**Arab Republic of Egypt**
**Cabinet of Ministers**
**Egyptian Environmental Affairs Agency (EEAA)**
**Environmental Management Sector**

*Environmental Impact Assessment*

# GUIDELINES FOR MUNICIPAL WASTE WATER TREATMENT WORKS

*SEAM Project*

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# 1 INTRODUCTION

This guideline identifies the main factors to be considered when preparing an EIA for waste water treatment works projects which discharge effluent to non marine water courses. The principals for EIAs for those works discharging to marine or estuarine areas will be the same as those discharging to freshwaters, but likely environmental impacts, and consequently the baseline information required, will differ considerably. They are, therefore, not considered further in these guidelines.

Not all matters in these guidelines will be applicable to every proposal, and this checklist is not exhaustive. The EIA must be tailored to suit the potential impacts of the specific proposal at the specific proposed location(s), and it is essential to focus on relevant key issues.

Use of this guideline alone will not be sufficient to prepare an EIA. Reference should be made to relevant laws and other guidelines, such as Law 4/1994 for the Environment, Law 48/1982 protecting the River Nile and its waterways from pollution, Law 93/1962 concerning disposal of wastewater to municipal sewers, relevant ministerial decrees, EEAA Guidelines for Egyptian Environmental Impact Assessment, and other guidelines. Developers should be fully aware of their obligations under all laws and guidelines applicable to their situation.

The aim of Environmental Impact Assessment (EIA) is to enable the approving authority, the public, local and central government and the developer to properly consider the potential environmental consequences of a proposal, and to make recommendations to reduce the environmental consequences if necessary. It is important to provide sufficient information for the approving authority to make a decision on whether to approve a proposal and if so, under what conditions. The EIA provides the basis for sound ongoing environmental management.

# 2 THE EIA PROCESS

The EIA process should proceed logically through a number of steps. These steps work at two levels:

- technical work undertaken by specialist contributors to the assessment;
- a guiding principle for the EIA overall, providing a structure for the EIA report and co-ordinating the technical contributions;

Each step in the EIA process requires consultation to ensure that all relevant views are being taken into account throughout the EIA process. Ideally consultation should be maintained throughout the EIA process with the developer and designer of the proposed scheme, so that modifications to the design to reduce potential environmental impacts may be introduced before completion of the final design. Consultation with the regulatory authorities, and also with the public, should be initiated at the Scoping stage of the EIA, and thereafter carried out as appropriate. The steps in the EIA process are broadly as follows, and are outlined in following sections of this guideline.

2.1 Description of the project: What type of project is it

2.2 Screening: is an EIA required

2.3 Scoping: What has to be covered and in what detail

2.4 Baseline: What are the existing environmental conditions

2.5 Prediction: What environmental effects will the development have

2.6 Evaluation: How significant are the predicted effects

2.7 Mitigation: Can significant negative effects be avoided or made acceptable

The developer is ultimately responsible for ensuring compliance with the statutory requirements for EIA preparation. A developer may employ a firm of consultants to carry out the assessment. The developer should verify the competence of the firm recruited to prepare the EIA.

The EIA should be prepared by a team with expertise appropriate to the study of the different aspects of the development site. The team should be headed by a project manager, whose ultimate responsibility is to co-ordinate the inputs of individual specialists and to provide an overview. For EIAs for waste water treatment works, members of, or advisors to, the team should include, but not necessarily be limited to, the following:

- socio-economics specialist;
- health (water borne diseases) specialist;
- freshwater biologist, microbiologist or biochemist;
- terrestrial/avian fauna and flora specialist;
- hydrologist/hydrogeologist;
- development planner or landscape architect;
- air quality (odour, dust and noise) specialist;

- transport/roads specialist;
- antiquities specialist;
- process engineer in wastewater treatment.

Some team members may fulfil several of the above roles if suitably qualified and experienced.

Each member of the team, for their specialist subject(s), will follow the basic processes identified above: scoping, consultation, baseline data collection, prediction and evaluation of impacts, and identification of mitigation measures.

The following sections outline the basic steps in the EIA process.

## 2.1 Outline of important characteristics of the proposed project

Details of the proposed project will need to be obtained in order to assess potential impacts of the scheme. The basic minimum in order to complete the following parts of the EIA process will need to include:

- Proposed location of works;
- General layout;
- General unit process and description diagram(s);
- Size in terms of population and population equivalents, present and projected;
- Number and type of connected industries;
- Anticipated influent and effluent characteristics, annual or monthly average discharge data;
- Pre-construction, construction, operation and maintenance activities, estimated staffing, and support facilities and services;
- Required off site investments;
- Life expectancy of major components.

## 2.2 Screening

This is the task of deciding whether or not an EIA is required for a particular project. Basic details of the proposed development will be needed for the project to be screened. For waste water treatment works the size of the population to be served by the works is the critical information required to determine whether an EIA is necessary.

Relevant legislation and guidelines (Law 4/1994 on the Environment, EEAA Guidelines on Egyptian Environmental Impact Assessment) identify projects which must have an EIA, and those projects where an EIA is discretionary or not required. Reference to the Competent Administrative may be necessary where the requirement for an EIA is not clear. The EEAA guidelines classify projects based on Law 4 into three groups, reflecting severity of possible environmental impacts:

- White list projects: those with minor environmental impact. Wastewater treatment plant of 1000 PE (population equivalent) or less fall within this category. The developer applies to the Competent Administrative Authority before construction works are initiated, with a letter of intent, accompanied by Environmental Screening Form
  is not required.
- Grey list projects: those which may result in significant environmental impact. Wastewater treatment plant with a capacity of 1000 to 1 million PE fall within this category. The developer applies to the Competent Administrative Authority before construction works are initiated, with a letter of intent, accompanied by Environmental Screening Form

  of such projects may be required at the discretion of the EEAA.
- Black list projects: those projects which require complete EIA due to their potential impacts. Wastewater treatment plant with a capacity of more than 1 million PE fall within this category. The developer applies to the Competent Administrative Authority before construction works are initiated, with a letter of intent, accompanied by the scoped EIA. The EEAA Guidelines include in Annex 1 sectoral guidelines for establishments that need full EIA.

Further details regarding the procedures to be followed can be found in the EEAA Guidelines.

In most cases, the Competent Administrative Authority would be the Ministry of Housing, New Communities and Public Utilities. This, however, may vary according to the nature of the proposed development.

## 2.3 Scoping

Scoping, or identification of potential environmental impacts, is an important early stage of the EIA process to ensure that the EIA is properly carried out. For a project to be properly scoped, a site visit and preliminary consultations with relevant regulatory authorities must be included (e.g. Ministry of Housing, New Communities and Public Utilities, Governorate and City/Town/Village authorities) at the scoping stage. Ideally public consultation should also be carried out the scoping stage, but it may be more suitable

to postpone consultation with the public until more detailed assessment of potential impacts has been completed. Consultations should involve exchange of information about the characteristics of the proposed project, and assistance to the consultant in identifying regional and local issues and/or sources of information of relevance to the EIA.

From consultations and a preliminary assessment of baseline conditions the consultant must:

- identify the characteristics of the proposed development that are likely to give rise to impacts;
- identify what type of impacts may arise, and;
- determine which environmental resources and people in the vicinity of the proposed site are likely to be particularly sensitive to the above impacts, and what categories of impacts are likely to be a problem in this respect.

If either the project characteristics or the boundaries of the proposed site should change, then the potential impacts may also change, and the scope of the EIA will need to be reviewed.

The EIA process will generally benefit from focusing attention on the key issues of concern. Not all issues identified will have the same degree of relevance for all proposals.

The identification and prioritisation process should result in:

- a list of all issues with a preliminary estimate of the relative significance of their impacts;
- identification of the key issues;
- an explanation as to why other issues are not considered to be key.

The EIA should address the key issues as fully as practicable. However the level of analysis should reflect the level of significance of the impacts and their importance for the proposal. Lesser attention should be given to those issues which have lesser significance. For these latter issues, there should be sufficient analysis to develop a sustainable mitigation strategy for any potential adverse impacts.

The consideration of alternatives, particularly alternative sites or schemes, during the scoping stage is often a good idea, as the amount of information on alternatives is often very limited. The scoping exercise can report why the preferred alternative was chosen on environmental grounds. The main part of the EIA can then concentrate on the preferred option. Alternative processes within the scheme may be dealt with as mitigation.

## 2.4 Baseline Environmental Conditions

Collating existing data is always the first step in collection of baseline information. It can then be reviewed for its relevance to the proposed site, its currency, and used as a basis for determining what survey work may be ne

Original site surveys are almost always bound to be required for most categories of effect, such as air quality, odours and noise; socio-economic situation; water quality and aquatic biology; terrestrial ecology; landscape. Published information usually does not exist at a suitable scale, or is not generally applicable to the development in question. Original surveys should be conducted initially at a general level to identify whether more detailed survey will be required.

Where baseline data is to be collected first hand, careful consideration must be given to the design of the survey and sampling programme. Data collection must focus on the key issues needing to be examined for the EIA (identified during the Scoping process), and should be collected at the appropriate time(s) of year. Consideration of likely monitoring requirements should be borne in mind during survey planning, so that the data collected is suitable for use as a baseline to monitor impacts or success/failure of mitigation measures in the future. The need for long-term sampling should also be assessed as early as possible. This will maximise the time available for this to be carried out.

Data needs to be collected over a sufficiently wide area to make sure that any effects likely to be caused by the development can be assessed. The area involved will not only vary for different proposals, but for the same proposal, will vary for each specialist type of data collected. For example, effects on watercourses or waterbodies should be assessed as far up and downstream as necessary to assess and monitor beneficial or deleterious changes in water quality or aquatic biota. The distances involved will depend on the characteristics of any existing discharge, of the watercourse(s) in question, and on the location and characteristics of other discharges affecting the watercourse(s).

## 2.5 Prediction of Impacts

Impact prediction must encompass both construction and operation of the works. Impacts should be quantified wherever possible, or fully described if not quantifiable. The following should be considered:

- magnitude of impact;
- duration and extent;

- whether impacts are reversible or permanent;
- direct and indirect effects.

Beneficial as well as adverse impacts on the following specific aspects of the physical, socio-cultural and biological environment must be assessed:

- Water quality;
- Social, economic and cultural environment;
- Waste management;
- Air quality;
- Flora and fauna;
- Transport and access;
- Hydrology and groundwater;
- Visual environment and landscape;
- Risk and hazards.

Impacts of the scheme as proposed (i.e. assuming no mitigation) should be clearly identified, so that if for any reason mitigation is not implemented, the consequences will be clearly identified in the EIA. Impacts of the scheme assuming recommended should be identified separately. If mitigation has already been incorporated into the design of the scheme by the developer during the EIA process, then the relevant identification of impacts without mitigation may be omitted from the EIA report.

### 2.6 Evaluation of impacts

Criteria for evaluation of impacts must be stated. Where possible, legislative standards or international standards should be followed (e.g. Egyptian Law 48 water quality standards for discharges to the River Nile and its waterways, US EPA guidelines for sludge reuse in agriculture, etc.). If no suitable standards exist, descriptive criteria may be used, but must be fully explained. Evaluation of significance of impacts should take account of the magnitude, duration and extent of impact, and whether the impact is temporary or permanent.

All predictions of impacts have an element of uncertainty associated with them. The consultant should identify and, where possible, quantify the level of uncertainty associated with these predictions. Some indication of probability of occurrence of impacts should also be included.

### 2.7 Mitigation

Mitigation strategies must be considered both in relation to individual impacts and collectively for all impacts. Many mitigation measures can be incorporated into the early design stages of the project by regular communication between the consultant and developer/designer of the works - mitigation should be an iterative process.

Reporting of mitigation should include such specific features which have been incorporated during the EIA process into the planning and design of the proposed development.

Where mitigation has not already been incorporated into the design or siting of the proposed works during the EIA process, or specific commitment to mitigation measures from the developer has not been obtained, mitigation measures should be included as recommendations, and should be clearly identified as such.

Recommendations for monitoring impacts in the form of an environmental management plan (EMP) should be included. It is not expected that a detailed EMP be prepared for the EIA however an outline of the content and structure and commitment to prepare an EMP is required.

## 3 GUIDELINES FOR THE EIA REPORT

The information provided should be clear, succinct and objective. It should include maps, drawings, photos, or other descriptive detail. Only data relevant to the decision-making process should be included.

The following sections outline suggested chapters, subsections and contents for EIA reports on proposed waste water treatment schemes discharging effluent.

These guidelines include all the information required for waste water collection, treatment, reuse and disposal projects described in EEAA Guidelines for Egyptian Environmental Impact Assessment.

Writing a good report of EIA is a difficult task - it must be technically robust, but at the same time it must be clear, intelligible and unambiguous. Those making a decision on the benefits and disadvantages of a proposed development will not be technically expert in all the areas covered by the EIA report. The principal advice is to keep the report short, and avoid use of technical terms unless absolutely necessary. Technical appendices may be included as appropriate. Suggested contents list for the EIA report:

## Table of Contents

A. Non technical or executive summary
B. Legislative framework
C. Description of the proposed development
D. Potential impacts (scoping), alternatives and consultation
E. Description of the existing environmental conditions within and surrounding the site
F. Prediction and evaluation of significant environmental impacts
G. Mitigating measures and alternative processes
H. Residual impacts
I. Monitoring plan
J. Conclusions
K. Technical appendices (optional)

The non technical summary should be around 4 pages, and certainly no longer than 10 pages (excluding plans). The main text of the EIA report should be around 60-70 pages, and certainly no longer than 100 pages. For more technically complex projects, technical appendices can be used to achieve this. Any individual technical appendix should be no longer than 20 pages (excluding plans, photos, drawings). The non technical summary may be presented as a separate report.

## A. NON TECHNICAL OR EXECUTIVE SUMMARY

The summary must be written in non-technical language to facilitate understanding by all readers. It should be succinct and must give an overview of:

- What the project is;
- What the significant environmental impacts will be;
- What has been done or is recommended to minimise these impacts;
- What significant residual impacts will remain after mitigation.

The content and structure of the summary should broadly follow the heading structure of the EIA report.

## B. LEGISLATIVE FRAMEWORK

This chapter refers to the laws and their executive regulations considered during the planning of the project, e.g. Law 4/1994 on the environment, Law 48/1982 as it relates to limits of certain substances in effluent discharges to the Nile or its waterways, Law 102/1983 concerning natural reserves, and other relevant laws, Governorate orders, guidelines, etc. A list of all approvals and licences is required under any legislation. This list should also identify the relevant authorities involved in the assessment and regulation of the proposal.

## C. DESCRIPTION OF THE PROPOSED DEVELOPMENT

This section of the report should be brief, and may refer to a feasibility study carried out by the developer or their agent. Such a feasibility report should be summarised within the main EIA report, and could be incorporated as a technical appendix. The following should be covered briefly.

### C.1 Objectives and Scope of the Proposal

There should be a clear statement of the objectives of the proposal, including rationale and/or need for the development.

### C.2 The Location

The following information should be provided:

- title details and land tenure;
- land use constraints;
- maps, plans or photographs and a site description, clearly identifying the location of the proposed development relative to:
  - waterbodies;
  - other land and water uses;
  - other waste water treatment works and potable water treatment works in the vicinity;
  - vegetation communities;
  - infrastructure, roads, utilities;
- compatibility of the proposal with:
  - any strategy such as local management plans;
  - existing land and water uses both on the site and on adjacent land and water;
  - any historical sites or environmental protection areas.

### C.3 Description and Layout of the Proposed Development and Associated Facilities

The following information should be provided:

- maximum land and water area affected by the proposal;
- on-site plans, layout, photomontages or similar, and cross sections identifying the existing and proposed facilities (of both the treatment works and any off site associated pipework or sewage collection systems);

- quality and quantity of existing and proposed effluent discharges;
- design/type of discharge proposed and its location;
- a description of the predicted inputs to and outputs from the works, e.g. population equivalent to be served, predicted effluent flows, quality and quantity of sludge and screenings produced, method and site(s) for sludge and screenings treatment and/or disposal, incoming/outgoing material and vehicles during operation of the works;
- a description of the size and type of the works proposed, e.g. method and degree of both treatment (drying, digestion etc.), number and dimensions of treatment vessels, storage tanks, pumps, etc.;
- types, quantities and storage arrangements for chemicals used in sewage treatment (e.g. Chlorine gas);
- power supply requirements and proposed energy conservation measures;
- details of access arrangements and whether these are completely new, upgraded or already in existence;
- identification of drainage lines and on site surface water management systems;
- employment during operation;
- arrangements for effluent treatment or storage during maintenance and/or breakdown of plant.

### C.4 Site Preparation and Construction Methods

Describe the works required prior to commencement of operations, including:

- any additional land requirement during construction period;
- timing, staging and hours of construction work;
- proposed construction methods including temporary works, the equipment to be used;
- methods and route of transport of the equipment to the site;
- pollution control systems, e.g. erosion and sediment control systems, wastewater holding tanks, noise and dust mitigation strategies;
- import or export of material to/from the site, including method and route of transport;
- any stabilisation structures or earthworks including dredging, reclamation, excavation or landfill, quantities of material to be moved out of or onto the site, the method of disposal of excess material, the sources of material to be brought to site;
- details of the workforce, including source, expected numbers and distribution throughout construction;
- details of potential land contamination which may constrain work on the site or disposal of excess material.

### C.5 Other Services in the Locality

Where applicable, outline:

- the capacity and type of any nearby waste water treatment facility;
- the relationship of the proposed development to previous or existing operations;
- past environmental performance of similar nearby works, including impacts on the environment and the effectiveness of any impact mitigation.

## D. POTENTIAL IMPACTS (SCOPING), ALTERNATIVES AND CONSULTATION

The section summarises the outcome of the process of identification and prioritisation of potential impacts, it should include:

- all issues identified;
- the key issues which will need a full analysis in the EIA;
- the issues which will not need a full analysis in the EIA, and the reasoned assessment of why they do not need full analysis.

A summary of the general alternatives (e.g. alternative locations, alternative schemes) should be given, with the reasons for the selection of the preferred option.

The section should include details of who has been consulted, and the outcome of such consultations.

### D.1 Potential Impacts (Scoping)

Scoping of the EIA should develop from a preliminary investigation of baseline conditions, consultation with regulatory bodies, and a preliminary site visit.

For waste water treatment works, the construction phase is likely to give rise to negative impacts regarding land take, noise, dust, traffic, and movement into and off the site of materials - especially large tanks, etc.

During operation of any waste water treatment works positive impacts may occur on the quality of a watercourse to which a works already discharges, and on health and living standards of local

residents. Negative impacts on water quality of a receiving water may also occur, if it is not currently used for effluent disposal.

Negative impacts are likely regarding loss of useful land to the works, odours, noise, traffic and landscape.

Disposal of sewage sludge generated may be either a positive impact (if of suitable quality, adequately treated and used in agriculture), or a negative impact (if of unsuitable quality for use in agriculture, insufficiently treated, or disposed to landfill or other waste disposal site). Other impacts, both positive and negative, will occur, but will depend on the particular site, proposal and circumstances.

The procedures or methodology used to identify and prioritise issues should be outlined. This should include:

- relevant guidelines issued by government authorities, provisions of any relevant environmental protection legislation, and relevant strategic plans or policies;
- relevant research or reference material, effluent or waste water treatment studies, and relevant preliminary studies or pre-feasibility studies.

### D.2 Alternatives

The EIA should include an assessment of the environmental impacts or consequences of adopting alternatives, including:

- alternative location(s);
- alternative schemes and layouts of the development and services (these may be further developed under mitigation section);
- alternative management or operational practices (these may be further developed under mitigation section);
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The scoping exercise can explicitly report on what grounds the preferred alternative was chosen. The main part of the EIA can then concentrate on the preferred option.

### D.3 Consultation

The EIA report should included details of consultation undertaken as part of the EIA process. Consultees should include relevant government agencies, NGOs, and the public. A brief description of the reason for and the outcome of consultation should be included.

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regulatory powers or responsibilities concerning planning control (including roads and traffic), waste disposal, discharge limits to fresh waters, emissions to air and application of sludge to land must be consulted. Other agencies or departments might include those responsible for historic monuments, conservation of natural resources, etc., as appropriate. These might include, the Egyptian Environmental Affairs Agency (EEAA), Governorate representatives, Ministry of Housing, Communities and Public Utilities, Ministry of Agriculture, Food Security and Land Reclamation, Ministry of Transport, Communication and Shipping, Ministry of Health, NOPWASD (National Organisation for Potable Water and Sanitary Drainage), and relevant Community Development Associations (CDAs).

## E. DESCRIPTION OF THE EXISTING ENVIRONMENTAL CONDITIONS WITHIN AND SURROUNDING THE SITE

An overview of the existing environment should be provided in order to place the proposal in its local and regional context, and to provide baseline data which may be used for subsequent monitoring.

General information to be provided for specific issues identified as potentially important in the assessment of impacts from waste water treatment proposals is discussed in the following subsections, and includes:

**E.1** Water quality and hydraulics;
**E.2** Socio-economic and cultural environment;
**E.3** Waste management;
**E.4** Air quality;
**E.5** Flora and fauna;
**E.6** Transport and access;
**E.7** Hydrology and groundwater;
**E.8** Visual environment and landscape;
**E.9** Risk and hazards.

Data must be specific to the proposed site, rather than general information on a particular area, and the EIA should only deal with issues relevant to the proposal being assessed. Each issue and the level of detail should match the level of importance of the issue in decision-making. To make the EIA report easier to read, it may be sensible to include the specialist detail for each of the following sections as a technical appendix to the report, with a summary of each section in the main EIA report.

### E.1 Water Quality and Hydraulics

As improvement in water quality is usually the driving force for provision of waste water treatment, this aspect of the environment is of primary importance in the EIA. Discussion should

focus on those water quality characteristics that may alter, and on the assimilation capacity of the water body to which the proposed works will discharge.

Both positive and negative changes in water quality will need to be quantified, and therefore baseline data will be required. The existing microbiological, chemical, biological and hydraulic conditions in the water body to which the works currently discharges, and if not the same, to which it will discharge should the development be approved, must be assessed. Baseline data collected should be sufficient that predicted conditions should the development be approved may be calculated.

The following water quality indicators and hydraulic conditions must be assessed for both the existing and proposed effluents, and for both water courses to which the works will discharge, and for any water course affected by existing discharges:

- faecal coliforms (as indicators of faecal contamination),
- levels of dissolved oxygen and Biochemical Oxygen Demand,
- particulate matter (increased turbidity and reduced light penetration),
- chemical contaminants from likely industrial or agricultural sources such as metals, biocides and hydrocarbons;
- aquatic biological indicators (invertebrates);
- nutrients (nitrogen and phosphorus).
- water quantity (daily inflow for small treatment works, dynamic inflow conditions for black list treatment works (see section 2.2))

Data should be obtained from sufficiently far upstream of the proposed discharge (and existing discharge, if any) to be able to estimate background conditions for the area/length of the watercourse affected, or likely to be affected should the project be approved. Care should be taken that no other discharges exist between the proposed discharge point and the point used for sampling background conditions. Samples should be taken as far downstream to permit assessment of the distance over which the discharge will be assimilated by the water course, or to the next discharge downstream if any.

Scoping should identify what may be likely sources of industrial contaminants in the catchment area, which may then require baseline measurement or monitoring.

As well as the obvious direct changes in water quality due to a changed or new effluent discharge, changes could result from secondary or cumulative effects of the development (during construction and/or operation). Points to consider include:

- accidental, deliberate or managed discharge or release of materials,
- individual sources of change from works construction (e.g. spillage of fuels, suspended solids such as cement dust, lubricants, etc.),
- activities that alter flow regimes, erosion and sedimentation patterns and water chemistry,
- run-off from site and road areas.

For large size projects or projects in ecologically sensitive areas, it is highly recommended that the evaluation of the environmental impact for larger treatment works, i.e. categorised in the high end of the grey list projects and all black list projects, are analysed on the basis of a dynamic model.

The modelling activity should preferably encompass the water quality and hydraulic conditions for the catchment (the sanitary drainage system), the treatment works and the receiving body. The modelling activity must consider both the existing and planned (future) conditions. It is recommended that the modelling of the existing conditions are validated against field measurements.

## E.2 Social, Economic and Cultural Issues

Social impacts of waste water treatment schemes are often indirect and complex to assess, and consequently often not adequately addressed in EIA. Baseline data collection should cover the following:

- existing health of the local population (in quantitative terms where possible) which may be affected by provision or change to waste water treatment or collection (e.g. local incidence of water borne diseases);
- existing potable water usage of the community, which may be affected after provision of waste water collection and treatment system;
- existing charging structure and cost of waste water disposal, which may be affected by provision of different waste water collection and treatment systems;
- impacts of existing waste water disposal systems which may be affected by provision of different systems;
- existing and projected water treatment facilities for potable supply, which may be affected by provision of different waste water collection and treatment systems;

- local employment conditions which may be affected during construction and operation;
- existing economic situation which may be affected by provision of different waste water treatment, especially concerning:
  - other developments,
  - land values,
  - agriculture,
  - tourist facilities;
- identification of items or sites of cultural or historical significance likely to be affected by the proposal, and an assessment of their cultural and/or financial importance.

Areas or sites of particular social or cultural importance or sensitivity should be plotted on maps or diagrams, shown in relation to the proposed development.

## E.3 Waste Management

Disposal of waste products is an important aspect of EIA for waste water treatment works, which is often omitted or not fully investigated. Data on existing and proposed waste management systems should include:

- likely opportunities for re-use of sewage sludge and/or effluent (e.g. availability of agricultural land, attitudes towards use of sewage sludge in agriculture, ease of distribution of sludge to end users, legislative requirements for such re-use);
- potential sites and routes for disposal of sewage sludge if unsuitable for re-use in agriculture, and quality required of sludge for disposal;
- potential sites and routes for disposal of screenings waste;
- potential disposal sites and routes for excess material from the site during construction.

## E.4 Air Quality

Air quality is likely to be significantly affected by any waste water treatment works proposal, both during construction and operation. Likely major issues include dust sources during construction, and odours and aerosols produced during operation of a treatment works. Noise generated during construction is also likely to have a significant impact if the proposed site is near centres of population, or if construction of a waste water collection system is included within the proposals.

Assessment of baseline conditions should include:

- identification of sources of existing odours at or near the proposed site;
- identification of sources of existing dust generation which may affect the proposed site;
- identification of sources of existing noise which may affect the proposed site.
- collection of meteorological data which will affect distribution and severity of air quality impacts, in particular:
  - strength and direction of prevailing wind
  - rainfall frequency, duration and quantity.
- collection of topographical information which will affect distribution of air quality (e.g. steep slopes, presence of tall vegetation)
- identification of sensitive receptors (e.g. schools and hospitals which may be affected by odours, dust and noise; important crops or natural areas which may be affected by dust and/or noise) within the area likely to be affected by improved or deteriorating air quality.

Consideration should be given to providing modelling studies to determine the likely distribution of odours, dust and noise during operation of the works.

## E.5 Flora and Fauna

Terrestrial and/or aquatic flora and fauna or their habitats which are likely to be disturbed or obliterated during construction or operation of the project must be identified and their importance evaluated. As a general rule, distribution data should be presented as habitat or species location maps, shown in relation to position of the proposed works. Data collection and surveys should include:

- identification, description and distribution of areas of terrestrial and aquatic habitats that may be directly or indirectly affected especially those:
  - supporting threatened or protected species or habitats;
  - of commercial importance (e.g. for agriculture, aquaculture or fisheries);
  - of nature conservation or scenic importance.
- assessment of the importance of the habitats or species identified above, in terms of International, National, Regional or Local importance.

## E.6 Transport and Access

Information to allow assessment of potential transport and access impacts should include:

- assessing condition and size of roads on route(s) to be used during construction and operation of the development;

- assessing existing traffic levels on these routes, at different times of year and times of day;
- assessing suitability of access to the site for vehicle sizes and types likely to be used during the construction and operation of the scheme;
- investigation for the presence of particularly sensitive developments on routes likely to be affected, e.g. schools on construction or operational routes.

A detailed traffic study may be required where vehicle movements are likely to significantly affect the community.

### E.7 Hydrology and Groundwater

Hydrological issues to consider which may either be affected by the development, or affect the development itself include:

- existing drainage patterns, including the location of wadis and identification of areas prone to flash floods, the range of water heights/depths in the area, daily flushing regime, storm surge or flood levels;
- groundwater regime and quality, e.g. depth to groundwater level, whether groundwater is used for water supply and its quality, whether control of groundwater is already exercised in the area;
- presence and importance of structures likely to be affected by changes in groundwater levels (such as buildings, bridges, flood mitigation works).

For larger treatment works, it is highly recommended that the hydrology and ground water conditions are analysed on the basis of a numerical model.

### E.8 Visual Environment and Landscape

The nature of the existing visual environment and landscape should be assessed for their sensitivity to impacts such as changed or obstructed views. Particularly sensitive receptors likely to be affected in the vicinity should be identified, such as tourist establishments, prestigious developments, schools, etc.

### E.9 Risk and Hazards

Existing potential hazards to identify, and if possible to quantify, which may affect or be affected by the proposals, include:

- storage and handling of hazardous materials;
- likelihood of release of chemicals, natural occurrences such as floods, storms, landslip, fire, explosion.

## F. PREDICTION AND EVALUATION OF SIGNIFICANT ENVIRONMENTAL IMPACTS

This chapter should include a discussion of impacts during both construction and operation of the proposed scheme. Impacts of different aspects of the proposed scheme on the above sectors of the environment should be considered separately.

Criteria for evaluation of the significance of impacts should distinguish between impacts which are:

- positive and negative;
- reversible and irreversible;
- short term and long term;
- direct, indirect or cumulative.

Criteria should be based on local legislative standards wherever possible. Where these are not available, acceptable international standards should be used (e.g. WHO, US EPA, etc. guidelines). In all cases the choice of the appropriate standard must be robust and defensible. If no suitable standard is available, then the criteria developed and used must be clearly explained in the EIA.

Use of matrices can be very helpful in co-ordinating and summarising information for this section of the EIA report.

For this section of the report, impacts should be considered before or without mitigation, unless particular mitigation is already incorporated into the design and development description included in the earlier part of the EIA report.

Examples of potentially significant impacts of waste water treatment developments include (but are not restricted to):

- positive impacts on water quality, health of local population, aquatic flora and fauna currently affected by untreated or inadequately treated discharges;
- negative impacts on flora and fauna or local inhabitants by occupation of site or direct removal of habitats of nature conservation, agricultural or aquacultural importance;
- positive impacts by provision of sewage sludge for use in agriculture, or this impact could be negative if the sludge is not adequately treated;
- negative indirect effects, e.g. dust generated during construction affecting crop growth, damage to crops by spillages or leakage onto adjacent land or into irrigation waters.
- positive effects on local economy allowing rapid development, by provision of waste water treatment. This impact could also be negative if increased flows to the waste water treatment works resulted in there being inadequate capacity to treat additional waste waters generated.

## G. MITIGATING MEASURES AND ALTERNATIVE PROCESSES

This section considers mitigation measures and strategies to reduce negative impacts on different sectors of the environment. Mitigation must be sustainable, integrated and feasible.

Some mitigation measures should be implemented at a very early stage of design of the works easily, but are difficult or expensive to implement once early design has been completed. Therefore it is vital that any mitigation should be discussed and developed in consultation with the developer and regulatory authorities throughout the EIA process.

This section of the EIA report should therefore be a summary of any mitigation already implemented in the ongoing design of the facility, and also include any recommended mitigation strategy to be implemented during construction and operation of the works.

This section may also include any enhancement measures for which there is a commitment from the developer, which will enhance any positive impacts of the development. This may include measures such as planned public education programmes in the use and operation of water collection and treatment systems.

Suitable mitigation for waste water treatment works will depend on the design and layout of the works, as well as the local environment, and location.

Examples of measures to reduce negative impacts may include, but will not be restricted to:

- relocation of a discharge to obtain greater dilution and/or avoid particularly sensitive habitats;
- alteration to treatment method to obtain higher quality of effluent;
- provision of larger areas for sludge drying beds to ensure adequate drying so that sludge can be safely re-used in agriculture;
- paving of roads to reduce erosion by traffic;
- re-routing of construction traffic to avoid sensitive developments such as hospitals;
- reduce dust damage to nearby crops;
- provision of by-passes or parallel treatment systems to avoid untreated or partially treated effluent being discharged to watercourse during maintenance or plant breakdown;
- restrictions to working hours or changes to methods of working to avoid dust/odour/noise nuisance to local inhabitants.

## H. RESIDUAL IMPACTS

This section should give a summary of those impacts which will remain assuming mitigation has been implemented. It will therefore include those impacts for which there is no suitable or only low levels of mitigation, and positive impacts. Assuming all suitable mitigation has been incorporated into the design, or recommended and will be implemented, for waste water treatment works these are likely to include, but not be limited to:

- improvements to water quality of receiving waters;
- availability of treated sewage sludge for use as fertiliser;
- improvements in local health due to reductions in water borne diseases;
- slightly increased local employment to operate the waste water treatment works;
- occupation of land formerly occupied by agriculture, natural environment or development;
- temporary disruption during construction;
- visual impact of waste water treatment works.

## I. MONITORING PLAN

This program should be carefully designed and related to the predictions made in the EIA and the key environmental indicators. This should be designed to demonstrate the potential ecological sustainability of the proposal. The EIA should outline the need for, and use of any proposed monitoring plan, its duration and reporting procedures, define suitable criteria for monitoring, and actions to be taken in the event of non-compliance with these criteria.

Parameters which may be relevant include:

- performance indicators in relation to critical operational issues including:
  - water quality,
  - sludge and screenings (quality and quantity),
  - noise and air quality,
  - public health indicators,
  - flora and fauna.
- monitoring of complaints received.

Commitment to monitoring may be demonstrated by production of an environmental management plan. This is a document designed to ensure that the commitments in the EIA, subsequent assessment

reports, and approval or licence conditions, are fully implemented. This should demonstrate that sound environmental practices will be followed during the construction and operation of the development. It should cover the following:

- management of construction impacts, (e.g. disposal of waste material, re-vegetation management plans);
- management of operational impacts, (e.g. effluent and sludge quality and quantity management, plant maintenance plans, hazardous materials and fuel management, transport management, site security plans, emergency and contingency plans);
- strategies and action plans to feed information from the monitoring program into the management practices;
- Public awareness and training programmes for operational staff;
- indicators of compliance with licensing and approval requirements.

The Environmental Management Plan should describe the following monitoring details:

- the key information that will be monitored, its criteria and the reasons for monitoring (e.g. limits of parameters such as BOD, faecal coliform bacteria, suspended solids, Ammonia and nutrients to be achieved in the effluent);
- the monitoring locations, intervals and duration of monitoring (e.g. sample for analysis of faecal coliforms to be taken 10m upstream of discharge, discharge itself, and 10m downstream of discharge, once per week);
- actions to be undertaken if the monitoring indicates a non-compliance with the defined criteria or an abnormality (e.g. inform WWTW site manager in writing of parameter exceeded and expected action to be undertaken);
- internal reporting procedures and links to management practices and action plans (e.g. WWTW site manager to review and remedy disinfection processes if faecal coliform levels are above the specified maximum);
- reporting procedures to relevant authorities and, if appropriate, to the consent authority or the community.

## J. CONCLUSIONS

This should be a summary of sections F, G and H of the report (prediction and evaluation of impacts, mitigation and alternative processes, and residual impacts), to emphasise:

- which impacts are likely to be significant;
- how significant they will be;
- which parts of the environment are likely to be affected;
- whether mitigation is possible;
- the likely success of mitigation measures adopted or recommended to alleviate those impacts.

This information can be presented either as text, or as summary tables, if desired.