three main components namely physical, biological and socio-economic environments. For the construction sector, it is mandatory to ascertain the baseline conditions of the following elements of the three environmental components:

- Physical Environment
  - Land
  - Geology
3.4.1 Physical Environment

3.4.1.1 Land

The current baseline conditions of land should be established based on changes in the land use pattern in the past 5 years. Primary baseline data should be obtained by conducting site specific investigations. Secondary data should be obtained from secondary sources such as census records, agricultural and land records. A comparative analysis of the two data sets should be undertaken in order to qualify current baseline conditions.
The land use pattern covering, for example, forest land, total irrigated land, non-irrigated land, cultivable waste land should be given in the form of maps, detailing the total area for each use. Climate, geology, relief, and other biotic interactions influence soil formation. Therefore, the soil samples should be collected, its characteristics (physical and chemical properties) should be analysed as per ZABS standards and such analysis should include the following:

- Particle size and grading based on the texture analysis.
- Soil porosity and Sodium Absorption ratios (SAR) as they are important and are to be assessed for all locations.

### 3.4.1.2 Geology and Hydrogeology

The geological setting of the study area should be investigated; its characteristics that include rock formation, structure, type, and properties described in detail. Further, hydro-geological settings, aquifer characteristics, flow directions and the ground water levels should be studied and submitted. An examination of ground water and surface water in the study area should be conducted for physico-chemical (nutrients, trace and heavy metals) and bacteriological parameters.

### 3.4.1.3 Air

Description of baseline data of ambient air should include particulate matter (PM), nitrogen dioxide, sulphur dioxide, and carbon monoxide among other parameters. Monitoring of ambient air should be done for a reasonable period taking into consideration seasonal changes. The nature of the project, meteorological conditions, topography, selected pollution pockets in the area and likely impact areas will determine the number and locations of ambient air quality monitoring stations.

For the estimation of the most probable wind speed and wind direction, the mean monthly normal of atmospheric parameters should be compiled from data recorded in the previous five years by the nearest monitoring station from the project site; and wind roses for each month giving the wind direction and speed should be recorded.

### 3.4.1.4 Surface Water

For surface water, available water should be quantified by conducting discharge measurements. A comparative analysis with existing secondary hydrological data of the nearest station if no station exists within the project area should be done stating extreme limits of water levels and discharge for a given surface water body. An examination of water quality of all water bodies within the study area should be conducted for physico-chemical (nutrients, trace and heavy metals) and bacteriological parameters.

### 3.4.1.5 Noise

A compilation of the baseline data of noise at the project area and the neighborhood habitat areas should be made and day-time and night-time data should be collected and recorded.

### 3.4.1.6 Topography

The topography of the land generally determines the drainage pattern in the area. A map showing the drainage pattern should be prepared. In addition, the developer should show how
the natural drainage in the area will be modified to contain any potentially harmful pollutant that may find itself into the surface water body.

3.4.1.7 Climate
Describe the climatic condition of the project area (rainfall, humidity, wind, temperature etc.).

3.4.2 Biological Environment
Biological baseline data should be collected from field observations for various terrestrial and aquatic systems as well as secondary sources. The data should be categorized into Fauna and Flora for both terrestrial and aquatic environments.

3.4.2.1 Fauna
Primary baseline data should be generated by conducting field surveys of the wild animals and birds in the study area. The fauna identified should be classified into various schedules. Secondary baseline data on Fauna should include identification of wild life sanctuaries and National parks located within 10km radius from project site based on secondary sources.

3.4.2.2 Flora
The general vegetation of the study area should be described. Primary data on flora should be obtained through fields’ surveys to establish relative frequency, abundance, diversity among other of the flora species in the area. Examination of flora habitats should be done and rare, threatened and endangered species established. A comparative analysis with existing secondary data on flora should be done to ascertain changes in species diversity over time.

3.4.3 Socio-economic Environment
Primary baseline data on the socio economic environment in the study area should be collected through field surveys. Secondary baseline data should also be collected. The issues to focus on should include:

- demographic structure - population distribution, average household size, population density, sex ratio, social structure and literacy levels,
- Economic Activity,
- Health - HIV/AIDS and other diseases
- Education and literacy profile
- Land use and
- Infrastructure resources
4.0 PROJECT ALTERNATIVES

4.1 INTRODUCTION

The consideration and presentation of the various alternatives investigated by the developer is an important requirement of the EIA process. The EIA Report should comprise an outline of the main alternatives studied by the developer and an indication of the main reasons for the preferred alternative. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004). Therefore, an alternative relates to both the purpose and need of a given action.

The objective of the alternative assessment study is to evaluate and compare the available options taking account of technical/ engineering, economic, social and environmental considerations. Alternatives for construction related projects should include technological, site, process, material, design alternatives among others.

Consideration of alternatives in the EIA provides the opportunity for an unbiased, proactive consideration of options, to determine the most optimal course of action in a given project.

4.2 TYPES OF ALTERNATIVES

Alternatives can be classified into several categories (DEAT, 2002). The following are some of the major types of categories:

- Demand alternatives
- Design alternatives
- Technology Alternatives
- Process alternatives
- Materials alternatives
- Scale alternatives
- Site Selection alternative
- Site layout alternatives
- Scheduling alternatives
- Routing alternatives

4.2.1 Demand Alternatives

Demand alternatives arise when a demand for a certain product or service can be met by some alternative means. Thus, for example, the demand for electricity could be met by supplying more energy or through using energy more efficiently by managing demand.

4.2.2 Design Alternatives

Design alternatives must take into consideration available options in order to achieve sustainable development. The construction design and EIA must be two comparative processes harmonized
at all levels with explicit hierarchical structure and defined sequence of data interchange. There is need to have a uniform sequence of data interchange between the planning preparation processes, design process and EIA process which is conditioned by the fact that results of one process are input of the other process and vice versa. Where designers are briefed at an early stage about environmental factors, these can usually be incorporated along with other design parameters. Many construction challenges can be resolved through a number of design solutions by varying layout, massing, alignment, shading, ventilation, etc.

4.2.3 Technological Alternatives

Alternative technology is a term used to refer to technologies that are more environmentally friendly than the functionally equivalent technologies dominant in current practice. These have the potential to deepen our rapid consumption of the natural resources and generate new sources of contamination. When properly designed and implemented, technology can significantly contribute to the efficient use of our resources and pollution prevention.

Sustainable technologies are those that reduce resource (energy, water, and materials) consumption through efficiency improvements, help to strengthen community, and reduce or eliminate the production of toxic substances. In case of sustainable construction design, there are five characteristics the design should possess namely; user Health, Energy Conservation, Resource Efficiency (construction material), Transportation and Affordability. Therefore, consideration of health and safety (HS) issues in construction design should be an integral part of all phases of a project life cycle: planning, design, construction, operations and maintenance, renovation, and decommissioning. Construction design must minimize long term costs by incorporating a flexible design to reduce future renovation costs, the use of long lasting materials with low maintenance.

The use of the alternative construction materials can help reduce the use of non-renewable resources and minimise the impact on natural resources. Use of inappropriate materials can lead to high consumption of water and energy. Therefore there is a need to adopt energy efficient technologies for conservation of energy.

4.2.4 Process Alternatives

Within each design solution there can be a number of different options as to how the processes or activities of the development can be carried out. The selection of process alternatives should be done with due consideration to environmental factors to avoid adverse impacts.

4.2.5 Material Options

Material options shall be guided by environmental considerations which avoid pollution and over exploitation of natural resources. The use of alternate materials must also focus on the management and reuse of waste materials locally available in the project area with the added advantage of economizing the project cost.

4.2.6 Scale Alternatives

In some cases, activities that can be broken down into smaller units can be undertaken on different scales. For example, in a housing development there could be the option of 300, 450 or 600 housing units. Each of these scale alternatives may have different impacts.
4.2.7 Site Selection Alternatives

Development of new construction projects should not have a negative impact on the existing biological diversity and ecosystem of the site. Development of the project on the located site should not disturb sites with heritage and cultural values such as protected grave yards and shrines. Site selection should be carried out in light of a holistic perspective of land use, development intensity, social well-being and preservation of the environment (protect water quality, soils, fauna and flora, etc.) The selected site should conform to designated land use of the area approved by the appropriate authority. Other considerations include orientation in terms of the sun and the direction of the wind.

4.2.8 Site Layout Alternatives

Site layout alternatives allow consideration of different spatial configurations of an activity on a particular site. This may include particular components of a proposed development or may include the entire activity. For example, siting of a noisy component of the project such as a crusher plant away from residences; and secondly, siting of a particular structure either prominently to attract attention or screened from view to minimize aesthetic impacts (Glasson et al., 1999).

4.2.9 Scheduling Alternatives

Scheduling alternatives are sometimes known as sequencing or phasing alternatives. In this case an activity may comprise a number of components, which can be scheduled in a different order or at different times and as such produce different impacts. For example, activities that produce noise could be scheduled during the day to minimize impacts, and activities that may impact on birds could be scheduled to avoid the migratory season (Glasson et al., 1999). Such alternatives could be incorporated into the project proposal and so be part of the project description, and hence need not necessarily be evaluated as separate alternatives.

4.2.10 Routing Alternatives

Routing alternatives generally applies to linear developments such as power lines, transport and pipeline routes. In route investigations, various corridors are investigated and compared in terms of their impacts.
5.0 IMPACT IDENTIFICATION, ANALYSIS AND MITIGATION

5.1 INTRODUCTION

Environmental impacts are classified as direct, indirect and cumulative impacts. The impacts can further be broken down for convenience and clarity to positive and negative impacts, random and predictable impacts, local and widespread impacts, temporary and permanent impacts, long term and short term impacts. The report should as much as possible cover the impacts as described above. Environmental liability of earlier use of the project site should be identified and assessed particularly if there had been an industrial unit on that site. For each of the alternatives provided, appropriate preventive, avoidance / mitigation measures should be given. The project developer should choose the most feasible method. (In choosing find out if feasibility is measured in terms of financial, technology or environmental considerations)

5.2 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

Impact identification is a very important step in the EIA process. It should bring an understanding of project description and the environmental baseline with a purpose of identifying all significant impacts upon a particular environmental component. There are several methods that could be used to identify impacts (DEAT, 2002). These include the following:

- Ad hoc approaches (e.g. expert judgment, project-, sector- or environment-specific guidelines).
- Checklists (i.e. the listing of potential impacts).
- Matrices (e.g. the Leopold Matrix).
- Networks (i.e. the presentation of higher order impacts and linkages using directional diagrams).
- Over lay maps (e.g. the McHarg technique).
- Modelling procedures (i.e. computerized, mathematical, physical scale models or descriptive models).

A method chosen to identify impacts should take into consideration the following:

- Compliance with national relevant legislation
- Comprehensive coverage of the impacts
- Distinction between types of impacts
- The nature of the receiving environment
- Quantitative and qualitative information

5.3 PREDICTING IMPACTS

Upon identification of the potential impacts, further investigation is required to predict the nature of the impact. Impact prediction is fundamental to the EIA process and can be considered to be the next step following impact identification. An impact once identified should then be analysed to assess its relative importance or severity with respect to an environmental
The impact should then be predicted into the future given likely changes to an environmental component as dictated by the project to assess the likely severity. An impact should be predicted in terms of magnitude, extent, and duration. The magnitude of an impact can be considered as the impact severity and may be quantitative or qualitative.

5.4 RANKING OF THE PREDICTED IMPACT

Each predicted impact should be categorized into magnitude, extent and duration. Further, on the basis of severity, impacts should be classified as high (H), moderate (Mo) and low (Lo). Under magnitude, in which (H) is irreversible, while (Mo) and (Lo) are reversible. Under the extent, an impact should be classified as site specific (Sp), local (L) and regional (R). Similarly under duration, impacts should be classified into short term (St), medium term (Mt) and long term (Lt).

5.5 DETERMINING IMPORTANCE WEIGHTING

Importance weighting is a structured approach to impact rating and permits a direct transformation of sum of impact magnitude, extent and duration into impact significance. Importance value should be assigned to the resources to be affected. An interaction table should be prepared where resources anticipated to be affected should be listed in the vertical column and the importance weighting should be marked in the horizontal column, indicating the degree of importance from 1 - 3 where 1 stands for the least important and 3 indicates the highest important. The individual ranking of importance should then be divided by the total score of importance value that provided the importance weighting of each resource to be affected by project implementation.

5.6 DETERMINATION OF SIGNIFICANCE OF PREDICTED IMPACTS

The concept of impact significance is at the centre of impact identification, prediction, evaluation and decision-making. Deciding if a project is likely to cause significant environmental effects is critical to the practice of EIA.

Impact significance is the final step in impact assessment and perhaps the most subjective of all steps. Impact significance is considered at all stages in the assessment (screening, scoping and assessment), is used to highlight the important impacts of the project and can be used to make fundamental decisions regarding projects and all their associated mitigation requirements.

Impact evaluation (assigning significance) should be discussed and agreed with stakeholders through the consultation process. However, significance is defined and reported within the report; it is extremely important that this is accompanied by a clear explanation of the methodology followed to ensure transparency within the process. Additionally, for efficiency purposes reporting should concentrate on impacts which are considered to be significant, with mitigation and monitoring strategies focusing on this.

5.7 MITIGATION MEASURES

Mitigation is described as measures envisaged in order to avoid, reduce and if possible remedy significant adverse impacts. Many types of mitigation measures exist and the EIA report must describe such measures as the ones highlighted under section 6.
5.8 ENHANCEMENT MEASURES

These are measures that aim at improving upon the positive impacts or opportunities associated with the project.
House built with minimal disturbance of vegetation
6.0 MANAGEMENT MEASURES FOR CONSTRUCTION SITES

6.1. LAND DISTURBANCE

Large projects usually involve extensive land disturbance, involving removing vegetation and reshaping topography. Such activities make the soil vulnerable to erosion. Soil removed by erosion may become airborne and create a dust problem or be carried by water into natural waterways and pollute them. Measures to address the impact of land disturbance on the environment should be included in the planning and design phase of the project, before any land is cleared. These measures should be placed into the framework of the segment environment control plan.

6.2 EROSION

When considering land disturbance and its consequences, priority should be given to prevention rather than treatment measures. To develop effective erosion controls it is necessary to obtain information on the erosion potential of the site where soil disturbance is planned. Erosion potential is determined by the erodibility of the soil (type and structure), vegetative cover, topography, climate (rainfall and wind), and the nature of land-clearing. Erosion potential will also be affected by the type, nature and intensity of earthwork. Erosion potential of rainfall can be calculated using the universal soil loss equation. Conversion to SI metric units is given by Foster et al. (1981). The erosion potential of wind can also be calculated, and details are available in a paper by Israelsen et al. (1980).

Information on predicted soil losses from land disturbance should be used to plan and engineer control solutions. Ground cover provides the most effective means of preventing erosion. Consequently, sediment run-off and dust controls depend on retaining existing vegetation or revegetating and mulching disturbed areas as soon as possible.

The following measures should be taken to minimise erosion:

- Keep land clearance to a minimum.
- Avoid wherever possible clearing areas of highly erodible soils and steep slopes which are prone to water and wind erosion.
- Revegetate and mulch progressively as each section of works is completed. The interval between clearing and revegetation should be kept to an absolute minimum.
- Coordinate work schedules, if more than one contractor is working on a site, so that there are no delays in construction activities resulting in disturbed land remaining unstabilised.
- Program construction activities so that the area of exposed soil is minimised during times of the year when the potential for erosion is high, for example during summer when intense rainstorms are common.
- Stabilise the site and install and maintain erosion controls so that they remain effective during any pause in construction. This is particularly important if a project stops during
the wetter months.

- Keep vehicles to well-defined haul roads.
- Keep haul roads off sloping terrain wherever practical.
- Designed the slope of a cut to minimise the angle of incline.
- Cultivating the cut surface will increase infiltration of rainfall and decrease the velocity of water across the slope during rain and therefore reduce erosion.

### 6.3 CONTAMINATED STORM WATER

Soil eroded during land disturbance can wash away and contaminate storm water. If contaminated storm water enters a drainage line or storm water drainage system, it will eventually discharge into an adjacent waterway and pollute it. The type of sediment controls suitable for a particular situation depend on the nature of the site, in terms of such factors as rainfall patterns, soil type and topography. These factors need to be taken into account when selecting appropriate controls and ensuring that designs are adequate. There are a number of ways of minimizing sediment run-off. Reduce storm water on the site. If uncontaminated water enters part of the site that has been cleared, it will quickly pick up sediment and need to be treated. Additional water may also add to the erosion potential, increasing the risk of pollution. It is therefore desirable to divert clean storm water away from those parts of the site where soil is to be exposed. This can be done by constructing diversion banks and intercept drains around the site while ensuring that the water discharging from such banks or drains is disposed of without causing erosion. Wherever possible, the new storm water drainage system should be installed before any land disturbance activities commence. If possible on-site inlets should not be connected until the site has been stabilised and rehabilitated. In this way, silt-laden storm water cannot escape the site via this route and pollute surface waters. It will have to be treated onsite.

### 6.4 WATER VELOCITIES

There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion. Installation of rock structures on the site to retard water flows is an effective measure to reduce erosion in areas where high water flows are expected. It is desirable to minimise continuous slopes where flowing water can scour. To prevent scouring, both sides of the drainage channel and its bottom may need to be lined. Alternatively, velocity-reducing structures, such as rocks or geotextile may be placed in the drainage channel. Where the natural slope is too steep, consideration should be given to the spillway design. For example stepping of spillways greatly reduce the kinetic energy of the flow and therefore reduce flow velocity thus avoiding scouring.
6.5 WATER ABSTRACTION

Over abstraction of water resources for construction activities may affect the availability of the resource for other users including the environment. Abstraction can alter the natural flow regime either directly changing surface water flows or indirectly by lowering groundwater levels and consequently affecting flows to springs, wetlands, lakes and rivers. At identification stage, prior to abstraction of water from a source, thorough hydrological investigations should be conducted to quantify the resource and establish its quality. If the water quality is found to be highly polluted, measures should be put in place to treat the resource to acceptable levels before use. On the other hand, if the overall available water is found to be inadequate to satisfy both the existing users and the proposed construction activity, an alternative water source should be found.

6.6 SLOPES

Any natural drainage lines that discharge water on to the top of a slope should be directed to grassy areas by intercept drains. Otherwise water will run down the slope, eroding it. Perimeter banks or sediment fences should also be constructed at the toe of the slope to contain sediment run-off.

6.7 DE-WATERING WORKSITES

After rain, pooled water is often pumped offsite. Often this water is contaminated with suspended sediment so it is essential that its disposal should not contribute to water pollution. To remove water from the work area, the pump intake should be kept as close to the surface of pool as possible. Floating intakes should be used when the depth of water is sufficient. Care must be taken to avoid pumping from the bottom of ponds, and constant supervision is required during pumping operations to ensure this does not happen. Treatment is required before discharging runoff to a natural waterway or system, where turbidity exceeds 30 NTU9 and is higher than upstream measurements. Hourly measurements of discharge water quality should be taken. Contaminated water pumped off the site should, wherever possible, be directed to vegetated areas. Precautions should be made to ensure that such areas don’t become waterlogged and have adequate capacity to effectively remove suspended solids. Where vegetated areas are not available, then water should be directed to existing or specially provided sediment control structures. Pumping to natural waterways should be supervised through the operations. In urban areas it may be possible to discharge contaminated run-off to sewers. Such a discharge will require approval of the relevant sewerage authority. 9 NTU is an abbreviation of nephelometric turbidity units, which is a measure of light scattered as it passes through a solution. It is not directly related to suspended material, but is a good measure of the clarity of a water sample. It can easily be measured in situ, making it a convenient measurement when an on-the-spot decision needs to be made.

6.8 DUST CONTROL

Disturbance of loose or unstable soil during construction may generate dust which may have a negative effect to human health, cause damage to property and other problems. Prevention of dust generation in preference to applying dust suppression measures should be given priority. For example, clearing of land during the driest months should be avoided to minimize on dust generation. Measures to reduce dust generation include the following:

- Pave and water haul roads. The frequency of watering will be determined by weather conditions and the erodibility of the soil. However, the use of water for dust suppression should
be limited to smaller projects. For bigger projects such as roads covering a long distance, other dust suppression measures such as the use of molasses and other environmentally friendly chemical binders should be explored and applied. Other than haul roads, an area should be watered if it is a source of dust.

- Ensure that smooth surfaces are deep ripped and left rough and cloddy to reduce the wind velocity at the soil surface.
- Construct wind fences if this is appropriate for the site.
- As a contingency measure, in areas that do not have access to a reticulated water supply, enough water should be stored on-site. Wherever watering is used to suppress dust, ensure it does not create contaminated run-off that will contaminate surface water.

6.9 NOISE AND VIBRATION

While no specific statutory controls exist for noise from construction sites, all noise nuisance should be reduced wherever possible from vehicles, fixed machinery within the site, blasting, general construction activities, and from movements of vehicles servicing the site.

- Limit the times of operation of noisy equipment vehicles, and operations as a means of reducing noise nuisance from construction activities, where there are residents nearby.
- Equipment should be regularly serviced and noise from vehicles and powered machinery and equipment on-site should not exceed the manufacturer’s specifications.
- Minimise traffic flows in and out of a construction site during normal business hours when traffic densities are high to avoid causing severe traffic snarls and even pose a danger to other vehicles.
- A provision of earthen embankments or other noise screens should be applied depending on the location of the facility.
6.10 WASTE
When choosing waste management strategies, minimization options should be considered. These options include: waste avoidance and/or reduction, reuse and recycling. Other measures may include:

- Obtaining construction materials, paints, lubricants and other liquids in reusable packaging or containers
- Using overburden to construct temporary noise barriers.
- Sending waste concrete from demolition activities to a concrete recycler instead of landfill
- Segregating and recycling solid wastes generated by construction activities
- Collecting lubricating oil from the construction vehicle fleet and sending it to a recycler

6.11 LOCATION AND MANAGEMENT OF CONSTRUCTION CAMPS
The location of construction camps shall take into consideration the likely effect the camp may have on the environment and surrounding communities. Particular attention shall be given to factors that include distance from built up environment, water bodies, cultural sites, etc. Construction of camps near community infrastructures such as schools shall be avoided unless there are valid reasons for such location and in which case stringent measures shall be put in place to reduce the impact on communities to ensure their safety and health especially for the females. Campsites generate solid waste that require management. To avoid indiscriminate disposal of waste, waste receptacles shall be placed in appropriate places and a program to empty these receptacles and dispose of the waste to designated sites shall be put in place. For safety reasons, fuel storage tanks and oils shall be located at places where the fire risk to equipment, people, and property is minimized. Please note that there will be no asbestos used in the construction of the camp.

6.12 ACCESS TO PUBLIC RESOURCES
Where construction works are going to limit access to natural resources such as water, wild fruits, measures shall be put in place to ensure that the community have continued access to these resources. For instance where communities no longer have access to naturally flowing water body, a borehole may be drilled as an alternative source of water.

6.13 PUBLIC AND WORKER SAFETY
Lack of proper training, traffic control, deficient enforcement of safety, unsafe equipment, unsafe methods or sequencing, unsafe site conditions, not using the safety equipment that was provided, and a poor attitude towards safety can compromise public and worker safety. In order to ensure the safety of the public and workers, principles of prevention to avoid hazards should be applied at all times. During the planning and design stage, hazards should be identified and engineering measures should be applied to eliminate the hazard(s) or reduce the risk. If the hazard(s) cannot be eliminated by engineering design, then safety device(s) should be incorporated. Where both engineering and safety devices cannot eliminate the risk of injury, then warning signs, instructions, and training should be applied.
6.14 CULTURAL AND ARCHEOLOGICAL RESOURCES

Construction activities have the potential to disturb cultural and archeological resources. Unlike cultural resources that can be identified by the local people, archeological resources are normally buried underneath the ground and usually discovered during excavation works. Therefore, all necessary and adequate care should be taken to minimize impact on archaeological and cultural properties which include cultural sites and remains, places of worship and shrines, graveyards, monuments and any other important structures during construction. Measures should be taken to avoid carrying out construction activities on known cultural and archeological sites. Where the cultural and archeological sites are discovered during construction activities, all construction works must cease on that site and the National Heritage Conservation Commission shall be notified of the discovery.

6.15 WATERWAYS AND FLOOD PLAINS

When carrying out construction works in waterways or flood plains, the following measures can be applied:

- Avoid using obsolete equipment and machinery to minimise contamination and noise pollution
- Ensure that the design option for the waterway side banks limit erosion to avoid siltation
- Avoid times of the year when aquatic population may be under stress, such as during migration and spawning
- Schedule works for the driest months of the year and the lowest flow of the waterway.

6.16 STREAM CROSSINGS

When constructing structures meant to be used for crossing streams, abutments should be protected against erosion to avoid washing away of the crossing. In addition, excessive sedimentation in the waterway should be avoided. The crossing should be positioned perpendicular to the flow and located at the narrowest part of the stream. Damage to the stream bed and banks should be avoided. The crossing should be engineered to be stable under the expected vehicle loads. Drainage over the surface of the crossing and access road should have adequate controls to ensure that sediment run-off to the stream is minimised. If a cofferdam is used, minimum downstream flows should be maintained that will sustain the aquatic ecology. Stream crossings also act as sediment traps. Cleaning sediment out behind a crossing should follow the same procedure as for weirs.
the extraction process starts. The extraction sites include borrow pits and quarries. The materials extracted from a borrow pit are soils and laterite while quarries are sources for course aggregates (stones) and quarry dust for various construction projects. Planned measures for operation and rehabilitation of borrow pits may not necessarily apply to quarries.

The following are some of the measures that should be applied to material extraction sites:

- Prepare baseline data/report that provides information on soils, landscape and vegetation at the site.
- Topsoil and subsoil should not be mixed. The minimum distance between topsoil and subsoil in terms of storage should be five metres (5m).
- A consistent blasting schedule should be planned way ahead of the works and the surrounding communities informed.
- Top-soil and sub-soils must be adequately stripped, properly stored maintaining a minimum of five metres (5m) apart, and then replaced without compromising soil quality.
- Warning devices (e.g. horns and flashing lights) and procedures should be implemented before each blasting activity to alert all workers and third parties in the surrounding areas. Use controlled blasting techniques to ensure less noise and acceptable ground vibrations.
- The minimum siting distance from an existing community will be five hundred metres (500m). Where conditions do not allow for such establishment then consideration should be made to relocate affected communities or find an alternative site.
- Borrow excavations and stockpiles should be a minimum of fifty metres (50m) away from water bodies or valley breaks.
- Create a buffer zone around the operational area to ensure safety of workers, communities and animals.
- Dust emissions from extraction activities should be controlled from the source by dust suppressors to reduce the risk of health hazards. Where possible; wet extraction methods should be applied.
- Dust emissions from processing equipment (e.g. crushers, grinders, screens etc.) should be controlled through dust collectors, wet processing or water spraying. Dust control applications should consider the final use of the extracted material in terms of moisture content.
- Internal roads should be adequately compacted and periodically graded and maintained. Speed limits should be imposed to haulage vehicles to avoid raising a lot of dust.
- The site must be formed and re-contoured after the extraction of materials using the overburden. The minimum slopes for quarries will follow the benching profile while borrow pits slopes of 1 in 5 shall apply.
- Both topsoil and subsoil must be replaced evenly and without excessive mixing as the soil may lose capacity to re-vegetate.
- Excessive soil compaction must be prevented or eliminated during and after the operation as over compaction will stifle vegetation growth. The final terrain must be stable, with no subsidence or slope movement.
- Use appropriate erosion control measures until vegetation can be established on a site. Possible erosion control measures could range from crimping straw into the topsoil, to the use of mulches, hydroseeding (a planting process that uses a slurry of seed and mulch), erosion control berms or other structures. Remember that the final landscape must be self-sustaining, require no special maintenance, and must not affect potential uses of the site, compared to original site conditions.
- Smaller, short-lived extraction sites should be reclaimed immediately, and larger sites with a useful lifespan beyond 3–5 years should be subject to on-going rehabilitation. In the event that a portion of the extraction site has deteriorated in quality of material the
6.18 MATERIAL STOCKPILES

The following measures can be used to manage dust from stockpiles:

- Locate all stockpiles within construction area boundaries and, where possible, on paved areas and near construction site entrances.
- Stockpiles should not be located in areas that are sensitive and should not be close to human settlements.
- Locate stockpiles a minimum of 50 metres from drainage courses and storm drain inlets.
- Stockpiles should be protected from effects of excessive wind speeds to avoid dust generation.
- Protect all stock/spoil piles from storm water runoff using temporary perimeter sediment barriers, such as berms, dikes, fibre rolls, silt fences, and/or gravel bags.
- Use plastic or other material to cover stockpiles.
- Use water spray on stockpiles to suppress dust.
- Reduce drop height of materials.
- Increase product moisture where possible.
- Fully enclosing stockpiles.

6.19 DEWATERING OF EXTRACTION SITES

Dewatering involves controlling groundwater in an excavation by pumping from the ground of an area near the excavation site. The other method is direct pumping from the excavation using...
6.19 DEWATERING OF EXTRACTION SITES

Dewatering involves controlling groundwater in an excavation by pumping from the ground of an area near the excavation site. The other method is direct pumping from the excavation using a sump in the excavation. To prevent significant groundwater seepage into the excavation and to ensure stability of excavation side slopes and base, it may be necessary to lower groundwater levels in advance of excavation. Other measures to manage dewatering of extraction sites include:

- Avoid pumping water directly into slopes.
- Ensure to channel dewatered water into vegetated buffer zone, if available.
- Discontinue dewatering if the area shows signs of instability or erosion.
- Channels to be used for dewatered water must be stabilized using grass or vegetation wherever possible.
- Avoid dewatering under heavy rains because the infiltration rate is at a minimum and water will move slower or just the dewatering process will not function.
- Never discharge water that has been contaminated with oil, grease, chemical products directly. In such instances an oil/water separator may be necessary.

6.20 STORAGE OF CHEMICALS AND FUELS

Although it may be necessary to store fuels and chemicals on project sites, this inevitably creates an environmental risk. Spills can severely pollute waterways and land. Reducing the quantities of chemicals and fuel stored on-site to minimum practicable levels is desirable. Where possible, infrequently used chemicals should be ordered just before they are needed. It may be possible to use a mini-tanker to refuel vehicles, instead of relying on a central fuelling point.

The following measures should be taken to reduce the risk of fuel spills:

- Designing storage units to prevent vehicles or fork-lifts puncturing tanks,
- Fitting automatic cut-offs to fuel dispensers,
- Making units vandal resistant.
- Installing bunds (to contain 110% of total volume of storage tank capacity) will prevent spilt fuel escaping and causing environmental damage.

Key design issues are height of bund walls, construction material, vehicular access, and stormwater management. Roofed bunds are strongly preferred. Should a spill occur, then it is necessary to have a contingency plan in place to deal with the clean-up. It should consider issues such as cleaning up spilled material on the site, containing and cleaning up spills which have entered waterways, disposal or reuse of recovered residues, and contacting key company and government agency personnel to advise them of the emergency.
7.0 ENVIRONMENTAL MONITORING PROGRAMME

7.1 INTRODUCTION

Environmental Monitoring includes the technical aspects of monitoring the effectiveness of mitigation measures (including measurement methodologies, data analysis, reporting schedules, emergency procedures, detailed budget and procurement schedules).

The environmental monitoring should focus on key environmental elements that include: Air pollution, Noise level monitoring and Water quality monitoring and ground water level monitoring.

7.2 MONITORING PROGRAMME

The monitoring programme should encompass: a technical plan which spells out in detail the methodologies for measurement, the required frequencies of measurement, the planned location of measurement, data storage and analysis, reporting schedules and emergency procedures, and detailed budgets and procurement schedules for necessary equipment and supplies, technical and administrative man power.

The environmental monitoring should constitute a matrix detailing the following:

- Summary of environmental monitoring covering location of monitoring stations
- Frequency of sampling, method of sampling analysis and data evaluation – during construction and operational stages
- Requirement of monitoring facilities
- Frequency of air quality monitoring of stack emission, static background dust sampling at project boundary and Stack monitoring provisions
- Frequency of water quality monitoring for surface and groundwater for water bodies within the project site and immediate surroundings
- Changes with reference to base line data and compliance to accepted standards
8.0 EIA ADDITIONAL STUDIES

8.1 INTRODUCTION
Where additional information is requested by the regulator in order to make an informed decision, the regulator shall request the developer to undertake further studies. Under these circumstances, the regulator shall clearly define and state what constitutes further studies.

8.2 ITEMS IDENTIFIED BY THE PUBLIC AND OTHER STAKEHOLDERS
Where additional information is requested by the public or the interested and affected parties in order to address an issue, the regulator shall request the developer to undertake further studies. Under these circumstances, the regulator shall clearly define and state what constitutes further studies based on the submission made by the public. The regulator shall be required to inform the public on how the issue has been addressed.

8.3 RESETTLEMENT ACTION PLANS
Where it is established that a sitting community is likely to be affected by the construction project, the developer should prepare a comprehensive resettlement action plan. The Resettlement Action Plan (RAP) should provide:

- Data on the existing socio-economic situation,
- Findings of the EIA study for the resettlement site where this is necessary,
- The schedule of the implementation of the RAP,
- Details of budget provisions for the RAP,
- Institutional arrangements for implementation of the RAP,
- Monitoring mechanisms for the implementation of the RAP.

8.4 DECOMMISSIONING PLAN
When it becomes necessary to shut down the facility related to construction, the owner and the operator will ensure that any negative environmental impact will be minimised. An updated detailed decommissioning plan should be in place before decommissioning works commence. At a minimum, the following main actions will be performed:

- Removal of any chemicals or wastes stored on site. Any oils, chemicals, lubricants or fuels on site at the time of decommissioning will be disposed of or recycled through appropriate registered waste disposal contractors.
After final operation, all plant and equipment will be adequately cleaned, dismantled and stored under suitable conditions until it can be sold, disposed of or recycled through appropriate licensed waste disposal contractors.

The site and buildings will be secured in the event that the site will be vacant for an extended period of time.

If the buildings cannot be reused, the structures will be dismantled and disposed of or recycled through appropriate licensed waste disposal contractors. The Site will be returned to its present state, except for any deep piling, which may be left in its position without any significant impact to the environment.

8.5 IMPACTS AND MITIGATION MEASURES FROM THE DECOMMISSIONING PHASE

The main impact from the decommissioning phase will be the generation of waste.

Relatively small quantities of waste will arise from the site and equipment cleaning phase of the decommissioning plan. If a reuse option cannot be found, the plant and buildings and their constituent materials will also be classified as waste. The materials arising in this situation will be recycled if feasible.
9.0 CONCLUSIONS

The development of these guidelines highlights the need to focus particular attention to issues related to the environment when carrying out construction activities to avoid undue pressure being exerted on limited available natural resources that may lead to environmental degradation. Lack of well elaborated guidance and resource materials specific to construction projects has limited the ability of developers to explore the opportunity for an unbiased, proactive consideration of options during environmental impact assessment, to determine the most optimal course of action in a given project.

Therefore, apart from providing guidance on EIA for construction related projects, these guidelines are a useful resource tool for EIA practitioners, developers, contractors, government agencies and ministries for decision making in considering project alternatives thus ensuring environmental sustainability. On the other hand, application of these guidelines will ensure better quality assessments that provide the necessary information for decision making by competent authorities.
REFERENCES


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