REPUBLIC OF YEMEN

Ministry of Water and Environment
National Water and Sanitation Authority (NWSA)

Water Sectoral Environmental Assessment and
Project Specific Environmental Assessment

Urban Water Supply and Sanitation Project Contract No. NWSACS-3

Draft EIA Report

Dhamar
August 2009
REPUBLIC OF YEMEN

Ministry of Water and Environment

National Water and Sanitation Authority (NWSA)
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<tr>
<td>AIEC</td>
<td>Average Incremental Economic Cost</td>
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<td>CBGs</td>
<td>Community Based Organizations</td>
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<td>DP</td>
<td>Development Plan</td>
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<td>EA</td>
<td>Environmental Assessment</td>
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<td>ECO</td>
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<td>Government of Yemen</td>
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<td>Infant Mortality Rate</td>
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EXECUTIVE SUMMARY


The assignment is divided into two main components; the preparation of Sectoral Environmental Assessment for the water and sanitation sector in addition to the Specific Environmental Impact Assessment Studies for the fourteen urban centers all over the Country. Preparation of the specific environmental assessment entails the preparation of the Draft Environmental Impact Assessment Reports and the Management Plan, followed by the revision of the Client before submitting the Final EIA and EMP Reports, as the last component of the assignment.

Based on the contract agreement of conducting the specific environmental impact assessment studies of a total of fourteen urban centers. The assessment was a condition of the donors for implementing the development plans under the water and sanitation sector. Each of the urban centers was studied thoroughly through other contracts; a feasibility studies and preliminary design were prepared for proposed water development and supply systems. In addition to studying the sanitation systems and wastewater treatment plant and reuse facilities.

The proposed development projects at Dhamar urban center was classified as Category "A" under the World Bank project category list, which requires a full EIA study. The study was commenced with the field investigations and collecting the necessary environmental and socioeconomic data. This was followed by conducting a comprehensive public consultation sessions at the targeted center. The results of the consultations were considered in the analysis.

The Consultant defined the valued environmental components in order to analyze and evaluate the anticipated negative impacts for the new water and sanitation projects and the current improper measures at the center under implementation. After conducting the analysis of the anticipated negative and positive impacts, it was possible to define the necessary mitigation and protection measures that need to be taken during the construction and operation phases. These measures were translated into an environmental management and monitoring plans with all required implementation mechanisms.

The Consultant adopted the World Bank Operational Guidelines 4.01 for the year 1994 and the related safe guards' policies to conduct the required EIA components. The current Yemeni laws and bi laws that are related directly and indirectly to the environmental impacts of the project were reviewed and considered.

This EIA Report entails ten Chapters, four of them are related to the environmental assessment and mitigations at the project sites and the Environmental Management Plan, where the others discussed the legal aspects, community consultations, base line conditions and the results and recommendations. The proposed water development, water supply, sanitation and wastewater treatment projects will definitely create a number of negative impacts during the construction phase and minimum impacts during the operation phase. The generated impacts differ from one case to another, but most of these impacts are manageable and mitigable. The main impacts were the land and property acquisition near the proposed expansion project of the WWTP in addition
to the interference with the traffic and the current services to the residents. The uncontrolled usage of treated wastewater by the farmers is another challenge that was defined and the necessary mitigations were proposed. Details of all the anticipated negative impacts and the requested mitigation measures were provided in the Report.

The proposed development projects will improve the standard of living of the local communities within the project area and deliver the necessary water and sanitation services to the citizens of Dhamar City. This project will improve wastewater treatment and reuse aspects for the residents and farmers through introducing a civilized infrastructure to the required standards in Yemen. These projects will relief some of the city districts from the daily suffering of discharging the sewage from their septic tanks and minimize the risks of pollution due to the flooding of the cesspits.

The scoping session activity was fruitful and touches base with the main concerns of the communities and resident. The main concerns were the expectations of the traffic congestions due to the narrow roads in the City and the suffering due to the introduction of the detours and secondary roads, fear of land acquisitions, expected delay in the construction, dust and noise pollution, expected interruption in the public services like the communication, sanitation and water facilities due to the construction works and other concerns which were elaborated in separate chapter of this report.

It is essential that most of the mitigation measures will be implemented at the impacted areas level in order to ensure the sustainability of the projects particularly during the construction and operation of the project with an effective participation of community and beneficiary groups. The Client should ensure that communities are involved in the progress of implementing the project with proper usage of the new infrastructure.

It is also important to undertake monitoring program in terms of implementing the proposed environmental plan so that the proposed mitigation measures are implemented. The monitoring should also foresee other environmental impacts that are probable to emerge and lay down strategies to overcome these impacts. The Client, represented by the local corporation in Dhamar City, should create a specialized unit supervised by an Environmental Control Officer to follow up the implementation of the proposed mitigation measures and the management plan.

Proper implementation of the EMP requires sound cooperation and coordination among all the stakeholders that will participate in the planning, implementation and monitoring of all the proposed mitigation and preventive measures.
CHAPTER 1: INTRODUCTION

1.1. Background


The rational behind the study was stemmed from the fact that water supply and sanitation sector of Yemen has currently employed remarkable efforts to meet great challenges, particularly for the next 10 to 20 years. Major deep groundwater aquifers are depleting causing often-serious groundwater quality deterioration. Additionally, only insufficient information about distribution networks and house connections exists. Within the study of urban centers, main focus was given on the technical improvement and maintenance of water supply facilities as well as the economic operation and management of water resources.

In connection with reduction of water availability, increase of the population and their water demand, the Government of Yemen developed an appropriate strategic water policy and published several programs and projects to improve the water supply and sanitation for several urban centers. Presently the existing water sector planning will be assessed under environmental aspects by the means of the Sectoral Environmental Assessment (SEA) which is a useful tool for the policy to incorporate important environmental aspects into the management of groundwater resources, the wastewater treatment and the water reuse.

Due to the lack of information and approved feasibility studies and water resources reports of the fourteen urban centers during the progress of phase II of this study (end of 2006 and all the year 2007), it was more practical to freeze the works until the feasibilities documents of the two Consultants of Groups I and II accomplished their works and their reports became accepted and official by the Client. By the end of 2007, both the Consultants CECl and Arcadia accomplished their works on the Water resources reports (Task A) and the feasibility studies and preliminary design reports (Task B).

The Client requested the Consultant to resume the works (Reference PMU letter 01/2608 dated 22/9/2007) regarding the resumption of the work. This was followed by reviewing the work schedule and set ups to meet the deadlines of the project.

This Draft EIA Report entails the analysis of the exist environmental conditions at the City of Dhamar and the anticipated impacts after the construction of the water and sanitation projects as scheduled until the year 2025. The report entailed the proposed mitigation measures and environmental management and monitoring plans.

1.2. Study Objectives

The requested assignments of this study was carried out by Domier Consulting in accordance with the TOR of the Ministry of Water and Environment and the World Bank operational guideline OP/BP 4.01, in two main phases; first, the Sectoral
Environmental Assessment Study considering the ongoing program of Yemen's Urban Water and Wastewater Sector which was accomplished. In the second phase, Project Specific Environmental Assessments for fourteen selected urban centers of the country are under consideration. These selected urban centers are Ma‘abar, Attaq, Al-Ghaida, Mareb, Dhamar, Al-Ba‘aidah, Al-Jawf, Daita‘, Damt, Shebam, Al-Mahwit, Khamer and Manakha.

1.3. Work Approach and Methodology

Work is scheduled into two main phases as mentioned previously. Work approach and Methodology for each of these phases will be elaborated in the following sections. Phase I which entails the Sectoral Environmental Assessment of this study which was accomplished and completed in 2006. The second stage is the specific environmental impact assessment of the fourteen urban centers which should generate 14 EIA studies, this report is one of these reports. The following are the main steps that are requested during the implementation of this phase of the study.

Phase II: Project Specific Environmental Assessments (PSEA)

Phase II consists of the following tasks which were partially accomplished:

> Stage (1): Scoping and basing on the SEA report

Preparation of Environmental Impact Assessments (EIAs) for 14 selected urban centers in Yemen will be based upon the guidelines developed by the SEA in Phase I. A standardized tool will be available for World Bank classification of water supply and sanitation projects in these centers.

> Stage (2): Preparation of Environmental Assessments

That will entail the following sub-tasks:

✓ Inventory of documents and information:

Acquisition of data and information from studies, maps, interviews with agencies and specialists, about all relevant water supply and sanitation projects issues and under consideration of special requirements of each project (e.g. nature and conservation, local economy, mining if any, health service, urban planning, infrastructure development).

✓ Compilation of environmental and socio-economic baseline data:

Environmental and socio-economic configuration, project-specific spheres of potential impacts in direct and indirect realm of project areas will be collected, registered from documents and information, field investigations. The compilation takes place for the relevant issues as stated in the sub-project guidelines of the SEA-Report. Special attention will be given to the Environmental Baseline Resource Map drawn up by the engineering consultant.
Each water supply and sanitation project has impacts on the environment and belongs to the category A or B-class of the World Bank Environmental Assessment classification, so PSEA must be carried out. In several screening and scoping meetings the essential issues and investigations (cf. interactions between the project and public/private activities) must be discussed with all relevant authorities and agencies, taking the criteria of the guidelines of the SEA-Report into account. In the meetings all documents, information and remarks on the subject must be presented by all relevant authorities and related groups.

Field investigations and data analyses:
It should be checked, whether investigations on potentially impacted areas and analyses of existing data sets might be supplemented by field measurements or laboratory analyses, performed by the engineering consultant.

Environmental Impact Assessment of Impacts on the natural and socio-cultural resources by the project:
Main objective of the EIA is the assessment of ecological and socio-cultural effects resulted from proposed facilities and their operations in the project area. These effects could be caused by water extraction, construction of water supply facilities; leaky sewage network, raw or insufficient treated sewage and inadequate operating waste water treatment plants.

Stage (3): Environmental Management Plan
For each urban center that entails water supply and sanitation project an Environmental Management Plan (EMP) has to be developed. Based on the results of the PSEA, the EMP presents the positive expected effects and points out all the measures required to mitigate potential negative effects of the project.

The EMP will contain information, activities, results and recommendations concerning following issues:

The main environmental impacts
Environmental impacts caused by construction and operation of water facilities. Summary of the PSEA results.

Mitigation and rehabilitation measures
Definition of mitigation procedures during the construction and operation phases. Rehabilitation measures will be discussed (e.g. groundwater observation wells, soil erosion protection, optimization of wastewater treatment), Boundary condition specifications for wastewater reuse for irrigation and drainage purposes, sludge disposal.

Implementation responsibilities
The institutional responsibility for implementation of the mitigation measures will be defined in detail, taking into account new regulations, management procedures,
training programs and financial support as well as the special role of local water corporations.

✓ Environmental Monitoring Actions

Main part of the EMP is the development of monitoring actions for environmental inspection and supervision of project activities. Ecological effects will be controlled by collection and documentation of critical and indicative data material (e.g. groundwater level, salinity parameter). Therefore, the monitoring program to be developed should contain a sampling and investigation scheme (e.g. inspection frequencies, parameter list).

✓ Environmental capacity development

Appropriate and well skilled staff (Environmental Agencies, Environmental Control Officer ECO) will be responsible to meet the environmental commitments and monitor the project during construction and operation phases. The deployment has to be designed after tasks are defined. The implementation and ensuring of the EMP will also be in responsibility of the ECO. His responsibilities, costs and indicative terms of references will be annexed to the EMP.

✓ Overview of EMP actions, responsibilities and costs

By means of a matrix format table, an overview on EMP activities, responsibilities and costs for actions to be undertaken during construction and operation, rehabilitation actions and actions required for monitoring.

The EMP will include all the protective instruments in accordance with World Bank Safeguard Policies, whenever it is applicable, particularly with regard to

- Policy 4.01 "Environmental Assessment"
- Policy 4.04 "Natural habitats"
- Policy 4.11 "Cultural Property"
- Policy 4.20 "Indigenous People"
- Policy 4.30 "Involuntary resettlement"

Furthermore, relevant policies on the water sector and wastewater (e.g. reuse for irrigation) will be advised in a draft paper and incorporated into the EMP.

Stage (4): Environmental Monitoring Plan and Program

In the context of the EMPs, the defined monitoring actions have to be converted into specific monitoring plans and programs. Corresponding to the different phases of monitoring, investigation procedures will be specified in detail.

The Environmental Monitoring Plan determines standard methods, monitoring equipment and boundary conditions for execution of the monitoring process. Characteristic parameters, acting as indicators for environmental quality and efficiency of plants, field and laboratory investigation methods, sampling sites and sampling frequencies, data processing and reporting will be established in this document.
Comparable and reliable results are required for evaluation of status and trends of natural and cultural resources.

1.4. Project Organization

The Project Management Unit PMU of the Urban Water Supply and Sanitation Project is the responsible Governmental party for preparation and implementation of the project and reports directly under the supervision of the Ministry of Water and Environment. Dornier Consultant as the responsible for the preparation of the SEA and PSEA and related tasks will coordinate and unite the necessary activities with all parties concerned. Other governmental authorities, mainly NWSA (Contractual party), EPA (environmental protection agency) and the local water and sanitation corporations are key partners in this study.
CHAPTER 2: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1. Environmental Policy in Yemen

Yemen natural resources are the basis for the nation development. The depletion or degradation of these resources leads to a loss of the country assets and undermined the future development. Therefore, the GOY has established institutions and responsibilities for environmental management, joined international conventions and is currently developing additional sector legislation and procedures. A National Environmental Action Plan (NEAP) was adopted in 1995 and the environmental Protection Law was enacted at the same year. The NEAP established priority issues and actions in the main environmental field such as:

- water resources;
- land resources;
- natural habitats; and
- waste management.

During the late 90's and the beginning of 2000's, the Government developed major strategies such as the Socotra Archipelago Master Plan and the Biodiversity, Ecotourism, Women and Environment strategies. Parallel to this, the public awareness and concerns have grown, supported by the increased NGO activity and the media involvement in the environmental issues.

Regardless of these efforts, Yemen is facing serious environmental problems: a severe water crisis, large land, forests and unique habitats are being lost; waste pollution is negatively affecting population health, poverty and development opportunities. It has been clear that the country needs more investment in sustainable environmental management. Conscious of this need, in October 2002, the Environmental Protection Authority (EPA)/MOTE issued the "Environmental & Sustainable investment Program (2003-08) (ESIP)" which constitutes the framework for Government's environmental policy of the next years.

The ESIP presents an outline strategy and priority interventions aimed at controlling and gradually reversing the above trend and supporting the sustainable human development for the people of Yemen. The ESIP is already under implementation and it focuses on 6 main areas of intervention, consistent with the Mandate and Resources of the Ministry of Tourism and Environment (from April 2003 Ministry of Water and Environment). These are:

1. Habitat and biodiversity conservation.
2. Sustainable land management.
3. Sustainable water management.
4. Sustainable waste management.
5. Sustainable climate change and energy consumption.
6. Institutional development/capacity building (as delivery mechanism for the Program).

The various programs in ESIP with the actions required are summarized in the table hereafter.

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Table 2.1 Environmental and Sustainable Investment Program (2003-2008), Program Areas and Actions

<table>
<thead>
<tr>
<th>Program Area</th>
<th>Action</th>
<th>Budget (mill. US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat and Biodiversity Conservation</td>
<td>Sectors conservation and development program</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>Protected area management, Village conservation</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Coastal zone management</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>Eco-tourism</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Monitoring</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Botanical garden, Natural history museum</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Total Program Area 1</td>
<td>20.7</td>
</tr>
<tr>
<td>Sustainable Land Management</td>
<td>Pollution and environmentally sound land use practices</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Action program for forest restoration and desertification</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Improvement of maps for soil degradation and desertification</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Support to land registration</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 2</td>
<td>3.4</td>
</tr>
<tr>
<td>Sustainable Water Management</td>
<td>Pollution control for fresh water resources, water supply and</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>water harvesting systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Support to enhancement of water law and information system</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Support to optimization of water use and securing additional</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>water resource</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awareness raising</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 3</td>
<td>1.5</td>
</tr>
<tr>
<td>Sustainable Waste Management</td>
<td>Development of waste reduction, reuse and recycling program</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Management system for hazardous waste</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Emergency unit for environmental pollution</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Implementation of the solid waste management guidelines, e.g. landfills</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Promotion of solid waste management systems, legislation</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Awareness campaign</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 4</td>
<td>2.5</td>
</tr>
<tr>
<td>Sustainable Energy Management</td>
<td>Promotion of renewable energies</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Development of energy use and air quality strategy</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Development of a National Adoption Strategy</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Established of an energy balance scenario</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 5</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 5</td>
<td>4.8</td>
</tr>
<tr>
<td>Institutional Development/ Delivery</td>
<td>Policy development</td>
<td>0.5</td>
</tr>
<tr>
<td>Mechanisms</td>
<td>Legal affairs and low enforcement</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Information and monitoring</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Awareness raising and education</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Community, NGO and gender participation</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>Technology development</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Institutional and capacity building</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Total for Program Area 6</td>
<td>4.8</td>
</tr>
<tr>
<td>Total for priority Actions</td>
<td></td>
<td>30.2</td>
</tr>
<tr>
<td>Total for the program</td>
<td></td>
<td>37.8</td>
</tr>
</tbody>
</table>

The ESIP was the guiding document in support of the Ministry of Water and Environment's strategic approach in the coming years. Also, it is one of the bases to
establish dialogue with all Ministry's partners and donors to raise awareness among all stakeholders and GOY agencies on a wide range of environmental concerns in other investment areas.

Recently, the Ministry of Water and Environment (MWE) proposed a National Water Sectoral Strategy and Investment Program (NWSSIP) for the period (2005-2009). The Ministry of Water and Environment is in charge of the most complex development problems such as:

- the problem of water scarcity;
- depletion of groundwater aquifers;
- providing clean drinking water for urban and rural pollutions;
- management and planning of the wastewater treatment; and
- management and planning of the water resources and their use according to the Water Law.

The importance of water is not just for drinking and food production but it is considered the basis for the nation development. Water availability is an essential factor in public health, unemployment, poverty, women education, and the various areas of development. Therefore, the establishment of MWE (2003) came to reflect the general belief that it is necessary to in charge a single government agency completely responsible for water development and management, to ensure that the development is achieved within a sustainable manner and to continue with sector structural reforms and to extend the participation of the communities and beneficiary. The participation of communities and therefore the decentralization of water sector call in the bearing the water cost and taking in charge of their own water sewage management. Also, the MWE is charged with achieving a rational and sustainable management of the environment in the various natural resources. In addition to that, the role of MWE is to support the implementation of the Water and Environmental Laws and raise the awareness to protect water and other environmental resources from depletion and pollution.

The expected investment (financing) from government budget is assumed to continue at the level of 50-55 M USD annually for UWSS and 18-22 M USD annually for RWSS. These numbers partially include funding through other entities such as the Social Fund for Development (SFD), the Public Works Projects (PWP), rural development projects and specialized international organizations.

The Government's general environmental policy and regulations are mainly embodied in the table below.
### Table 2.2 Government policy statement, strategies and programs relevant for the environmental sector

<table>
<thead>
<tr>
<th>Strategy, Action, Program</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Environmental Action Plan</td>
<td>1996</td>
</tr>
<tr>
<td>Environmental &amp; Sustainable Investment Program</td>
<td>2003-08</td>
</tr>
<tr>
<td>Biodiversity Strategy (1999, in course of approval in December 2003)</td>
<td>1999-03</td>
</tr>
<tr>
<td>Environmental Impact Assessment Policy for the Republic</td>
<td>1997</td>
</tr>
<tr>
<td>Yearly Reports on the State of Environment (by EPA)</td>
<td>Yearly</td>
</tr>
<tr>
<td>Evaluation of Future Development of the EIA System in Yemen (METAP)</td>
<td>2001</td>
</tr>
</tbody>
</table>

#### 2.2. Procedures of Environmental Assessment Process

An Environmental Impact Assessment policy for the country was prepared in 1996. This policy was prepared for EPC as an initial guide towards preparing the necessary by-laws regarding EIA. Due to the international financing procedures, World Bank EIA Guidelines were dominant. For our study, the environmental assessment reports are expected to cover the following major areas:

- an information describing the proposed activities;
- motivation for site selection and a discussion of alternative locations;
- analysis of the initial state of the environment at each site;
- assessment of potential environmental impacts including direct and indirect, positive and negative, cumulative, short or long term, permanent and temporary;
- description of mitigation measures for significant adverse impacts and procedures on how to avoid, reduce, or remedy these impacts;
- development of monitoring plan; and
- brief and non-technical summary.

#### 2.3. Selection criteria and characterization for environmental and socio-economic conditions

The selection of criteria for the evaluation of the environment and socio-economic of the program requires an intensive review for all potential environmental impacts of the project is necessary. Regardless, if it has direct or indirect affects with regards to the general environmental categories (World Bank classification category A, B, C, F). The selection criteria and characterization will consider the following measures:

- favorable or unfavorable impacts of the program from design, construction and operational;
- resettlement and land acquisition;

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• assessment of the project significance such as likelihood, intensity, risk and environmental impacts;
• identification the potential significant impacts with emphasis on special characteristics of the Yemeni environment;

The collected data and information are reviewed and characterized in a scientific manner, to achieve the best governmental framework for the program objectives.

2.4. Analysis and assessment of the alternatives for water and sanitation sector

The data should be investigated whether it has potentially affected areas and analyses of existing data sets might be supplemented by field measurements or laboratory analyses. These investigations could provide additional information for the characterization of the project conditions or initial levels of water pollution with quantitative information. The major impacts of water supply and wastewater project activities on natural and socio-economic conditions; project or facility alternatives/modifications were evaluated.

Alternatives reviewed, compared and classified corresponding to their potential impact. For each alternative measure total costs and benefits must be taken into account. Cost effectiveness and feasibility of the alternatives are main aspects for the classification. Assessment of alternatives will consider the following issues:

• Review all the proposed alternative approaches from engineers to achieve the objectives of the program in cases of significant impacts.
• Consideration of alternatives to the present and intended water sector policy, if major effects must be feared for the environment.
• Tabular comparison and analysis of major alternatives, their economic benefit and realisation under national and local conditions.

2.5. Environmental Management Program

Environmental management has been given attention in Yemen, through various activities such as:

• The consideration given to national environmental organization,
• The national environmental organization.
• The national fund and
• The environmental legislation.

It became clear that despite important efforts in the environmental management made in recent years, Yemen still lacks adequate institutional and regulatory frameworks to manage its natural resources, disseminate information concerning environmental issues, and fully promote public awareness and participation. Environmental management is considered in an international context. Yemen's has international treaties and obligations are ratified by the Government.

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2.6. Social development Policy

2.6.1. Policies and Program

The Government of Yemen, in cooperation with international funding agencies, stated a series of policies and programs aiming at ameliorating the socio-economic situation in Yemen. These can be summarised as follows:

- The Social Welfare Fund (SWF), an agency under the Ministry of Insurance and Social Affairs (MISA) which provides transfers to those unable to work and to members of the poorest section of Yemeni society.
- The Public Works Project, run by the Ministry of Planning and Development (MOPD), which is designed to create short-term employment opportunities for those able to work.
- The Social Fund for Development (SFD), which seeks to provide support for long-term development opportunities for the poor.

2.6.2. Vision

Through Vision 2005, the Government of Yemen identifies and supports the following actions:

- to develop and implement sustainable management and monitoring programs for water resources, land resources and agriculture, coastal zones, biodiversity and waste;
- to develop a desertification combating program;
- to provide energy substitution;
- to use environment-friendly technology and enhancement of renewable energy resources;
- to implement environmental impact assessment for projects; and
- to increase public awareness in all environmental fields.

2.6.3. Poverty Reduction Strategy (PRSP)

A key issue confronting Yemen is poverty, and the linkage with environmental degradation, and resources depletion occurring in both rural and urban areas. There are high levels of poverty in rural areas, people are living below subsistence levels and they are using soils, forest and other resources at rates exceeding sustainable limits for recovery and renewal. The poor have no other option than to adopt short-term survival strategies. Also, Yemen's urban areas illustrate the mutually reinforcing effects of poverty and environmental degradation. Foremost among the environmental issues are the health problems resulting from substandard living conditions (like that do not shield them from) human extracts, domestic refuse and other wastes.

The Government of Yemen adopted the Poverty Reduction Strategy (PRSP) which reflects the role of the environment for the living standard of the people in Yemen where the poor are primarily reliant on the environment for their livelihood. They are directly affected by the methods by which the environmental resources are exploited.
The Government has therefore decided that the following environmental policies are to be strengthened within the PRSP:

- enhance the technical capacities of relevant institutions to develop comprehensive environment as well as development projects and programs relying on community participation;
- develop a legal framework;
- institutional empowerment of local organization;
- carry out field studies to assess environmental conditions;
- find incentives accompanying awareness campaign;
- provide job opportunities through environmental projects; and
- finance projects that provide soft loans for the poor.

In spite of the emphasis given to environmental issues in the PRSP, the budget allocated by the GOY does not allow significant environmental measures to be taken in support of poverty eradication. Out of the total planned spending of YR 446,384 Million for the period 2003-2005, environmental measures will only amount to some 0.8% of the PRSP budget.

2.6.4. Gender Policies

Yemen's constitution declares equal rights and obligation for men and women, and makes discrimination on the basis of sex illegal; the government capacity to enforce such laws is weak, mostly due to inadequacy of the administrative apparatus. New laws introduced since Yemeni unification provide women more security rights, yet without effective enforcement, these are virtually ineffectual.

In 1997, the government adopted the Yemeni Women's National Strategy. Among the institutions established to work on women's issues is the women National Committee. Its duties include cooperating with local, regional and international organizations involved in women's projects, conducting studies relating to women, contributing to women's legal awareness, and holding workshops and conferences. Its effectiveness is hampered, however, by lack of adequate funding; absence of coordination at a national level, unavailability of data disaggregated by gender, and ambiguity of its goals.

2.7. Legal Framework

EIA, in Yemen, is enabled by the Environment Protection Law No 26 of 1995 (EPL). The provisions of this framework law are implemented through Executive Regulations (By-Law 148-2000), issued by a decree of the Council of Ministers. A copy of the Environmental Protection Law for the year 1995 and the EIA regulations for the year 2000 are attached in Annex 1 of this report.

The objectives of the Environment Protection Law are to protect the environment, to reduce pollution, and to protect natural resources, society, human health, and living beings from activities that damage the environment. In addition, the law is designed to protect the national environment from activities practiced beyond the national boundaries and to implement international commitments ratified by the Republic of Yemen in relation to environmental protection, control of pollution, conservation of
natural resources, and the protection of such globally important environmental elements as the ozone layer and climatic changes.

To avoid future adverse environmental effects, the law stipulates the incorporation of environmental considerations in economic development of plans at all level and stages of planning for all sectors. It requires the preparation of environmental assessment for all projects proposed by the government, public, private and cooperative agencies, and foreign companies. No licenses are to be issued for projects that degrade the environment. However, there is as yet no regulatory framework to support the implementation of the Environment Protection Law and the provision of undertaking environmental assessment for projects is not enforced.

The competent bodies for EIA defined in the EPL are those government bodies with powers under other legislation to approve development activities (e.g. line Ministries). The Environmental Protection Council (EPC) was given the responsibility of coordinating the activities of the competent bodies, and providing advice to them. In 2001 the Government of Yemen transferred the EPC into the Environmental Protection Authority (EPA).

Environmental Standards and Specifications have been prepared by the former EPC as annexes to the Executive Regulations, covering potable water quality, wastewater quality for agriculture, and ambient air quality, emissions, noise, biodiversity and protected areas. These include standard application forms intended for use by all relevant government bodies.

2.8. Environmental Institutions

In the following sections there will be elaboration about the institutions that are working directly or indirectly in the environmental sector with more focus on the water and sanitation activities in the country.

Ministry of Water and Environment (MWE)

The Ministry of Water and Environment was created after the election of April 2003. The establishment of MWE came as a natural development of previous governmental efforts on the Water supply and Sanitation Sector Reform. The efforts started with establishment of the High Water Council (HWC) in 1980s, than followed by establishment of the National Water Resources Authority (NWRA) in 1995. The effort continued and actions are taken in the direction of decentralization of urban Water Supply and Sanitation Sector through the transformation of eligible branches of the National water and Sanitation Authority (NWSA).

Previously, the Ministry of Tourism and Environment (MOTE), created in 2001 with the Republican Decree 329/2001-Article II, had the mandate to manage and organize tourism, with aim of developing it into a prosperous industry resource, while maintaining and protecting the environment. Figure 2.1 is schematic organizational chart of the MWE.
Environmental Protection Authority (EPA)

EPA, established by Decree 601/2005, under the mandate of the Minister of Water and Environment is the official and specialized governmental agency for environmental protection and natural resources conservation to the EPL and other legislation in force, with statutory planning, licensing, monitoring and auditing functions as well as to establish functions as well as to establish branches in the governorates if prescribed by a decree from the Minister based on a proposal approved by the Minister of Civil Services and Insurance.

The Environmental Protection Council (EPC), established in 1990 with the responsibility of coordinating the activities of the competent and providing advises to them to manage and protect the environment. It was an official organ of the state under the Council of Ministers on the implementation of the Environment Protection Law.

The aim of the EPA is to ensure that all planned investments in Yemen are sustainable and not in conflict with long-term preservation of the country's national resources which are the very basis of its economic and human development.
The organizational chart for the EPA staff is lead by a Chairman and a Deputy Chairman managing 3 Directorates (Natural Resources; Control and Monitoring; Planning and Environmental Data) and 4 units (Climatic Change; Ozone Unit; Women and Environment; Local Environment Issues). The Authority has also two departments: one for legal Affairs and one for Awareness Raising, NGOs and Information.

Comparing EPA with the former EPC which had just a coordinating role the new EPA has a clear mandate to implement environmental legislation and to execute projects under the following main objectives:

- protect the environment, conserve of its balance and maintaining the ecosystems;
- combat the different kinds of pollution and avoiding any damage or negative impacts of various development projects;
- protect and develop the natural resources and conserve the life qualities in national environment from the damages coming out side the national environment;
- protect the society, human health and other organisms from the different non-environmentally activities;
- eliminate air pollution and impacts of climate changes.

The duties and attribution of the EPA to achieve its objectives are the following:

- propose and implement policies, strategies and plans for protecting the environment, its components, conserving balance, ecosystems, combat the different kinds of pollution and conserving the natural resources from degradation;
- prepare national emergency plans to face the natural disasters and pollution in coordination with concerned agencies;
- carry out environmental surveys and determine the areas, resources and species, which require the adoption of legal procedures for their conservation. Protect the fauna and flora, wild and marine birds according to the laws in force and monitor their application;
- prepare proposals for laws related to environment protection in coordination with MOTE and concerned agencies;
- pursue the implementation of policies, established criteria and stipulated by public and private establishments. Implement the procedures established by the EPL and other existing legislation in coordination with concerned agencies;
- impose principles, procedures and terms of environmental impact assessment and review EIA studies of public and private projects to give EPA opinion and monitor their implementation;
- impose the national criteria to protect the environment from pollution, conserve the natural resources and monitor the national criteria implementation in coordination with concerned agencies;
- implement the international commitments related to environmental protection that has been ratified by the Republic of Yemen according to the existing legislation.
• collect the international and regional data, information related to the changes on environmental and natural resource periodically in coordination with concerned agencies. Assess these data and information to be used in environmental planning and management
• prepare regular reports documentations on the environmental status and the main environmental indicators in the Republic of Yemen to be published periodically;
• propose protected areas and manage them in coordination with concerned agencies according to the existing legislation;
• prepare integrated plan for coastal zone management in coordination with concerned agencies;
• prepare and implement environmental awareness programs in coordination with concerned agencies
• participate in preparing educational programs to introduce environmental protection concepts in curriculum for different levels in coordination with concerned agencies;
• follow up the implementation of the environmental policies and regional conventions related to the environment in which Yemen has a part; prepare proposal of required laws and programs to be implemented as result of the signed conventions and submit regular reports in coordination with MOTE.
• prepare and implement pilot projects and mechanisms to encourage the different activities necessary for eliminating air pollution and the impacts of climate change; and
• provide technical consultation to the governmental organization, public and private sectors in different environmental protection fields.

➢ Other Government Agencies (Indirectly related to environmental protection)

At present there is no formal role for other Government agencies in enforcing the EIA process, whether it is through the central Government or through local governments at the different governorates. Most of their roles are in development planning, especially in initiating and implementing projects and in securing support through the Governor where appropriate.

Ministries and Government bodies, which may have indirect relationship with EIA implementation, are listed here below:

✓ Ministry of Agriculture and Irrigation (MAI):

The Ministry of Agriculture and Irrigation has overall responsibility in overseeing the irrigation sector. Irrigation consumes about 90% of the national available water resources.

✓ National Water Resource Authority (NWRA):

established in 1995, the NWRA is charged with the responsibility of managing, developing, exploiting, and conserving the nation's water resources. NWRA is mandated to prepare basin plans and monitor water resources.
Ministry of Public Health (MOPH):

the Ministry of Public Health (MOPH) is responsible for the overall health sector in Yemen, including financing, planning, regulation, management, and provision of health services at all levels (specialized hospitals, district and rural hospitals, governorate hospitals, health centers and primary health care in MOPH facilities either free of charge, if indigent, or by paying subsidized user charges for better-off collected at the facility level. Yemen does not have a compulsory health insurance system.

Non-Governmental Organizations

There is evidence, however, of the expanding role of the private sector and NGO in the delivery of basic services to the citizens and preserving the environment. There is at present no official role of NGOs in EIA, except as organized for international funding bodies. There are however a reasonable number of Yemeni NGOs that, in theory, may have a role to play in the EIA process. A list of NGOs that may relevant to the Water and Wastewater Project is shown in the table below.

Table 2.3 Indicative list of Yemeni NGOs active in Yemen

<table>
<thead>
<tr>
<th>NGO</th>
<th>Area of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporters of the Environment</td>
<td>Specialized Society</td>
</tr>
<tr>
<td>Association for Environmental Communicators</td>
<td>Specialized Society</td>
</tr>
<tr>
<td>Yemeni Environment Protection Society</td>
<td>Increase awareness of environmental issues, coordinate with government and NGOs to implement environmental projects and promote sustainable development practices especially in rural areas.</td>
</tr>
<tr>
<td>Al Yemen Al Khadra</td>
<td>Protection of the rural environment</td>
</tr>
<tr>
<td>Wildlife Protection Society</td>
<td>Specialized Society</td>
</tr>
<tr>
<td>Urban Development Society</td>
<td>Specialized Society</td>
</tr>
<tr>
<td>Welfare Associations</td>
<td>CBS Welfare Associations have largely replaced local development associations as the main avenue for sponsoring rural development. Often related existing social structures and marked by strong tribal affiliations</td>
</tr>
<tr>
<td>NGO Network for Women</td>
<td>To provide organizational structure for the coordination of work on women's issues and to provide input into development projects planning.</td>
</tr>
<tr>
<td>Social Organization for Family Development</td>
<td>To provide training and health care to poor women and children</td>
</tr>
<tr>
<td>Yemeni Family Care Association</td>
<td>To provide maternal and child health services and increase awareness of family care services</td>
</tr>
<tr>
<td>Yemeni Women's Union</td>
<td>To improve situation of women, economically, socially and culturally and encourage participation in development.</td>
</tr>
</tbody>
</table>

Unfortunately, the reality is that just these NGOs can be considered truly effective, or potentially, as key players in the EIA process or the implementation of a sector strategy in the future. There are a number of reasons for this:

1. The NGOs are in fact quasi-government agencies in Yemen therefore cannot be viewed as independent bodies by the population. In effect any NGO operating effectively is perceived to do so only as a result of through government patronage.
2. The restrictions on the independence of NGOs imposed by the law, few NGOs have the ability to organize and manage to a level that suggests they could operate as an effective element in a sector strategy.

3. The strength of Yemeni traditions and customs, in particular the powerful family, clan and tribal linkages and associated support mechanisms are 'unrelated' and independent.

The direct public participation in decision-making commonly takes place through established social mechanisms.

2.9. International Conventions

Yemen has international environmental law obligations that are directly related to its national environmental planning activities and concern the marine and terrestrial habitats. Many of the global treaties were ratified by either the former YAR and/or by the former PDRY. According to Unification Declaration, the international conventions ratified in this manner remain valid and are applicable to the whole nation.

International conventions have little or direct impact on environmental conditions in poor developed countries. In most cases the international law is implemented through the national local legislation and environmental actions, various scenarios may occur which is depending on each particular case:

- The international agreement may already cover by similar national laws, and no particular action is required to be taken to comply with the international agreement.
- The implementation of the international law may be in line with national legislation
- International agreements may require new or substantially changed national laws and new compliance measures.

Yemen is signatory of more than 20 international conventions on environmental issues. Those relevant for the environmental are indicated in the table below.
Table 2.4 Global conventions ratified by the Government, containing provisions relevant to environment

<table>
<thead>
<tr>
<th>Convention</th>
<th>Place &amp; Date of Stipulation</th>
<th>Ratification data in Yemen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol on Substances that Depletes the Ozone Layer</td>
<td>Montreal, 1987</td>
<td>Approved by Parliament</td>
</tr>
<tr>
<td>Agreement on Banning the Use of Technologies that Change the Environment for Military Purposes and for any Other Aggression</td>
<td>Geneva, 1977</td>
<td>5.10.1978</td>
</tr>
<tr>
<td>Convention on intervention on High Seas in Case of Catastrophes of Oil Pollution</td>
<td>Brimis, 1996</td>
<td>4.6.1979</td>
</tr>
<tr>
<td>Agreement on Civil Responsibility concerning Damage from Oil Pollution</td>
<td>Brussels, 1986 amended</td>
<td>4.6.1979</td>
</tr>
<tr>
<td>Convention for the Prevention of Pollution of The Sea by Oil</td>
<td>1954</td>
<td>6.6.1969</td>
</tr>
</tbody>
</table>

The Yemeni Government is concerned about effective implementation and enforcement of international obligations in light of national financial and managerial constrains. Some conventions have not been signed by Yemen due to the lack of funds. Ratification of other international environmental conventions has been slow for similar reasons. These include:

- Convention on the conservation of Migratory Species of Wild Animals (Bonn, 1997).
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar, 1971).

Implementation of international treaty obligations invariably becomes the responsibility of national agency. It appears that, in Yemen, the capacities of national agencies to deal with the technical complexities and reporting requirements of international agreements are not sufficient. For example, Yemen is a party to several international conventions dealing with the marine environment, but does not have sufficient capacity to enforce them. It is clear that the assignment of new responsibilities to an agency to implement international treaties should go parallel with technical strengthening of the agency concerned.
2.10. Environmental Application

This section includes information on Yemen's environmental application. The Government general environmental policy provides a broad framework for environmental management, and there are some regulations, policies and laws available in hand which should be improved and implanted to environmental application for the water sector.

The current Government policy in water sector is mainly to solve the problem of water scarcity, stop the depletion of groundwater aquifers, and provide a clean drinking water for urban and rural population, management and planning for wastewater treatment and the water resources. The government of Yemen has developed different projects and programs with international links to achieve these policies. An example of these efforts is a project to strengthen water resources management capabilities aimed at national capacity-buildings in water resources management to establish an independent and natural water resources authority. This project funded by UNDP/ and the Netherlands Government.

Other important issues related to the water sector were embodied in laws and regulations as follows:

- Water Law No. 33/2002
- Project for Water Standards and Reuse, 1999
- Environmental Protection Law 26/1995
- Additional regulations, procedures and specifications.

The lack of proper sectoral environmental policy, enforcing regulations and implementation of management programs which are the main driver to the development of the water sector. Copies of Water Law, EPA Decree, EP Law are attached as Annexes to this report.
2.11. World Bank Framework

The World Bank has defined the Environmental and Social Safeguard for all World Bank financed projects. Policies of particular relevance for Yemen Water Program are shown in the table below.

Table 2.5 Safeguards Policies Triggered by the project

<table>
<thead>
<tr>
<th>Policy</th>
<th>Reference</th>
<th>Applicability to Water Sector in Yemen</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Environmental assessment</td>
<td>OP/ BP/ GP 4.01</td>
<td>Yes</td>
</tr>
<tr>
<td>2 Natural habitats</td>
<td>OP/ 4.4*</td>
<td>Yes</td>
</tr>
<tr>
<td>3 Pest management</td>
<td>OP 4.09</td>
<td>Yes</td>
</tr>
<tr>
<td>4 Cultural property</td>
<td>OPN 11.03, being revised as OP 4.11</td>
<td>Yes</td>
</tr>
<tr>
<td>5 Involuntary resettlement</td>
<td>OB/ BP 4.30</td>
<td>Yes</td>
</tr>
<tr>
<td>6 Indigenous peoples</td>
<td>OD 4.20, being revised as OP 4.10</td>
<td>No</td>
</tr>
<tr>
<td>7 Forestry</td>
<td>OP/ BP 4.35</td>
<td>Yes</td>
</tr>
<tr>
<td>8 Safety of dams</td>
<td>OP/ BP 4.37</td>
<td>Yes</td>
</tr>
<tr>
<td>9 Projects in disputed areas</td>
<td>OP/ BP GP 7.6</td>
<td>No</td>
</tr>
<tr>
<td>10 Projects on international waterways</td>
<td>OP/ BP GP 7.5</td>
<td>No</td>
</tr>
</tbody>
</table>

* These policies will be triggered only if significant issues are identified during individual projects screening under the program. Agreed Policy Framework (see below) will then apply in the design and implementation of these individual projects.

Specific locations for the new facilities of this study are not defined yet. Safeguards policy compliance will be assured through a programmatic approach. In particular, an Environmental and Social Management Process has been agreed and put in place for identification, screening, implementation and monitoring of all project facilities improved under the project. Environmental screening of individual projects could possibly trigger seven safeguard policies: Environmental Assessment (OP/BP/GP 4.01), Involuntary Resettlement (OD 4.30); Natural Habitats (OP 4.04, BP 4.04, GP); Cultural Property (OPN 11.03), Forestry (OP/BP 4.35); Pest Management (OP4.09) as shown in Annex 2. Accordingly, the Program's Environmental and Social Framework Agreement contains Policy Frameworks for these five policies, which would be applied when triggered.
CHAPTER 3: PROJECT DESCRIPTION AND ALTERNATIVES

3.1. Environmental Assessment Objective

The purpose of this EIA Report is to provide the Client with a full understanding of the significant environmental impacts of the proposed activities. This chapter covers and discusses the components of the proposed projects of water supply, sanitation and wastewater treatment plant at Dhamar city as part of the development program of the Group I urban centers up to the year 2025. Description of the project components is necessary to define the nature of the proposed project and the anticipated impacts on the surrounding environment.

3.2. Development Project Objectives

The main objectives of the development project of water and sanitation in Dhamar are:

- To determine design improvement and extension to the water and wastewater facilities to serve the population of the project area up to the year 2025 and to implement the first phase requirement up to year 2015 or towards 2025 depending on the available funds and cost of full project period.
- To determine the most feasible, cost effective solutions for effluent reuse, treatment and usage including odor control at the wastewater facilities.
- To determine the most feasible and cost effective development of sustainable water resource for demand through out the project horizon.
- To determine satisfactory levels of service and standards commensurate with affordability and environmental concerns.
- Supply the required water quantity to the urban centers with suitable water quality, in accordance with Yemeni water standards and the WHO Standards.
- Study and design the proper transmission pipelines.
- Study and design the proper secondary pipelines and house connections.
- Study and design storage reservoirs and the required pumping stations.
- Agree on the design criteria taking into consideration the population projection until year 2025.
- Study the water resources in connection to the adjacent areas.
- Study and find the most suitable solution for the wastewater network coverage and the treatment options.
- Look into pollutions and their affect on health to minimize the damage affect.
- Minimize leakage and unaccounted for water to match international standards.
- Preparation of tender documents (preparation of pre-qualification documents, tendering bid evaluation and Contract finalization).
- Preparation of cost estimates.

Divide the schemes into packages with cost less than 10 million US Dollar, and as applicable.
3.3. Project Area and Location.

Dhamar City is located around 100 km south of Sana'a City. People of Dhamar are mainly farmers, traders, and government employees.

The topography of Dhamar city is partially flat, with average elevation of 2400 – 2450 masl. The main source of drinking water is groundwater, which is pumped from fourteen operating wells in samah and west well fields. The city has a sewerage collection network and wastewater treatment plant.

The location of Dhamar city is shown in the next figure in relation to the whole country. The figure after it shows the location of the city in relation to the main highways reaching the Governorate of Dhamar.

Figure 3.1 General location of Dhamar in relation to the whole country.
Dhamar city both urban and peri urban has the population of 175,159 inhabitants (based on 2004 Census); reside in 60% of city area, in the center and around the main road (Sana'a-Taiz). The city expansion is towards the south and north. In the future, there is possibility to expand toward east, if Mareb road is constructed.

Because of the new roads which were constructed in South and West area, around 80% of the lands are cultivated) and water resources were developed heavily in the southeast, and west parts of the city. Seventy percent of Dhamar's buildings are one floor.

Many field visits were conducted to the project area and intensive discussions were conducted with the officials and authorities. It was clear that Dhamar is in need for the upgrading and extension of the existing water supply system, sanitation collection systems with the expansion of the wastewater treatment facilities. The development will be divided as mentioned in chapter one into two stages; the year 2015 and the year 2025. The figure below shows the delineation of the two phases.
The following sections show the projected water demands for domestic and non-domestic uses and the proposed project for the water and sanitation at the City. In addition to the proposed projects components with relation to water supply, sanitation and treatment plant for the two phases 2015 and 2025.

3.5. Water Demand Projections

3.5.1. Domestic Demand

It is anticipated that the domestic water consumption will increase to 65 l/c/d in the year 2025. The table below shows that the available water production potential i.e. 15,840 m³/day is sufficient only to satisfy water demand up to around year around 2012 and additional source/s of water supply will be required to meet the total daily demand (i.e. Domestic + non-domestic + water losses) of water for Dhamar city from year 2012 up to year 2025. For covering deficit of 7,816 m³/day additional source/s will be required with the total production rate of 110 l/sec.
### Table 3.1 Dhamar Water demand projections and deficits

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>UNIT</th>
<th>2008</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dhamar Residents</td>
<td>Person</td>
<td>153,661</td>
<td>174,283</td>
<td>202,041</td>
<td>231,956</td>
</tr>
<tr>
<td>2</td>
<td>Rate of Water Consumption</td>
<td>lcap/d</td>
<td>50</td>
<td>50</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>Total Water Demand per day (Domestic)</td>
<td>m³/d</td>
<td>7,883</td>
<td>8,714</td>
<td>13,133</td>
<td>15,077</td>
</tr>
<tr>
<td>4</td>
<td>Total Water Demand per day (Non-domestic) 15% of Domestic</td>
<td>m³/d</td>
<td>1,152</td>
<td>1,307</td>
<td>1,970</td>
<td>2,282</td>
</tr>
<tr>
<td>5</td>
<td>Total Water Demand per day (Domestic and Non-domestic)</td>
<td>m³/d</td>
<td>8,835</td>
<td>10,021</td>
<td>15,103</td>
<td>17,339</td>
</tr>
<tr>
<td>6</td>
<td>Total Water Demand per year (Domestic and Non-domestic)</td>
<td>m³/year</td>
<td>3,224,751</td>
<td>3,857,758</td>
<td>5,512,447</td>
<td>6,328,634</td>
</tr>
<tr>
<td>7</td>
<td>Connection Rate</td>
<td>%</td>
<td>76%</td>
<td>80%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>8</td>
<td>Required daily Demand for the Connected Houses</td>
<td>m³/d</td>
<td>6,715</td>
<td>8,017</td>
<td>15,103</td>
<td>17,339</td>
</tr>
<tr>
<td>9</td>
<td>Hourly Peak Flow factor</td>
<td>-</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>10</td>
<td>Peak Water Demand per hour</td>
<td>m³/h</td>
<td>588</td>
<td>701</td>
<td>1,321</td>
<td>1,517</td>
</tr>
<tr>
<td>11</td>
<td>UFW</td>
<td>%</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>Water Losses</td>
<td>m³/d</td>
<td>2,868</td>
<td>1,603</td>
<td>3,021</td>
<td>3,466</td>
</tr>
<tr>
<td>13</td>
<td>Required Water Production per day</td>
<td>m³/d</td>
<td>9,400</td>
<td>9,620</td>
<td>18,123</td>
<td>20,806</td>
</tr>
<tr>
<td>14</td>
<td>Required Water Production per year</td>
<td>m³/year</td>
<td>3,431,135</td>
<td>3,511,447</td>
<td>6,814,936</td>
<td>7,594,361</td>
</tr>
<tr>
<td>15</td>
<td>Available Water Production</td>
<td>m³/d</td>
<td>15,840</td>
<td>15,840</td>
<td>15,840</td>
<td>15,840</td>
</tr>
<tr>
<td>16</td>
<td>Water Deficit or Increase</td>
<td>m³/d</td>
<td>6,440</td>
<td>6,220</td>
<td>2,283</td>
<td>-4,986</td>
</tr>
<tr>
<td>17</td>
<td>Generated Wastewater</td>
<td>m³/d</td>
<td>5,372</td>
<td>6,414</td>
<td>12,082</td>
<td>13,671</td>
</tr>
<tr>
<td>18</td>
<td>No of existing productive wells</td>
<td>-</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>19</td>
<td>Required Average well production per day=row13×row18</td>
<td>m³/d</td>
<td>671</td>
<td>687</td>
<td>1,295</td>
<td>1,466</td>
</tr>
<tr>
<td>20</td>
<td>Available Water Production per year = row15×365d</td>
<td>m³/year</td>
<td>5,781,600</td>
<td>5,781,600</td>
<td>5,781,600</td>
<td>5,781,600</td>
</tr>
<tr>
<td>21</td>
<td>Extra needed(-) water</td>
<td>m³/year</td>
<td>2,350,465</td>
<td>2,270,153</td>
<td>-833,336</td>
<td>-1,812,761</td>
</tr>
<tr>
<td>22</td>
<td>Number of needed wells</td>
<td>m³/d</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

### 3.5.2. Non-Domestic Demand

Non-Domestic water demand (Commercial, Institutional and Industrial) will be set to 15% of the domestic demand along the project horizon after the agreement with the Client of the project.

### 3.5.3. Water Losses

The water losses in distribution system are estimated to about 40%. The excessive leakages in old distribution system and damaged/non working water meters are the two main reasons for this high figure of water loss percentage.

### 3.5.4. Required Water Production

According to the required water demand the following yields, as summarized in the table below, will be required based on 20 hrs daily pumping.
Table 3.2 The Required Yields of the Wells

<table>
<thead>
<tr>
<th>Year</th>
<th>Required Water Demand m³/day</th>
<th>Required Yield based on Recommended 20 Pumping hrs (l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>9,400</td>
<td>131</td>
</tr>
<tr>
<td>2010</td>
<td>9,820</td>
<td>133</td>
</tr>
<tr>
<td>2015</td>
<td>18,123</td>
<td>252</td>
</tr>
<tr>
<td>2020</td>
<td>20,806</td>
<td>280</td>
</tr>
<tr>
<td>2025</td>
<td>23,856</td>
<td>329</td>
</tr>
</tbody>
</table>

The average well production for Dhamar existing wells was calculated to amount of 220 l/sec assuming the well operation duration to 20hrs/day. The total daily production capacities of the 14 existing water wells are about 15,840 m³/day, the accumulative number of needed wells are three, seven and eleven wells for the years 2015, 2020 and 2025 respectively.

It is evident from the above table that additional water production source/s will be required with a combined production capacity of 7,816 m³/day or 110 l/sec. At present only about 163 l/s is pumped from eight production wells in Samah well field and 57 l/sec is supposed to be pumped from other six existing wells, a total of 220 l/s will be available for domestic water supply.

To make up for the deficit supply of 110 l/sec by the year 2025, quantity of additional water supply can be taken from the following proposed well sites according to the results of exploratory wells.

- 3 wells near Dhamar University
- 3 wells in Samah well field
- 2 wells between Dhamar and Yareem
- 3 wells near Dhamar Town

The second implementation phase up to year 2025 will require well points discharging 329 l/s at 20 hours daily pumping.

3.6 Proposed Water Supply System

The water supply system of Dhamar in 2025 is visualized as:

Two new supply ground reservoirs will be added in the present system based on one supply reservoir. One of the two new reservoirs will be constructed to the north of Dhamar city at Haran Mountain. The reservoir will have a water storage capacity of 6000 m³. This reservoir will be used to serve the Northern and North-western areas of Dhamar. The second proposed reservoir will be constructed at a hill located at the southern part of Dhamar city and it will have a water storage capacity of 6700 m³. This reservoir will be used to serve South and South-western areas of city. The third proposed reservoir will be constructed adjacent to the existing eastern reservoir and it will have a water storage capacity of 5000 m³. This reservoir in addition to the existing 6000 m³ reservoir will be used to serve the rest of Dhamar city. Additional 11 wells shall be drilled, to supply the north and south reservoirs.

The North (Haran) reservoir will be fed from four (4) existing wells (i.e Shuaibah, Jodad, Harran and sports stadium wells)+ (4) proposed future well/s, while the
southern reservoir will be fed from two 2 existing wells located at Al-Melah and Al-Jodad +7 proposed future wells. The existing and proposed eastern reservoirs (at Thamar) will continue to be fed from Samah well fields.

The Dhamar existing water distribution network will be rehabilitated and extended to provide connections for all consumers of the newly developed areas of the Urban Center. The nature of further extensions to the system will depend on the town planning layouts to be developed in future.

The storage capacity will be designed to supply the average daily demand of 2025 population. The minimum storage capacity can be summarized as follows.

Table 3.3 Minimum Storage Capacity for different horizons

<table>
<thead>
<tr>
<th></th>
<th>Storage capacity /2010 m³/day</th>
<th>Storage capacity /2015 m³/day</th>
<th>Storage capacity /2020 m³/day</th>
<th>Storage capacity /2025 m³/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9,620</td>
<td>18,123</td>
<td>20,806</td>
<td>23,658</td>
</tr>
</tbody>
</table>

3.7. Proposed Stages of Implementation of water supply designed works

3.7.1. Water Resources

➢ Phase (I) Year 2015
Drilling of the 3 new wells (including Structural, Mechanical and Electrical works).

➢ Phase (II) Year 2025
Drilling of the 8 new wells (including Structural, Mechanical and Electrical works).

3.7.2. Reservoirs

According to design criteria and standards for water supply systems, it is common to choose minimum storage capacity equal to the maximum 24 hours demand of the area supplied.

The consultants recommended proposal is to provide reservoirs for 2025 required storage capacity in phase-1, this will result in cost saving.

➢ Phase (I) Year 2015
For this purpose, a new reservoir of 5000 m³ capacity is proposed to augment the existing storage capacity (8000 m³) of the eastern reservoir. In addition, construction of 2 new reservoirs of capacities of 8000 m³ and 6700 m³ is proposed at the north and south areas of Dhamar city respectively.

3.7.3. Transmission and Distribution Mains

The transmission main will convey water under pressure from the well field up to the proposed storage reservoir, whereas, the distribution mains will convey water by gravity from the reservoirs up to the distribution network.

Year 2025 is taken as horizon for the project design. However, for implementation purpose the overall work is divided into two Phases i.e Phase-1 and Phase-2.
The details of works to be implemented under Phase-1 and Phase-2 are provided in the following section.

**Transmission Mains**

**Phase (I) Year 2015**

Based on the stipulated maximum daily consumption, the capacity and size of the transmission main shall be as follows:

Construction of 3.5 km long, 300 mm diameter DI pipe Transmission main with 83 l/sec total flow capacity (based on 20hrs/day pumping). The line will convey water under pressure from the west well field (4 existing wells and 4 future wells) up to the proposed north storage reservoir at Harran Mountain (with capacity of 6000m³). In addition approximately 6 km of collecting pipes of different diameters (150mm-250mm) are proposed to connect 4 existing wells and 4 future wells to the north reservoir (the final length depends on the location of the future wells).

Construction of 3.0 km long, 300 mm diameter DI pipe Transmission main with 93 l/sec total flow capacity (based on 20hrs/day pumping). The line will convey water under pressure from 2 existing wells and 7 future wells up to the southern proposed storage reservoir (capacity of 6700 m³). In addition approximately 5 km of collecting pipes of different diameters (150mm-250mm) are proposed to connect 2 existing wells and 7 future wells to the south reservoir (the final length depends on the location of the future wells).

**Distribution Mains**

**Phase (I) year 2015**

Construction of 2.6 km long, 400 mm diameter DI pipe Distribution main. The line will convey water by gravity from Harran (north) reservoir (6000 m³ capacity) up to the distribution network.

Construction of 1.5 km long, 400 mm diameter DI pipe Distribution main. The line will convey water by gravity from the south reservoir 6700 m³ capacity up to the southern distribution network. Existing 4.2km long, 500 mm diameter DI pipe Distribution main continue conveying water by gravity from the east existing and proposed storage reservoirs (11000 m³) up to the distribution network. The existing pipe is in good condition and doesn't need to be changed.

**Internal Distribution Network**

**Phase (I) Year 2015**

The length of distribution Pipes of diameters (150-300) is 22 km DI and 61 km of (50-100 mm) PE, and the total length for the interior networks PE(50-75) mm is 50 km.

**Phase (II) Year 2025**

The length of distribution Pipes of diameters (200,150) mm is approximately 4km DI and 44km of (50-100mm) PE.
3.7.4. Water Supply House Connections

By using average length of five (5) meters per house connection and 100% connection rate, the number of house connections and total length of diameter (15mm-32mm) PE and GMS pipes will be as followings:

Table 3.4 Number of households for water supply – Phase I Year 2015

<table>
<thead>
<tr>
<th>Center</th>
<th>Average household</th>
<th>No of household</th>
<th>Connection rate</th>
<th>No of house connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAMAR</td>
<td>202,041</td>
<td>28,883</td>
<td>100%</td>
<td>15,199</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>28,883</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13,684</td>
</tr>
</tbody>
</table>

Year 2015, length of Pipes 68,320 m

Table 3.5 Number of households for water supply – Phase II Year 2025

<table>
<thead>
<tr>
<th>Center</th>
<th>Population</th>
<th>Average household</th>
<th>No of household</th>
<th>Connection rate</th>
<th>No of house connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAMAR</td>
<td>283,720</td>
<td>37,674</td>
<td>100%</td>
<td>28,863</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>37,674</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8,811</td>
<td></td>
</tr>
</tbody>
</table>

Year 2025, length of Pipes 44,055 m

3.8. Chlorination Facility

- Water intended for human consumption must be free from putrid bacteria and pathogens; this can be achieved by disinfections. The most commonly used disinfectants are chlorine (in several forms).
- The sodium hypochlorite or calcium hypochlorite is the most suitable for small plants.
- Disinfection rates by sodium or calcium will be the range of 1.5 g/m³, with Contact time of 30 minutes.

The following formula will be used to calculate the chlorine storage capacity.

- Chlorine storage tank capacity = (max. chlorine dosing x total water demand) + (0.30 free chlorine content in beaching powder calcium hypochlorite) x solution concentration (0.20%).
- Chlorine storage tank capacity at year 2025 = [(5 x 23656) / (0.30 x 0.20)] + 1000 = 1971 liter

The use two tanks 1971 liter each (one for supply while the other will be under mixing) is recommended.

The atmosphere in the chlorination room will be moist and corrosive, the materials best suitable for storage tanks are glass fiber reinforced epoxy (GRP), PVC and polyethylene.
In case of using sodium hypochlorite, the free chlorine content shall be 0.80. It gives smaller capacities but more costly. It is recommended to use calcium hypochlorite, with two (GRP) chlorine storage tanks of 1971-liter capacity each.

The rate of dosing pumps = 1971/24 = 82.

Two dosing pumps are to be connected one in operation and one stand-by. The dosing pumps are to be regulated into 10 divisions to allow gradual dosage.

Frequent measurements of residual chlorine should be made to ensure 2 mg/liter residual chlorine and from 0.20 to 0.40 mg/liter at the end of the network.

3.9. Proposed Wastewater Collection System

The preliminary design will concentrate on the rehabilitation of the existing network in Dhamar to improve the situation of the frequently plugged sections. With help of field investigations breakage, blockage and overflows, problematic pipe sections will be identified. These will have to be replaced in the frame of the rehabilitation measures. According to hydraulic requirements, the existing sewer pipes will be examined for suitability for future operation.

Furthermore, the extension of sewage network will include the new populated areas in the centers that will be connected to the sewage collectors.

The design calculations for both, sewer networks and wastewater treatment plant will be performed, so that they can handle the generated wastewater from the project area till the horizon year 2025. The general layout of the sewer networks and the pipe sizing will be determined according to the population distribution in the project area, as expected in year 2025 (according to TOR requirement).

3.9.1. Design Outline of Wastewater Collection

In order to ensure an environmentally sound wastewater discharge within the Centers, the following measures concerning the installation of the wastewater disposal facilities will be implemented:

- Rehabilitation and construction of the sewerage trunk system in defined priority areas,
- Rehabilitation and construction of secondary network in defined priority areas,
- Rehabilitation of the existing Wastewater Treatment Plant (lagoons) and treatment structures with extensions to overcome the increase of the received quantity,
- Extension of wastewater system in Dhamar to cover the remaining areas,

In terms of alignment, the Consultant’s concept for the installation of the trunk sewers is based on the concept developed and gained from the Dhamar future extension directions with all growth factors.

The topographical feature of Dhamar city is flatness, with average elevation of 2,400–2,450 masl. Therefore the sewer networks shall be laid with appropriate slope and with minimum depth if needed to avoid deep trenching and pumping stations. Accordingly Dhamar wastewater will be conveyed to the treatment plant through main trunk line and sewer network.
3.9.2. Sewerage Network

➢ Phase (I) year 2015
Main trunk line of GRP, DN 800 - 800 pipes of 3.2 km length.
The total length of sewer network is estimated to be 125 km of uPVC pipes of DN 200 - 300 mm.

➢ Phase (II) year 2025
The total length of sewer network is estimated to be 84 km of uPVC pipes of DN 200 - 300.

3.9.3. Sewer House Connections
By using average length of seven (7) meters per house connection and 75% connection rate, the number of house connections and total length of DN 160 uPVC Pipes will be as followings:

Table 3.6 Number of households for sewerage – Phase I Year 2015

<table>
<thead>
<tr>
<th>Center</th>
<th>Population</th>
<th>Average household</th>
<th>No of household</th>
<th>Connection rate</th>
<th>No of house connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAMAR</td>
<td>202,041</td>
<td>7 persons</td>
<td>28,863</td>
<td>75%</td>
<td>8,660 21,647 12,987</td>
</tr>
</tbody>
</table>

Year 2015, length of Pipes 90,909 m

Table 3.7 Number of households for sewerage – Phase II Year 2025

<table>
<thead>
<tr>
<th>Center</th>
<th>Population</th>
<th>Average household</th>
<th>No of household</th>
<th>Connection rate</th>
<th>No of house connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHAMAR</td>
<td>203,720</td>
<td>7 persons</td>
<td>37,674</td>
<td>75%</td>
<td>21,647 26,258 6,608</td>
</tr>
</tbody>
</table>

Year 2025, length of Pipes 46,259 m

3.10. Proposed Wastewater Treatment System

The existing wastewater treatment plant in Dhamar is stabilization pond treatment method.

3.10.1. Wastewater Quantities
The table below presents the projected population and flow calculations for Dhamar based on the following assumptions:

<table>
<thead>
<tr>
<th>Water demand for Dhamar</th>
<th>65 l/c/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater return factor</td>
<td>80%</td>
</tr>
<tr>
<td>Max. day/Average day flow</td>
<td>1.2</td>
</tr>
</tbody>
</table>

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Table 3.8 Design criteria for Dhamar City

<table>
<thead>
<tr>
<th>ITEM</th>
<th>2006</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Population</td>
<td>153,651</td>
<td>174,283</td>
<td>202,041</td>
<td>231,956</td>
<td>263,720</td>
</tr>
<tr>
<td>Water Demand (m³/day)</td>
<td>6715</td>
<td>8017</td>
<td>15103</td>
<td>17339</td>
<td>19713</td>
</tr>
<tr>
<td>Average Flow (m³/day)</td>
<td>5,372</td>
<td>6,414</td>
<td>12,082</td>
<td>13,871</td>
<td>15,770</td>
</tr>
<tr>
<td>Maximum Day Flow (Design Flow) (m³/day)</td>
<td>6,446</td>
<td>7,696</td>
<td>14,498</td>
<td>16,645</td>
<td>18,925</td>
</tr>
<tr>
<td>Peak Factor</td>
<td>3.1</td>
<td>3.1</td>
<td>3.1</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Peak Dry Weather Flow (m³/day)</td>
<td>16,652</td>
<td>19,882</td>
<td>37,454</td>
<td>43,000</td>
<td>48,888</td>
</tr>
</tbody>
</table>

The Dhamar BOD₅ is around 750 mg/l due to high water consumption.

Yemeni Standards for effluent quality for the discharged effluent to water body was the basis of the treatment plant design.

3.10.2. Proposed Location for Wastewater Treatment Plant

The Wastewater Treatment Plant (WWTP) of Dhamar is proposed at the location same as that of existing WWTP. The site location of proposed as well as existing WWTPs meets the requirements of the site selection criteria for treatment plant as provided under.

The criteria for selecting the location of the treatment plant were as follow:

- Maintain "flow by gravity" from all parts of the collection system to the treatment plant.
- Far from the residential, agricultural and human activities.
- Minimize the negative impacts on the environmental components.
- Avoid / minimize the compensations for land acquisitions at the selected location.
- Enough land and possibility for expansion in the future.

Based on that, the location coordination of the proposed treatment plant of the city of Dhamar were selected as summarized on the table hereafter.

The figure on the next page shows the layout of proposed wastewater collection system and location of Dhamar treatment plant. The proposed location will be confirmed through the detailed design under Task "C".

Table 3.9 Proposed location of the Wastewater Treatment Plant

<table>
<thead>
<tr>
<th>Proposed treatment plant method</th>
<th>Proposed location of the treatment plant</th>
<th>Influent quantity m³/day</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilization ponds</td>
<td>North 1,610,250 East 437,199</td>
<td>27,744</td>
<td>Treatment Plant is already existed and require major expansion and Rehabilitation</td>
</tr>
</tbody>
</table>
3.10.3. Preliminary Sizing and detail of Treatment Facility

Preliminary design for the stabilization ponds, presented in the table on the next page has been developed based on the design criteria that were adopted.

The figure presents a process flow diagram and general layout of the proposed waste stabilization pond of Dhamar.
Figure 3.6 Process flow diagram of waste stabilization ponds for Dhamar
### Table 3.10: Dhamar Wastewater Stabilization Ponds Preliminary Design and Sizing

<table>
<thead>
<tr>
<th>Basic Data</th>
<th>Unit</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Influent Wastewater Characteristics and Flow Quantities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Flow</td>
<td>m³/day</td>
<td>15,770</td>
</tr>
<tr>
<td>Max. Day Flow (Design Flow)</td>
<td>m³/day</td>
<td>18,924</td>
</tr>
<tr>
<td>Peak Dry Weather Flow</td>
<td>m³/day</td>
<td>48,887</td>
</tr>
<tr>
<td>BOD₅ Concentration</td>
<td>mg/l</td>
<td>750</td>
</tr>
<tr>
<td>Total BOD₅ Load</td>
<td>Kg/day</td>
<td>14,193</td>
</tr>
<tr>
<td><strong>Treatment Capacity of the Existing WSP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Treatment Capacity of the existing WSP</td>
<td>m³/day</td>
<td>8,000</td>
</tr>
<tr>
<td>Average BOD₅ load to the existing WSP</td>
<td>Kg/day</td>
<td>6,000</td>
</tr>
<tr>
<td><strong>Treatment Capacity of the Proposed WSP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Day Flow to the proposed WSP (Design Flow)</td>
<td>m³/day</td>
<td>10,924</td>
</tr>
<tr>
<td>BOD₅ load to the proposed WSP</td>
<td>Kg/day</td>
<td>8,193</td>
</tr>
<tr>
<td><strong>Screens 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Screen</td>
<td>Manual</td>
<td></td>
</tr>
<tr>
<td>Bar Rack Spacing</td>
<td>mm</td>
<td>50</td>
</tr>
<tr>
<td><strong>Screens 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Screen</td>
<td>Automatic</td>
<td></td>
</tr>
<tr>
<td>Bar Rack Spacing</td>
<td>mm</td>
<td>25</td>
</tr>
<tr>
<td><strong>Aerated Grid Tank</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of Duty Tanks</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No. of Standby Tanks</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Detention time at Peak Flow</td>
<td>minute</td>
<td>8</td>
</tr>
<tr>
<td>Tank Volume</td>
<td>m³</td>
<td>170</td>
</tr>
<tr>
<td>Length/Width ratio</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Depth of Tank</td>
<td>m</td>
<td>4</td>
</tr>
<tr>
<td>Length of Tank</td>
<td>m</td>
<td>16</td>
</tr>
<tr>
<td>Width of Tank</td>
<td>m</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Flow Measurement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of Flume</td>
<td>Standing Wave</td>
<td></td>
</tr>
<tr>
<td>Flume width</td>
<td>mm</td>
<td>500</td>
</tr>
<tr>
<td>Maximum Depth of Flow</td>
<td>mm</td>
<td>544</td>
</tr>
<tr>
<td><strong>Anaerobic Ponds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Anaerobic Ponds</td>
<td>(Y=Yes, N=No)</td>
<td>Y</td>
</tr>
<tr>
<td>No. of Ponds in Parallel</td>
<td>No.</td>
<td>3</td>
</tr>
<tr>
<td>Retention time each Pond</td>
<td>Days</td>
<td>5</td>
</tr>
<tr>
<td>Length/Width Ratio @ Top</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Berm Slope 1 V in</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Water Depth</td>
<td>m</td>
<td>5</td>
</tr>
<tr>
<td>Free Board</td>
<td>m</td>
<td>1</td>
</tr>
<tr>
<td><strong>Calculations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid Depth Area Each Pond</td>
<td>ha</td>
<td>0.385</td>
</tr>
<tr>
<td>Surface Area Each Pond at top of water surface</td>
<td>ha</td>
<td>0.583</td>
</tr>
<tr>
<td>Water Volume each Pond</td>
<td>m³</td>
<td>18,510</td>
</tr>
<tr>
<td>Total Surface Area including free board (3 Ponds)</td>
<td>ha</td>
<td>2.052</td>
</tr>
<tr>
<td>Influent BOD Load</td>
<td>Kg/day</td>
<td>8193</td>
</tr>
<tr>
<td>BOD Reduction Efficiency</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Effluent BOD Load</td>
<td>Kg/day</td>
<td>4,087</td>
</tr>
</tbody>
</table>

*Draft EIA Report of Dhamar City*  
*August, 2009*
### Basic Data

<table>
<thead>
<tr>
<th>Each Pond Dimensions at Top of water surface</th>
<th>Unit</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>m</td>
<td>108</td>
</tr>
<tr>
<td>Width</td>
<td>m</td>
<td>54</td>
</tr>
</tbody>
</table>

### Facultative Ponds

#### Design Criteria

| Influent BOD Load | Kg/day | 4,097 |
| No. of Ponds in Parallel | No. | 3     |
| Temperature        | °C    | 13    |
| Surface Loading    | Kg BOD/ha.day | 192  |
| Length/Width Ratio | 2     |
| Berm Slope 1 V in  | m     | 3     |
| Water Depth        | m     | 1.8   |
| Free Board         | m     | 1     |

#### Calculations

| Mid Depth Area Each Pond | ha | 10.532 |
| Surface Area Each Pond at top of water surface | ha | 10.904 |
| Total Surface Area including free board (3 Ponds) | ha | 33.985 |
| Water Volume Each Pond | m³ | 189,541 |
| Calculated Retention Time Each Pond | days | 52 |

| Each Pond Dimensions at Top of water surface | |
| Length                                      | 467 |
| Width                                       | 233.5 |

### Maturation Ponds

#### Design Criteria

| No. of Ponds in Series | No. | 2 |
| No. of Ponds in Parallel | No. | 3 |
| Retention time for each Pond | days | 7 |
| Length/Width Ratio | 2 |
| Berm Slope 1 V in | 3 |
| Water Depth        | m | 1.6 |
| Free Board         | m | 0.8 |

#### Calculations

| Water Volume Each Pond | m³ | 25,685 |
| Mid Depth Area Each Pond | ha | 1.429 |
| Surface Area Each Pond at top of water surface | ha | 1.566 |
| Total Surface Area including free board (3 Ponds) | ha | 5,089 |
| Effluent Fecal Coliform Count | No./100 ml | 9799 |
| Each Pond Dimensions at Top of water surface | |
| Length                                      | 177 |
| Width                                       | 68.5 |

| Total Area of Ponds | |
| Total Surface Area of Ponds including free board | ha | 41.126 |
| Allow 15% for Roads and others | ha | 6.169 |
| Total Gross Area | ha | 47.295 |

### 3.10.4. Required Land Area

The following table presents summary of the land requirements for the waste stabilization ponds for Dhamar.
3.11. **Summary of proposed works and estimated capital costs**

The works designed and covered in this report are summarized as shown:

**Table 3.12 Proposed water supply system components:**

<table>
<thead>
<tr>
<th>Water Resources (Wells)</th>
<th>No.</th>
<th>Cost (LM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling of the 3 new wells (including Structural, Mechanical and Electrical works) - year 2015</td>
<td>No</td>
<td>3</td>
</tr>
<tr>
<td>Drilling of the 8 new wells in (including Structural, Mechanical and Electrical works) - year 2025</td>
<td>No</td>
<td>8</td>
</tr>
</tbody>
</table>

**Transmission lines**

| from west well field up to Harman reservoirs | L.M | 3,500 |
| D.I 300mm diameter | L.M | 6,000 |
| D.I (150-250)mm diameter | L.M | 5,000 |

| from S-E well field up to South Reservoir | L.M | 3,000 |
| D.I 300mm diameter | L.M | 6,000 |
| D.I (150-250)mm diameter | L.M | 5,000 |

**Reservoirs**

| Construction of new additional ground reservoir (East) at Thamur; capacity 5000 m³ up to year 2015 | No | 1 |
| Construction of new ground reservoir at (North) Harman mountain; capacity 8000 m³ up to year 2015 | No | 1 |
| Construction of new ground reservoir (South); capacity 6700 m³ up to year 2015 | No | 1 |
| Chlorination facility at proposed ground reservoirs | No | 3 |

**Distribution Mains**

| from Harman ground reservoirs down to the distribution network (D.I, DN 400) | L.M | 2,600 |
| from South ground reservoir down to the distribution network (D.I, DN 400) | L.M | 1,500 |

**Distribution network up to year 2016**

| (D.I, DN 150-300) | L.M | 22,000 |
| PE Pipes (DN 50-100) | L.M | 61,000 |
| PE Pipes for city internal distribution system (DN 50 to DN 75) | L.M | 50,000 |
| PE & GMS Pipes for House connections | L.M | 68,320 |

**Distribution network up to year 2025**

| DI Pipes (DN 150-200) | L.M | 4,000 |
| PE Pipes (DN 50 to DN 100) | L.M | 44,000 |
| PE & GMS Pipes for House connections | L.M | 44,055 |
Table 3.13 Proposed Wastewater Collection and Treatment Systems

<table>
<thead>
<tr>
<th>Phase (1) Year 2015</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk Lines (GRP, DN600-800)</td>
<td>L.M</td>
</tr>
<tr>
<td>Sewerage network (upvc, DN200-300)</td>
<td>L.M</td>
</tr>
<tr>
<td>12987 House Connections (upvc, DN160) up to year 2015</td>
<td>L.M</td>
</tr>
<tr>
<td>Rehabilitation of existing wastewater Treatment plant</td>
<td>each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase (2) Year 2025</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewerage network upvc,( DN200-300)</td>
<td></td>
</tr>
<tr>
<td>6608 House Connections (upvc, DN160) up to year 2025</td>
<td>L.M</td>
</tr>
<tr>
<td>Construction of new wastewater treatment plant</td>
<td>each</td>
</tr>
</tbody>
</table>

The capital costs of implementing the proposed project until year 2015 were estimated as follows:

- Water resources and tanks $4,141,450 US$
- Water network $12,590,008 US$
- Treatment plant and main lines $3,344,800 US$
- Sewerage network $16,381,328 US$

For the second phase until year 2025, the additional facilities will cost as follows:

- Water resources and water network $5,854,972 US$
- Sewerage network $10,409,560 US$

The total investment costs for the two phases of the project are around 52.5 Million US$. 
CHAPTER 4: DESCRIPTION OF CURRENT ENVIRONMENTAL AND SOCIAL STATUS OF THE PROJECT AREA

The following sections will describe the current environmental and social existing conditions at the project area in order to establish a base line data before analyzing the anticipated environmental and social impacts due to the implementation of the project components.

4.1. Existing Socio-economic Conditions

The data needed in this section was gathered from the collected reports and previous studies in addition to the field visits to the project area by the working team of the study.

4.1.1. Location, History and Population

Dhamar Governorate is considered the geographical center of the (Hymirr Civilization) project. Dhamar has ruled in the past by strong King of Hymirr tribes whose name was Dhamar Ali. Dhamar is famous and known by natural mineral baths which are considered an important feature in Yemen which are located in Ames district and Al Hosain village.

Dhamar is located 100 km to the south of Sana'a. Population of Dhamar (urban and peri urban) is 175,159 inhabitants (urban and peri urban) where 52% males and 48% females. (Census 2004). The Governorate entails 12 districts and 313 Oza, 3255 villages and about 7000 Mehales (sub village). Dhamar City is the Capital of the Governorate and surrounded by mountains.

It was a trade center and situated in the middle of the country. It connects all Yemeni towns with each others. It used to be surrounded by great Castles. Dhamar played an important role during Islam so it has famous mosques as (The Grand Mosque) which is considered as the oldest one in Yemen, in addition to the oldest school in Yemen (Al Shamsya school).

People of Dhamar are mainly farmers, traders, and government employees. Topography of Dhamar city is partially flat, with average elevation of 2400 - 2450 m. Location of the City was shown in chapter three of this report.

The city expansion is towards the south and north. In the future, there is possibility to expand toward east, if the Mareb road is constructed. Because now the new roads are constructed in South and West area, around 80% of the lands are cultivated, and water resources are located in the Southeast, and west parts of the city.

Seventy percent of Dhamar's buildings are one floor. The immigration rate to Dhamar is very high; around 80% of yearly increasing is due to immigration.

Population density in 2006 was 830 person/km² where the estimated number of houses in the town center were counted from the Satellite images= 17,175 house and the average residents in each house in the center estimated at 7 persons.

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4.1.2. Education

According to the census of 2004 the number of students in Dhamar governorate who are enrolled in schools is 207,776. Out of that 65% are males and 35% are females. In 2006 the total number of students enrolled in schools of Dhamar City is 40,991 distributed among 66 schools of different scholastic stages. The number of females enrolled in school in Dhamar city is 14,445 which accounts for 35% of the total enrolled students (Yemen News, 2009).

Regarding the higher education institutions, there is a university of Dhamar. The total registered student in all specializations in Dhamar University is 11,759 students, out of which 9,380 students (80%) are males. The total number of faculties staff in Dhamar University is 470 persons, 72% are males, and 81% are Yemeni citizens.

The number of students in different faculties ranges from around 2,000 like in the Arts and Administrative sciences to 65 students like in the Dentistry School, out of which 51 are males.

Table 4.1  Population Enrolment Rate in Basic Schooling (6 to 15 years old) by Sex according to 1994 and 2004 Censuses

<table>
<thead>
<tr>
<th></th>
<th>Censuses 2004</th>
<th>Censuses 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enrolled</td>
<td>Total</td>
</tr>
<tr>
<td>Dhamar</td>
<td>207,776</td>
<td>134,605</td>
</tr>
<tr>
<td></td>
<td>Total of population</td>
<td>368,865</td>
</tr>
<tr>
<td></td>
<td>Enrolment rate (%)</td>
<td>56.3</td>
</tr>
</tbody>
</table>

4.1.3. Health Situation

There are 9 medical centers in 2006 in Dhamar. The number of physicians is 62, out of which two are male specialists, two male and one female general practitioner, two male and one female dentist, two medical assistants. Also there are 15 male and 6 female nurses. On the other hand, there is one public health specialist.

The city has only one public hospital with 194 beds, where there are 11 male and 3 female specialists, 21 general practitioners, ten dentists (half of them females), 4 medical assistants, 37 male and 36 female nurses, one pharmacist, and 9 anesthesiology specialists. There is another hospital still under construction. Moreover, there are four medical centers, two medical units and one center for pediatrics and maternity.

As shown in the table below, the main diseases dominating in Dhamar are Dysentary, Infectious hepatitis, Malaria and Typhoid.
Table 4.2  Reported diseases and number of cases in Dhamar Governorate during 2003 (Annual Statistics Book, 2004)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Dysentery</th>
<th>Malaria</th>
<th>Bilharzia</th>
<th>Pneumonia</th>
<th>Infection A Hepatitis</th>
<th>Typhoid</th>
<th>Cholera</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Reported Cases</td>
<td>4,555</td>
<td>32,785</td>
<td>4,138</td>
<td>-</td>
<td>256</td>
<td>1,551</td>
<td>0</td>
</tr>
</tbody>
</table>

4.1.4.  Agricultural Activities

Based on the 2005 statistical for the agricultural activities in the Governorate, the total cultivated areas are around 85,767 hectares. Where the irrigable areas but not cultivated yet may reach to 52,453 hectares. Table 4.3 illustrates the cultivated area and breakdown by type of crop in Dhamar area. It can be noticed that the the cultivated land is dominated by serials crops (68%). This is mainly because the area is enloving a relatively high rainfall level, which encourages the rain fed agriculture.

As shown in the next table, in Dhamar region, the dominant crop is the cereals (20,767.94 hectares) followed by fodders (2,440.98 hectares) and the rest are vegetables, fruits, and pulses. The majority of the cultivated lands are irrigated through private wells and rain fed. Very little depends on streams and drains.

For the agricultural livestock, the total numbers of sheep heads in Dhamar Governorate are 380,000, goats (295,000 heads), cows (157,000 heads), camels (4,700 heads) and honey bees (30,000 hives). These figures are based on the 2005 statistical survey at the governorate which is considered as the most accurate and latest one.

Table 4.3  Total cultivated area and breakdown by type of crops in Dhamar Region

<table>
<thead>
<tr>
<th>Dhamar Region</th>
<th>Cereals</th>
<th>Vegetables</th>
<th>Fruits</th>
<th>Pulses</th>
<th>Cash crops</th>
<th>Fodder</th>
<th>Coffee and Qat</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (Hectares)</td>
<td>20,767.94</td>
<td>1,348.91</td>
<td>390.29</td>
<td>711.41</td>
<td>0</td>
<td>2,440.88</td>
<td>4,594.39</td>
<td>30,251.92</td>
</tr>
</tbody>
</table>

4.1.5.  Electricity and communication

The total received energy for the Governorate is about 101 MWH (Mega V Hour) the sold is 88 MWH and the lost is 13 MWH serving a total of 60,000 subscribers.

The total number of telephone subscribers at the Governorate is 33,200 for different sectors; public, Government and private.

4.1.6.  Labor forces

The total labor forces on Governmental level are around 22,000 members (2006), the majority (70%) are working in the field of education, followed by health, agriculture and home rule.
4.1.7. Tourist Establishments

The total number of beds at the available hotels in Dhamar is 450 beds distributed over 11 hotels. Another 15 pensions are available and 36 restaurants, 24 cafeterias, one park and one museum.

4.2. Water Resources and Climate

4.2.1. Rainfall and Humidity

Rainfall is the basic water resource, and there are marked differences in the amount of rain received in various parts of Dhmar governorate. The next figure shows Dhamar governorate map with rainfall distribution in various governorate districts.

Figure 4.1 Agro-Climatic zones and rainfall of Dhamar Governorate (Agro-Climate and Production Systems in Dhamar Governorate, 2000).

As for the City of Dhamar, the average annual rainfall is ranging from 200 to 500 mm. The figure on the next page shows the average annual rainfall on Dhamar City for the period 1999-2004 (Yemen Agro-Climate Guide, 2004). It can be seen that during the year 2003, the rainfall was the maximum (500 mm), while during the year 1999 had the lowest rainfall level of 200 mm. This implies that rainfall is highly variable in time and quantity. Despite that, Dhamar governorate is considered relatively wet area as compared to other regions of Yemen.

Rainfall occurs in two periods, the first from March through May, and the second from July until September, which is the heaviest rainy season. There is little or no rain from November to February but there are exceptions in certain regions and years.
Figure 4.2 Average annual rainfall on Dhamar City for the period 1999-2004 (Source: Yemen Agro-Climate Guide, 2004)

Relative humidity in Dhamar is ranging from 30 to 60% during the year, with highest (60%) being recorded in August and lowest (30%) during June. The figure below depicts the average relative humidity levels in Dhamar City for the period 1999-2004 (Yemen Agro-Climate Guide, 2004).

Figure 4.3 Average relative monthly humidity in Dhamar City for the period 1999-2004 (Yemen Agro-Climate Guide, 2004)

4.2.2. Temperature, wind and evaporation

Dhamar city is located in the seventh Agro-climatic zone, in which the average maximum temperature is ranging from 23 to 30°C, while the average minimum temperature is ranging from 4 to 13°C. (Yemen Agro-Climate Guide, 2004). The next figure shows the average, minimum and maximum temperature values recorded in
Dhamar during the period 1999-2004. It can be noted that the lowest temperature is in January, while the highest is reached during the month of June.

The wind in Dhamar is seasonal. It is characterized of being moderate with a speed ranging from 1.8 -3.8 m. The figure on the next page shows the average wind velocity in Dhamar City for different months of the year during the period 1999-2004. The dominant wind direction is eastern direction in most of the months. (Civil Aviation and Meteorology Authority, 2003)

Figure 4.4 Average, Maximum and minimum temperatures in Dhamar City for the Period 1987-2004 (Source: Yemen Agro-Climate Guide, 2004).
The average potential evapo-transpiration at the project area ranges between (1300 - 1600 mm). (Yemen Agro-Climatic Guide, 2004), while the average period of solar radiation of Dhamar is ranging from 8-10 hours

4.2.3. Water and Sanitation

The water supply system of Dhamar depends on the groundwater resources. The main aquifer in Dhamar area is the complex system of alluvium deposits and the tertiary volcanic rocks, which are hydraulically interconnected. Local water resources are of good quality. Recharge to the aquifer may cover the domestic water needs if groundwater is used only for domestic water supply. Spacing of the pumping wells to be drilled in the future has to be well located to prevent any interfaces of cones of depression in the pumping wells. The city has 14 wells in total. Out of these total 14 wells 12 wells are operational while the remaining two are not connected to the system. Eight of the total 12 operational wells are located in Samah well field. The drilling of these wells carried out in 1990 with average depth of 150m. The Samah field wells are feeding Thamar ground water reservoir through a 15 km long, 250 - 500 mm diameter D.I Transmission Main. The details of the relevant 14 wells are presented below.
Table 4.4 Details of the existing drinking water wells

<table>
<thead>
<tr>
<th>Well No</th>
<th>Q In</th>
<th>Q m³/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samah Well 16</td>
<td>22</td>
<td>1,584</td>
</tr>
<tr>
<td>Samah Well 19</td>
<td>19</td>
<td>1,368</td>
</tr>
<tr>
<td>Samah Well 20</td>
<td>21</td>
<td>1,512</td>
</tr>
<tr>
<td>Samah Well 23</td>
<td>21</td>
<td>1,512</td>
</tr>
<tr>
<td>Samah Well 24</td>
<td>20</td>
<td>1,440</td>
</tr>
<tr>
<td>Samah Well 25</td>
<td>22</td>
<td>1,584</td>
</tr>
<tr>
<td>Samah Well 26</td>
<td>21</td>
<td>1,512</td>
</tr>
<tr>
<td>Samah 2</td>
<td>17</td>
<td>1,224</td>
</tr>
<tr>
<td>Stadium well (Task A well 2)</td>
<td>9</td>
<td>648</td>
</tr>
<tr>
<td>Mehlah well (not connected)</td>
<td>10</td>
<td>720</td>
</tr>
<tr>
<td>Qusoor well (not connected) (Task A well No 1)</td>
<td>11</td>
<td>792</td>
</tr>
<tr>
<td>Shuabah well</td>
<td>15</td>
<td>1,080</td>
</tr>
<tr>
<td>Harran well</td>
<td>7</td>
<td>504</td>
</tr>
<tr>
<td>Jodad well</td>
<td>5</td>
<td>360</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15,840</td>
</tr>
</tbody>
</table>

Based on the current yields the combined productivity from Samah field wells totalled to 11,736 m³/day. The total combined production from other four operating wells is 2,592 m³/day. Whereas the combined productivity of Al-Melah and Al-Qosoor wells is 1,512 m³/day. Hence the overall productivity of Dhamar existing wells is 15,840 m³/day or 5,781,600 m³/year.

The location of Dhamar well field is presented in chapter III.

Current water quality results of Samah wells showed a good water quality with respect to TDS in comparison with WHO and Yemeni Standards; below (1000 mg/l) as presented in the table below. No treatment is necessary for the pumped water.

Table 4.5 Comparison of the current water quality of the wells in Samah with WHO and Yemeni Standards

<table>
<thead>
<tr>
<th>No</th>
<th>Well name</th>
<th>TDS, mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Well No.2</td>
<td>340</td>
</tr>
<tr>
<td>2</td>
<td>Well No.18</td>
<td>330</td>
</tr>
<tr>
<td>3</td>
<td>Well No.19</td>
<td>340</td>
</tr>
<tr>
<td>4</td>
<td>Well No.23</td>
<td>340</td>
</tr>
<tr>
<td>5</td>
<td>Well No.24</td>
<td>351</td>
</tr>
<tr>
<td>6</td>
<td>Well No.25</td>
<td>352</td>
</tr>
<tr>
<td>7</td>
<td>Well No.26</td>
<td>353</td>
</tr>
<tr>
<td>8</td>
<td>Yemen Standards No. 109/2000</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>WHO guidelines</td>
<td>1,000</td>
</tr>
</tbody>
</table>

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4.2.4. Existing Water Supply System

Most of the existing water supply network in Dhamar was constructed in two Stages i.e. Stage-1 and Stage-2. Works under Stage-1 were completed in 1967, whereas Stage-2 started in 1985 and completed in year 1992. The Stage-1 was constructed by USAID, while the stage-2 works was constructed utilizing funds from Arab and OPEC Funds as well as the Government of Yemen. The works under Stage-2 were being implemented and operated by NWSA through Dhamar branch, and were put into service in 1992.

The works carried out under Stage-1 comprises construction of distribution network inside old city area by laying 25mm-100mm diameter GMS pipes. However WSSLC Dhamar replaced about 50% of the pipes previously laid under stage-1. There are still about 15km length of distribution network lines of old network and some more lines laid afterwards, which needed replacement. WSSLC expected replacement of all pipes by the year 2010.

Under Stage-2, in addition to construction of Ground water reservoir, D.I pipes of diameters from 100mm to 500mm and house connection GMS pipes (with polythene sheets wrapping) of diameters from ½” to 2” were laid. After completion of Stage-2, the extension in distribution network and provision of house connections (using ½” to 4” diameter pipes) has been carried out from time to time.

The city is supplied continuous water supply (i.e. 24 hrs supply). The Eastern areas of city are fed from a Ground water Reservoir located in an area called Thamar. The water storage capacity of Thamar reservoir is 6,000 m$^3$ and elevation is 2,473 masl. A Ductile Iron (D.I) distribution main of 500mm diameter carry water from reservoir to the distribution network. This happen to be the only working Ground Reservoir in the city that is supplying water under gravity. Moreover, chlorination unit is provided at reservoir site that is in operation since September 2007.

There also exists a non functional O/H reservoir near the Ground reservoir site. The height and storage capacity of O/H Tank are 12m and 140 m$^2$, respectively.

In addition to Eastern areas of city, there are four villages (Thamar, Mawaheb, Lakhmah, and Kharabah) which receive water from Thamar water reservoir. The total estimated population of these four villages is around 20,000. Due to priority of water supply to city, the villages are not getting water in required quantity and pressure from the east reservoir, but actually they are connected directly to the main 500 mm transmission line.

The reservoir itself is being fed from 8 wells located in Samah well field in the south eastern part of Dhamar. The city is also supplied water through direct pumping through existing operational 4 wells located in Shuaibah, Jodad, Harran and sports stadium. Two more wells, are located in the west-southern part of city at Al-Mehlah and Al-Qosoor, However they are not connected to network yet.

Presently, there is a project under construction which is aiming at enhancing the water network of the west area of Dhamar city. Under the project, wells located at Sport Stadium, Al-Mehlah, Al-Qosoor and Shuaibah will be connected to distribution network of western area of the city. The project includes construction of one O/H balancing Reservoir (capacity=100m$^3$ and height=12m) in South of city at a place called Roma. In addition to above, the project also includes construction of a pump station (piping, building and pumps) and laying of 100mm to 250mm diameter transmission lines.
The number of subscribers of water supply to-date stands at 15,199 that cover about 76% of city area. The house connections are still in good conditions.

As stated before, the water supply system of Dhamar was constructed in two stages; the first stage was completed in 1967 and still in operation which means that part of the distribution network is very old, almost 38 years old which explains the high percentage of water losses (almost 40%). The water system was extended through the second stage by NWSA in 1992.

From Thamar reservoir, water is conveyed by gravity through a DI Distribution main of DN 500, with a total length of 4.20 km to the distribution system of Dhamar city. The distribution network is made of DI (diameter 100 mm - 400 mm) and GMS (DN 50-150 mm). The total pipe-length of the distribution system is about 64 km. Most of the GMS pipes of DN 50-100 installed in the old city are deteriorated and should be replaced by new and bigger diameter pipes.

The existing distribution network constructed during the second stage (in 1992) is still in good condition. All new and good condition pipes will be integrated in the system; the deteriorated and small diameters pipe will be either replaced or reinforced respectively. Detail of Dhamar Existing piping system is summarized below.

**Table 4.6 Dhamar Existing Piping System**

<table>
<thead>
<tr>
<th>Dia mm</th>
<th>Length km</th>
<th>Conditions</th>
<th>Material</th>
<th>Date of installation</th>
<th>Water losses</th>
<th>House connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>250-500</td>
<td>15.0</td>
<td>Good</td>
<td>DI</td>
<td>1992-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>500</td>
<td>4.2</td>
<td>Good</td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>400</td>
<td>1.0</td>
<td>Good</td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>300</td>
<td>2.5</td>
<td></td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>250</td>
<td>2.3</td>
<td></td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>200</td>
<td>6.1</td>
<td></td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>150</td>
<td>0.2</td>
<td></td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>100</td>
<td>3.5</td>
<td></td>
<td>DI</td>
<td>1992</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Network</th>
<th>Dia mm</th>
<th>Length km</th>
<th>Conditions</th>
<th>Material</th>
<th>Date of installation</th>
<th>Water losses</th>
<th>House connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤150</td>
<td></td>
<td>38</td>
<td>Bad + Good</td>
<td>GMS,DI</td>
<td>1967-1992</td>
<td>40%</td>
<td>PE,GMS, DN25</td>
</tr>
</tbody>
</table>

**4.2.5. Required Water Production**

According to the required water demand the following yields, as summarized in the table below will be required based on 20 hrs daily pumping.
Table 4.7 The Required Yields of the Wells

<table>
<thead>
<tr>
<th>Year</th>
<th>Required Water Demand m$^3$/day</th>
<th>Required Yield based on Recommended 20 Pumping hrs (l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>9,400</td>
<td>131</td>
</tr>
<tr>
<td>2010</td>
<td>9,620</td>
<td>133</td>
</tr>
<tr>
<td>2015</td>
<td>18,123</td>
<td>252</td>
</tr>
<tr>
<td>2020</td>
<td>20,606</td>
<td>289</td>
</tr>
<tr>
<td>2025</td>
<td>23,868</td>
<td>329</td>
</tr>
</tbody>
</table>

4.2.6. Existing Wastewater Disposal System and Treatment Plant

Parts of the northern and eastern areas of Dhamar are currently served by an existing sewer network consists of uPVC pipes with diameter varying from 150-600 mm and total length 58 km. The first stage of Dhamar existing wastewater network was implemented in 1992 and the network is still in good condition. The remaining areas have no wastewater collection system and cesspits are being used to collect wastewater.

Recently, a small sewer laying contract was being undertaken in Dhamar’s western areas of Omer ben Al-Khatab and Al-Methaq. Under the contract, about 2.5 km of 200mm and 180mm diameters of uPVC pipes were laid. The works under this contract completed in 2006. The source of financing for this contract was arranged from Social fund.

The number of sewer house connections is around 8660, covering about 42% of the town population. The detail of existing wastewater network i.e lengths, diameters and materials of pipes is summarized as follows.

Table 4.8 Existing Sewerage Network of Dhamar City

<table>
<thead>
<tr>
<th>Pipes</th>
<th>Material</th>
<th>Diameter</th>
<th>Length</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>uPVC</td>
<td>ND 600</td>
<td>2km</td>
<td></td>
<td>The treatment plant with four anaerobic and two aerobic ponds.</td>
</tr>
<tr>
<td>uPVC</td>
<td>NDN 180</td>
<td>60 km</td>
<td></td>
<td>Number of sewer house connection is 8660, representing only 42% of the town.</td>
</tr>
</tbody>
</table>

Dhamar existing Wastewater Treatment Plant (Natural Stabilization Ponds System) is located towards North East of the city as shown on the next page. The plant receives the waste water through a 2 km long uPVC pipe line of diameter DN 600 mm. The treatment plant was designed to receive an average wastewater flow about 8,000 m$^3$/day during winter and 12,000 m$^3$/day during summer, which is not adequate for the current wastewater flows. The two next figures show parts of the existing treatment plant.
The plant requires rehabilitations and more controlling for the effluent quality. The treated effluent is discharged to the areas near the treatment ponds with unrestricted reuse. The treatment plant consists of four anaerobic and two aerobic ponds. The next figure shows part of the reuse uncontrolled activities downstream the treatment plant.
4.3. Ecological and Archaeological Conditions

This section entails description of the existing Flora and Fauna of the project area.

4.3.1. Flora

For the natural habitats and endangered flora species, there are no records of any endangered species at the City or the surrounding areas. This is also confirmed during the scoping session as it will be presented in Chapter 6.

4.3.2. Fauna

As mentioned earlier, the Governorate hosted a remarkable number of sheep heads, cows and camels. The intensity of the livestock in the City of Dhamar is very minimal due to the type of works and jobs that are available. Most of the animals are distributed within the villages and sub villages of the Governorate. There are no records of endangered fauna species at the City.

4.3.3. Archaeology

Dhamar Governorate is considered the geographical center of the (Hymirit Civilization). Dhamar has ruled in the past by strong King of Hymirit tribes whose name was Dhamar Ali. Dhamar is famous and known by natural mineral baths which are considered an important feature in Yemen which are located in Annes district and Al Hassin village.

It was a trade center and situated in the middle of the country. It connects all Yemeni towns with each others. It used to be surrounded by great Castles. The City of Dhamar
played an important role during Islam so it has famous mosques as (The Grand Mosque) which is considered as the oldest one in Yemen, in addition to the oldest school in Yemen (Al Shamaya school).

4.4. Topography, Soil and Geology

Dhamar is located in the central area of Yemen between 444,200 – 444,600 East and 1,419,000 - 1,419,210 North. Most of the highways connecting Yemeni cities are passing through the governorate. The area is characterized by flat agricultural land through which some hills and mountains exist, such as Yefaa Mountain in the west and Ghata Haran that is located in the north side of Dhamar City. This mountain is considered as the site of an old volcano which covered most of the city by basaltic formations and volcanic ashes in the old ages.

The area in the north of the City where the campus of the University of Dhamar lies, is gently inclined towards east and north east.

Soil investigations study was performed on June 2008 for the project; three hundred and eighteen boreholes were drilled at the site to cover wastewater and water networks, water tanks and treatment plant which located in Dhamar City.

The results of the soil investigations conducted for the drilled boreholes (10 m depth) at the location of wastewater treatment plant encountered subsurface material consist of the following layers:

- Top soil materials composed of light brown silty clay with gravels and cobbles of basalt
- Mixture materials composed of brown silty clay with gravels and cobbles of basalt
- Gray highly fractured highly weathered moderately weak to moderately strong basalt.

For the boreholes drilled at the location of the proposed water storage reservoirs (Harran Reservoir, Harren Reservoir, and South Reservoir) with average depth from 6 - 9 m; the materials encountered in these sites consist of the following layers:

- **Harran Reservoir:**
  - Top soil material composed of brown silty clay with gravels and cobbles of volcanic ash and basalt.
  - Dark grey to black fractured weathered weak to moderately weak volcanic ash.
  - Light pink to pink highly fractured highly weathered very weak to weak volcanic ash.

- **Dhamar Reservoir:**
  - Fill materials composed of light brown silty clay with gravels and cobbles of basalt and volcanic ash.
  - Brown moist stiff silty clay with gravels of volcanic ash.
  - Light brown to light rosy highly fractured highly weathered volcanic ash.
South Reservoir:
- Black moderately weak highly fractured highly weathered basalt intercalated with volcanic ash.
- Pink very weak to weak highly fractured highly weathered volcanic ash.

The subsurface materials encountered in the drilled boreholes conducted for the routes of water and wastewater networks consist of the following layers (with average depth of 5-10 m):
- Top soil materials composed of light brown to silty clay with gravels and cobbles of basalt and volcanic ash.
- Fill materials composed of dark brown to brown silty clay with gravels and cobbles of basalt and volcanic ash
- Dark brown to brown moist stiff to very stiff sandy silty clay with gravels and cobbles of basalt and volcanic ash.
- Light brown to pink very weak highly fractured highly weathered volcanic ash.
- Dark gray moderately strong fractured weathered basalt.
- Grey moist very weak marl with gravels and cobbles of basalt.
- Reddish brown moist to wet very weak very clayey marl
- Mixture materials composed of brown silty clay with gravels, cobbles and boulders of basalt and volcanic ash.

The northern part of Dhamar is covered with volcanic basaltic rocks and ashes from the third age. On the other hand the southern part is mainly composed of clay and silt that are mixed with sand.

Dhamar area has been exposed to several seismic events. One major earthquake took place in 1982, which is considered the major earthquake that hit Yemen in the modern age. One of the major natural faults is passing through north eastern part of the city. This fault is seismically active. On the other hand, in the northern, the north western and western sides of the city left-lateral- normal faults can be noticed. As for the southern side of the city, it is considered an active area from seismic point of view, where medium and weak seismic activities are still recoded to date, which renders the area as one of the active seismic areas in Yemen. The next figure shows Dhamar Geological map, while the table after it lists the geological formation and ages that are existing in Dhamar area.
Figure 4.9 Geological map of Dhamar

Table 4.9 Geological formation and ages in Dhamar region

<table>
<thead>
<tr>
<th>Period</th>
<th>symbol</th>
<th>Letter</th>
<th>Litho logy description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENOZOIC</td>
<td></td>
<td>C6</td>
<td>Loess and ancient dunes: areas of wind-plowed soils and sands.</td>
</tr>
<tr>
<td>QUATERNARY</td>
<td></td>
<td>QVB</td>
<td>Basaltic lava</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QVT</td>
<td>Ignimbrite ashflow deposit</td>
</tr>
<tr>
<td>CENOZOIC</td>
<td></td>
<td>TVB</td>
<td>Basalt</td>
</tr>
<tr>
<td>TERTIARY</td>
<td></td>
<td>TVi</td>
<td>Trachyte</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TVA</td>
<td>Rhyolite and dacite</td>
</tr>
</tbody>
</table>
CHAPTER 5: GUIDELINES FOR CONDUCTING ENVIRONMENTAL IMPACT ASSESSMENT IN YEMEN

5.1. Introduction

The selection of criteria for the evaluation of the environment and socio-economic of the program requires an intensive review for all potential environmental impacts of the project (if necessary). Regardless, if it has direct or indirect effects with regards to the general environmental categories (World Bank classification category A, B, C, F1). The selection criteria and characterization will consider the favorable or unfavorable impacts of the project from design, construction and operational; resettlement and land acquisition; assessment of the project significance such as likelihood, intensity, risk and environmental impacts; and identification the potential significant impacts with emphasis on special characteristics of the Yemeni environment.

The guidelines for conducting environmental impacts assessments and the process of the screening to define the project category have been discussed in this chapter. This guideline was developed under phase I of this study, named the Sectoral Environmental Assessment guidelines for the water and sanitation sector. It was essential to elaborate on the findings of our SEA study and how that will be reflected in our analytical procedures at this stage.

5.2. Objectives

Scoping and screening will consist of identifying, for each potential project, the major issues, the appropriate environmental category, and establishing a plan for appropriate environmental assessment (EA) studies. It will also serve to heighten awareness of these issues among stakeholders and institutes, which are engaged in the planning process. Scoping will rely on baseline data drawn from related reports, interviews, photographs and maps, supplemented by on-site inspection and initial stakeholder consultations.

The main objective of these guidelines is to set procedural framework for the Environmentalists in Yemen to perform screening, and scoping before deciding on the level of Environmental Impact Assessment of any Water and Sanitation Project.

These guidelines will be adopted for conducting the specific EIA studies of the 14 urban centers that were mentioned in chapter one of this report. The terms of reference of this study requested the Consultant to develop the EIA guidelines in phase I and consider it during the preparation of the EIA in phase II.

The process of EIA study started with deciding on the category of the project based on the anticipated negative impacts. The figure on the next page shows the recommended steps toward deciding the level of EIA that need to be done, and usually called screening process. Categories of "A", "B", "C" and "F1" are related to the World Bank categorization that gave an indication of the sensitivity of the project from the environmental aspects. The highest environmentally sensitive is "A" and the lowest is "F1". All the details of these categories are attached in annex 2 of this Report.

After deciding on the Category, which is an indication of the level of details for the environmental impact assessment study, the second step will be to check the
requirements of each category and the necessary safeguards that need to be considered for each project. The last step will be to carry out the study based on the conclusions in previous stages.

Figure 5.1 Schematic diagram shows the steps for deciding on EIA level

<table>
<thead>
<tr>
<th>Environmental Category Checklist</th>
<th>Decide on Category A, B, C, D1</th>
<th>Define the level of EIA study</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screening Checklist</td>
<td>(Stage 1)</td>
<td>(Stage 2)</td>
<td>(Stage 3)</td>
</tr>
</tbody>
</table>

In the following sections, more elaboration will be presented regarding the proposed methodological approach that may be adopted for screening process before conducting the environmental assessment (EA) studies for Water and Sanitation Projects in the Republic of Yemen.

5.3. Environmental Category Checklist

Environmental category checklist is prepared to support the environmental categorization process and focuses on the anticipated environmental potential impacts of the Water and Sanitation projects in relation to the following aspects:

- Land Resources;
- Hydrology, Hydrogeology and Water Resources Management;
- Air Quality and Noise Nuisance;
- Biological Resources (Flora and Fauna);
- Socio-Economic and Cultural Resources

Category Checklist was developed to assist the decision maker to pinpoint on the category level of the project as shown in the next table. The definition of these categories is shown in after it.
### Table 5.1 Category Checklist

<table>
<thead>
<tr>
<th>Kind of water/sanitation project</th>
<th>Project Activity</th>
<th>Anticipated Impacts (Negative/Positive)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Water resources</td>
<td>- Land resources</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resettlement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Air &amp; noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
<td></td>
</tr>
<tr>
<td>Water supply</td>
<td></td>
<td>- Land resources</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resettlement</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Air &amp; noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
<td></td>
</tr>
<tr>
<td>Water treatment</td>
<td></td>
<td>- Land resources</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resettlement</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Air &amp; noise</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
<td></td>
</tr>
<tr>
<td>Awareness and Capacity Building</td>
<td>Hygienic</td>
<td>- Land resources</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>educational</td>
<td>- Resettlement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>program</td>
<td>- Cultural resources</td>
<td></td>
</tr>
<tr>
<td>Wastewater</td>
<td>Wastewater</td>
<td>- Soil</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>treatment plants</td>
<td>- Surface &amp; groundwater</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Human health</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Resettlement</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
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</tr>
<tr>
<td>Wastewater</td>
<td>Wastewater</td>
<td>- Soil</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>collection</td>
<td>- Surface &amp; groundwater</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Human health</td>
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<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
<td></td>
</tr>
<tr>
<td>Water Reuse</td>
<td></td>
<td>- Soil</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Surface &amp; groundwater</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Human health</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Biological resources</td>
<td></td>
</tr>
</tbody>
</table>

### Table 5.2 Definition of the categories

| Category A                      | Definition: A proposed water/wastewater project is classified as Category (A) if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. Environmental Actions: EA for a Category (A) project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. Environmental Impact Assessment Report shall include elements of other EA instruments such as environmental audit, hazard or risk assessment, and Environmental Management Plan (EMP). |

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For the case of Dhamar water and sanitation projects, it will be considered as a Category "A" project which may produce negative impacts on the project area and surroundings and requires an EMP at the end of the process.

5.4. Policy Frameworks and Selected Safeguards

After deciding on the Category of the project (A), the next step will be to select the applicable safeguard policies that need to be considered for each Category. For the case of Dhamar, these policies are related to:

- Resettlement Policy Framework, (OP 4.12)
- Natural Habitats Policy Framework, (OP 4.04)
- Cultural Resources Framework, (OPN 11.03, being revised as OP 4.11)

These safeguard policies were quoted from World Bank Guidelines and are applicable for the case of water sector in Yemen.

5.5. Details of Safeguard Policies

5.5.1. Resettlement

Projects involving "major" resettlement impacts (i.e. more than 200 affected persons) shall automatically be placed under environmental screening Category (A) and will require a Full Resettlement Plan as defined in the Resettlement Policy Framework. Projects with less than 200 affected persons shall be placed under Category (B) and will require an Abbreviated Resettlement Plan.

The failure to take into account potential involuntary resettlement in the developed urban centers can increase the risk of hardship, poverty and increase environmental damage. The over all policy objectives are:

a) Resettlement must be avoided or minimized, exploring alternative project designs;
b) Where it is unavoidable, resettlement must be handled as a sustainable development program, where the displaced persons are given the opportunity to join the planning and implementation process, while sharing the benefits of the project; and

c) Displaced persons must be assisted to improve their livelihood or, at least, restore it to pre-project level.

To fulfill the purpose of the resettlement framework objective, "affected persons" are defined as:

- All persons who, as a result of works carried out or to be carried out under the project, would incur: (i) relocation or loss of shelter, such as houses; (ii) loss of assets or access to assets such as land, or (iii) loss of income sources or means of livelihood whether or not the affected persons must move to another location, such as shops or productive activities on the land; or
- The involuntary restriction of access to legally designated parks or protected areas resulting in adverse impacts on the livelihood of displaced persons.

The Yemeni Constitution (Article 7.c and 20) protects citizens from general expropriation of their assets. The Public Utility Owner Law (1/1995) (PUOL), gives governmental bodies (including governors) the right to acquire private property for projects in the public interest. Yemeni law stresses that land expropriation is to take place only in the event that no suitable land alternatives exist that are already in the public domain. In such instances the legal provisions for expropriation and compensation will apply. The law describes the following:

- Situation of legal expropriation
- Procedures for expropriation; and
- The agency responsible for valuation of the compensation and its procedures.

Former regulations exist for land acquisition in urban areas, under Executive Regulations (280/1997) to the urban Planning Law (No. 20/1995). In these cases, compensation for land taken for urban streets and services when the percentage of area taken for public interest exceeds 25% of the property affected. When such conditions apply, the procedures and documentation requirements are quite extensive and time consuming and, as a result, the Law is effectively applied in 10% of the cases.

Land-taking practice is rooted in longstanding traditional community-level agreements geared to avoid the expensive, time consuming litigations set up for the urban areas which also trigger legal proceedings warranted by civil law and the judicial process. The current practice consists in negotiating land donation by affected landowners, and/or in-kind property replacement for buildings and structures, under the tutelage of local authorities, generally the Governor.

Assets developed by private individuals on Government land are not compensated in case of demolition for public interest. Religious trust land (waqf) is considered public property. However, assets developed by, and the benefits accruing to the private renters of waqf states are liable to compensation, including houses, farms and shops. The facilities built on trust land for social or religious purposes, such as community
buildings; mosques and graveyards must be relocated and reconstructed in the nearest convenient place.

In conclusion, formal provisions for land expropriation exist in Yemen. The conflicts over land acquisition have been settled through consultations and internal arrangements, which generally involves land donation and/or in-kind compensation for loss of buildings. This practice provides guidelines for implementing a Resettlement Policy for UWSSP’s inconsistent with the World Bank OP 4.12 policy.

5.5.2. Natural Habitats

Any proposed project located, or is adjacent to, any of the "declared", "proposed declared" protected areas in Yemen shall automatically be placed in Environmental Category A and will require to carry out a detailed impact assessment and Environmental Management Plan (EMP), as defined in the Natural Habitats Policy Framework (BP 4.04), as part of the overall EA. Projects whose proposed alignment pass through or are adjacent to any "non-critical habitat" may be Category A or B depending on its relative location and extent of anticipated impacts, but in either case need to carry out the detailed impact assessment and EMP.

The proposed projects could significantly convert or degrade natural habitats, which would trigger the application of the Natural Habitats Safeguard Policy, Operational Policy (OP) 4.04.

Due to the unknown exact location of the UWSSP facilities, it is not possible to determine which WSSP project could significantly convert or degrade natural habitats and thus it is necessary to establish a Natural Habitats Policy Framework (NHPF) which provides procedural guidelines on how to address this issue if it is occurred:

The conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development.

International Donors do not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its sitting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would convert or degrade natural habitats, the project must include mitigation measures acceptable to the donors. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g. strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The World Bank accepts other forms of mitigation measures only when they are technically justified. Based on the World Bank’s Operational Policy OP 4.04 the following definitions apply:

Natural habitats are land and water areas where: (i) the ecosystem’s biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the area’s primary ecological function.

Critical natural habitats: (i) existing protected areas and areas officially proposed by Governments as protected areas (e.g. reserves that meet the criteria of the World Conservation Union-IUCN2 classification), areas initially recognized as protected by traditional local communities (e.g. sacred groves or forests). And sites that maintain
conditions vital for the viability of these protected areas (as determined by the EIA process) or (ii) sites identified on supplementary lists prepared by the Bank or an authoritative source determined by the Regional Environmental Sector of the World Bank.

**Significant conversion** is the elimination or severe diminution (reduction) of the integrity of a critical or other natural habitat caused by a major long-term change in land or water use. Significant conversion may include, for example, land clearing replacement of natural vegetation, drainage dredging, filling or canalization of wetlands, etc. Conversion can result directly from the action of a project or through indirect mechanism

**Degradation** is modification of a critical or other natural habitat that substantially reduces the habitat's ability to maintain viable populations of its native species.

**Appropriate conservation and mitigation measures** remove or reduce adverse impacts on natural habitats or their functions, keeping such impacts within socially defined limits of acceptable environmental change. Specific measures depend on the ecological characteristics of the given site. Such measures will always include provision for monitoring and evaluation to provide feedback on conservation outcomes and to provide guidance for developing or refining appropriate corrective actions.

The scoping and screening process will be carried out by the staff, during which time the applicability of the Natural Habitats Policy Framework is determined. This determination is based on visual assessment of the existing location and any proposed new location that could entail significant conversion or degradation of a critical or non-critical natural habitat. These are defined as follows:

a) **Critical natural habitat**: the proposed location or is adjacent to any of the declared or proposed declared protected areas in Yemen.

b) **Non-critical natural habitat**: the proposed location or is adjacent to a natural habitat, but is observed to be or is locally known, as a sensitive natural habitat.

The legal and regulator framework concerning the protection Natural Habitats and Biodiversity (Areas and Species) in Yemen is embodied in the following texts:

In general terms, the EPL provides for the establishment of individual protected areas where there is a need for conserving ecosystems and maintaining viable populations of species in their natural habitats. Such protected areas are established on the condition that private ownership is respected and dealt with according to the provisions of the Constitution and other legislation. Under the Fisheries Law (No. 42, 1991, amended in 1997), the State can establish marine protected areas in Yemeni territorial waters. Thus, the State may establish natural protected areas in any part of Yemeni territory regardless of whether it is state or privately owned or endowed (Waqt and without prejudice to the rights of owners to get fair compensation.

In 1995, Yemen ratified the International Convention on Biological Diversity (CBDRio de Janeiro 1992), which has become part of Yemeni legislation. The convention includes provisions concerning in-situ conservation. Article 8 (a) and (b) obligates Parties to create a national system of protected areas and develop guidelines for their selection, establishment and management.
The EPL does not designate one institution which is to be responsible for protected areas and ecosystems. However, it provides that the Environmental Protection Council (EPC) (now the Environmental Protection Authority (EPA)) or any other concerned body may present to the Council of Ministers a proposal for establishing a protected area, and that the Council of Ministers will designate the entity competent to administer the area.

The State has absolute sovereignty over and ownership of all natural resources, according to Article 8 of the Constitution. Wild animals are owned by the State and not by the owner of the land on which they are found. Wild plants enjoy the same protection as wild animals, in accordance with the Constitution, even if grown on privately owned land.

The EPL provides broad protection for wild animal species in situ. The law states that all fauna and birds that have their habitat in Yemeni territory, as well as migratory birds, have legal protection. Protection for wild plant species is limited to rare and endemic species.

The EPL does not address the issue of managing wild species generally. It allocates responsibility for controlling hunting to the EPC (now EPA) or any other competent body. The Fisheries Law gives the Minister of Fisheries broad powers in the field of protecting, developing and managing fisheries and marine resources.

5.5.3. Cultural Resources

Projects, whose proposed alignment runs through or is adjacent to any physical cultural resources shall trigger the application of the Cultural Resources Policy Framework, but may be placed in Environmental Category A or B, depending on the relative location and extent of anticipated impacts.

Cultural Resources Policy Framework, which provides procedural guidelines on how to address this issue should the case arise. This Policy Framework has been developed in conformance with OP 4.04.

The World Bank seeks to assist countries to manage their physical cultural resources and to avoid or mitigate adverse impacts of development projects on these resources. To this end, the Bank seeks to:

- Ensure that physical cultural resources likely to be impacted by Bank-financed projects are identified, protected and managed
- Ensure that project design and implementation comply with the Borrower's national laws governing the protection of physical cultural resources
- Contribute to the development of the Borrower's capacity to identify, protect and manage physical cultural resources.
- The Bank normally declines to finance projects that will significantly damage nonreplicable cultural resources and assists only those projects that are sited or designed so as to prevent such damage.

The Bank assists in the protection and enhancement of cultural properties encountered in Bank-financed projects, rather than leaving that protection to chance. In some cases, the project is relocated in order that sites and structures can be preserved, studied and
restored intact *in-situ*. In other cases, structures are relocated, preserved, studied and restored on alternate sites. Often, scientific study, selective salvage and museum preservation before destruction is all that is necessary. Most such projects include the training and strengthening of institutions entrusted with safeguarding a nation’s cultural patrimony. Such activities are directly included in the scope of the project, rather than being postponed for some possible future action, and the costs are internalized in computing overall project costs.

Physical “cultural resources” are defined as movable or immovable objects, sites, structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above ground, underground or underwater.

The scoping and screening process will be carried out during which time the applicability of the Cultural Resources Policy Framework is determined. This determination is based on visual assessment of the proposed site and any possible adverse impact on physical cultural resources. If such impacts are identified scoping and screening will include an initial assessment to determine whether these impacts can be avoided or minimized through the design measures.

The initial assessment during scoping and screening will include consultations with the community, local government and authorities, so as to obtain as best an understanding as possible at this stage on the scope of the potential impact, as well as the various design options for avoidance or mitigation.

Aware of the exceptional importance of Yemen cultural heritage, the Government of Yemen enhanced the Law on Antiquities (21/1994) and in 1997 established the General Organization for Antiquities, Manuscripts and Museums (GOAMM -Decree No. 128/97) and the General Organization for the Protection of Historic Cities (GOPHC-Decree No. 129/97) as the institutional bodies which are responsible for protection and research on cultural heritage in Yemen. Both Organizations are under the Supervision of the Ministry of Culture (formerly Ministry of Culture and Tourism) and have juridical status and independent financial responsibility.

The Law on Antiquities, integrated with the Law No.8/1997 (together referred to herein as the Law”) constitutes the organic text for the archaeological sector’s management in the whole country. It defines as “antiquity” any material left by Yemeni civilization or left by previous Yemeni generations in the form of manufactured products, erected structures, inscriptions, or writings older than two hundred years. This includes documents, manuscripts and remains of humans, animals, and plants. The definition also covers remains of cities, buildings, caves, and schools found on land or within national waters. All antiquities are owned by the State.

The Law’s provisions prohibit the undertaking of agricultural, industrial, or telecommunications projects in antiquities areas without prior approval. It also prohibits the use of these areas to install wastewater facilities, irrigation facilities, build cemeteries, or even remove trees that will change the general appearances of the area. The law stipulates penalties for violations, which inter-alia cover the transfer of antiquities area to other uses, preparations for agriculture damaging ruins and removal of soil from a site without prior approval, the revision for executive regulations is not indicated in the law.

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Article 8 of the Law establishes the possibility and the criteria of expropriating land in which archaeological remains are found: in the case of discovery of immovable archaeological objects on land of demonstrated private ownership and whose conservation on the same site as a valuable archaeological object is required for the sake of public interest, the Organization has the right of direct expropriation, annexing the property in exchange for just compensation, on the basis of the expropriation Law for public interest. The value of the archaeological objects which are found there is not taken into consideration in attributing the value of the expropriated land.

Article 13 of the Law introduces the concept of a 500 meters observance distance: "It is forbidden to install heavy and dangerous industries, military industries, cement factories or quarries at a distance of less than half kilometer from any archaeological site. Exception is made for those situations in which the Organization permits it with obligatory respect of its conditions, and it is likewise forbidden to dig under roads, carry out industrial, agricultural or flattery projects, or extend overland electrical, telephone or telegraph cables in archaeological site areas, prior to the Organization's consent.

Article 14 of the Law establishes the powers of the archaeological authority to halt any work which may damage archaeological remains: The archaeological authority has the right to halt any work which causes damage to an archaeological object or to an archaeological area whether directly or indirectly, and it likewise has the right to annul the provision through administrative channels with the help of the security forces, such as imposing on the transgressor the duty of restoring the object to its original state, and otherwise it will carry out the work at the transgressor's expense.

The Ministry of Endowment, A waqf is another important body to the conservation process since it owns a great deal of property and is the biggest property owner in the old cities.

In conclusion, the Yemen legal framework provides an adequate legal, institutional and procedural basis for ensuring the World Bank policy objectives in respect of physical cultural resources.
CHAPTER 6: SCOPING ACTIVITIES AND COMMUNITY CONSULTATIONS

Scoping is a process which occurs at the initiation of project planning to identify the study area, potential environmental issues, preliminary alternatives, related decisions and affected parties, and to establish time lines and responsibilities for completing an environmental assessment. Scoping generally involves specialists from different departments and institutions with knowledge of the technical components of the proposed action and of the geographical area where the action will be implemented. Also scoping should include public participation.

To ensure that all the environmental issues will be adequately addressed in the EIA study during all stages of the project life cycle, scoping session at Dhamar City was conducted and attended by key stakeholders of the project. The main objective of this section is to document the dates and attendants of these sessions. Findings and outcomes of the scoping session were considered in defining the valued environmental components (VECs) of the study.

6.1. Scoping Objectives and Methodology

Scoping is meant to determine the scope and the significant of the issues identified in preparation for further analysis in EIA, including direct and indirect effect on the environment. The primary purpose of scoping is to establish the extent of the subsequent EIA, ensuring that, as far as possible, all potentially significant environmental impacts are adequately addressed.

In this case, scoping will determine those potentially significant environmental impacts likely to result from the construction and operations of the proposed water and wastewater projects. The outcome of scoping would be that only potentially significant impacts associated with the project are carried forward to the assessment stage. Other impacts would therefore not be assessed further. Scoping ensures that mitigation and enhancement measures are identified at an early stage in the design process for a project. This should minimize the need for subsequent design amendments and ensure that environmental protection and sustainability are key factors in the design.

To achieve the above objectives, a scoping session was held in Dhamar on 01, March, 2008. The session was attended by different stakeholders who represented various sectors. The purpose of the scoping session that was organized in Dhamar are:

- To identify the significant environmental issues which will be addressed in the EIA
- To describe how the significant issues will be analyzed
- To present a draft outline of the EIA study.

In order to familiarize the EIA study team with the physical and socioeconomic environment of the project area and its vicinity, preliminary visits to the proposed project sites were conducted before starting the sessions. In addition, field surveys were carried out so as to investigate physical, biological and socioeconomic resources within the project area.

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To obtain a full picture of the situation, consultations with different individuals from governmental and nongovernmental organizations (NGOs) were carried out. The scoping process involved the following activities:

- Field research and site visits to identify key environmental issues associated with the proposed project.
- Consultation with government departments, scientific and other institutions, and, where appropriate, with interested groups and societies, especially NGOs.
- Identification of environmental assessment frameworks and procedures promulgated by the official Yemeni regulatory authorities.
- Public participation session conducted specially for allowing different stakeholders that may be affected by the project to express their views and interests.

To obtain input from knowledgeable and affected individuals, NWSA, PMU and the local corporations in collaboration with the consulting team attended the scoping session in Dhamar on March 1, 2008 which that covered by the project according to an agreed upon schedule with the Client. Due to the geographic locations of Dhamar, Al Baidah and Meabar, one scoping session was held for the three centers for more fruitful discussions and examining similar challenges.

The Engineering Consultants CECI was invited officially by the Client to attend the scoping sessions at the different urban centers (Group 1) in order to assist in presenting the components of the proposed water and sanitation projects to the audience.

The scoping session in Dhamar was unique and a good opportunity to meet with stakeholders and consultants to express their concerns and raised questions about their future projects.

The scoping team representing Dornier Consulting which attended and run the sessions consists of the Project Manager, two senior environmentalists, water and sanitation engineers, socio-economist in some cases and the supporting staff for logistical purposes.

A list of participants was identified by MoWE, who issued invitation to all stakeholders. Prior to scoping session, the Consultant met with MoWE officials, reviewed the project components, and identified potential issues. The Consultant then prepared scoping session packet for each town covered by the project and has distributed to all attendees of the sessions. The questionnaire that was prepared for reporting the reactions and concerns of the attendants at the scoping sessions is attached in Annex 3 of this report.

The list of participants and the program at the scoping sessions are attached in Annex 3 of this report. The following figures show cited photos of the scoping session.
The scoping session was designed to elicit as much information and issues as possible from the participants. The Consultant adopted high tech in presenting the information and stemming the results during the sessions. Power point presentations were prepared for each center with all the details in Arabic and English. A consensus building was accomplished before starting the distribution of the questionnaire. With that in mind, the consulting team divided the session into three major phases:

- In the first phase and after the official opening ceremony, the Consultant presented the fundamental background, objectives and scope of the project. The main environmental features of the project area were presented by various consulting team members. Data collected were also presented. This was designed to allow for an overall understanding of the process and the system component of the project. In addition, a special presentation by the
consultant was devoted to environmental issues during which the scope and objectives of the EIA process were presented. The main issues and the proposed outline of the study were identified. Furthermore, the way in which the scoping session will be carried out was explained.

- In the second phase, the stakeholders were given the opportunity to elaborate, highlight, and discuss with the consulting team various issues that could reflect their interests and worries. The issues raised during these discussions were focused around three main pivotal groups of issues:
  - Environmental and Public Health issues
  - Socio-Economic issues
  - Biodiversity and Heritage and Cultural issues.

- In the third phase, specially designed questionnaires were distributed to the participants and were asked to fill it. To lead and stimulate the discussions and document the output, a facilitator and reporter were assigned. The participants were asked to identify any anticipated additional impacts during different phases (i.e., planning, construction, operation and decommissioning) of the project which were not covered during the consultant presentation. This has resulted in enhancement of information and data collected earlier.

6.2. Main Outcome of the Scoping Sessions

The main outcomes and results of the scoping session can be divided, according to the prepared questionnaire, into the following categories:

1. Public health and environment
   - Risk from wastewater reuse
   - Workers' health
   - Surface and groundwater
   - Noise
   - Dust

2. Socio-economic issues
   - Employment
   - Land prices

3. Biodiversity and cultural issues
   - Flora and fauna
   - The Agricultural projects established in the area.
   - Sites of cultural and historical value

The Consultant considered the scoping sessions as a success events that achieved the objectives that were set at the beginning. Degree of involvement an understanding
ranges from one center to another depending on the level of involvement in the project and the essentiality of the proposed projects for the urban center. The outcomes of the scoping session were summarized in the form of recommendations, as follows:

6.2.1. Public health and environment

The practices of reuse of treated wastewater need to be controlled under the responsibility of Ministry of Agriculture and Ministry of water and the local corporation in Dhamar. The sludge should be collected and properly mitigated.

Main concerns about the agricultural pattern and the type of crops which can be irrigated by the reclaimed water need to be addressed in the EIA Report.

Specific mitigation measures for reducing the noise, dust and other air pollutant as a result of the projects implementation.

Awareness program for farmers should be carried out before operating the wastewater treatment plants.

A fully equipped laboratory with all necessary instruments for water and treated wastewater characterization should be provided at the existing treatment plant.

The selected site for wastewater treatment plant and pumping stations should be environmentally and socially evaluated with emphasis on the land acquisition, negative impacts, water reuse and their effect on the groundwater aquifers. Certain attention should be given to the north eastern side of the City.

Flood protection measures should be taken in the area of expanding the existing wastewater treatment plant. This area is impacted by water streams after the rainy periods.

Safety measures should be part of the contract of the contractors who will start the construction. Based on past experiences, contractors don’t respect the safety rules and measures for their labors and for the surrounding communities.

Ensure that the land and properties acquisition are discussed and covered with the Client during the preparation of the EIA report for the water supply and sanitation projects. This is valid for the water supply system, sanitation and wastewater treatment plant.

Specific recommendations for the management of the existing infrastructures and services (electricity and communication lines; roads etc) during and after constructions need to be addressed. There should be proper coordination with the service delivery agencies before and during the construction.

Shorten the duration of water cut during the construction of the new water supply system and the same for the sanitation collection system. Provide proper alternatives for discharging the wastewater of the currently served citizens.

Involve the local labor of Dhamar Governorate in the construction activities of this project.

Draft EIA Report of Dhamar City
August, 2009
Proper road management should be planned before the starting of the construction. It is known that Dhamar city has narrow streets and the construction of the water and sanitation systems will interfere with the traffic flow and may cause congestions. This item should be thoroughly studied between the Client and the traffic department and start a community campaigns regarding the possible detours and interference of the current traffic inside the City.

The type of soil in Dhamar is rocky, which means that the contractor will use heavy machines and jack hammers intensively. The raise in noise levels should be monitored and controlled during the implementation of the project.

The debris and construction wastes should be transported and dumped in remote areas which will be allocated by the local government in coordination with the Client and the contractor.

Consider the future development urbanization as a result of the expanding of the water supply and sanitation facilities in the project area. It is expected that the immigration from the peri-urban areas towards the city will increase.

The involvement of NGOs in educating the civil society and farmers should be considered in the environmental issues.

Special terms and conditions should be developed for the contractor to remove the waste and recover all the road construction work.

6.2.3. Biodiversity and cultural issues

The attendants didn't expect that there will be any impacts on the existing flora and fauna at the city, mainly because the project is within the urbanized areas which lack the natural flora and fauna. This item is considered negligible for the case of Dhamar City.

Attention should be given to the historical sites and old mosques at the city. In case that any signs of archaeological sites were appeared during the construction, it should be reported and managed in cooperation with the local government.

Dra
August, 2009
CHAPTER 7:  ANTICIPATED ENVIRONMENTAL IMPACTS FOR THE WATER AND SANITATION PROJECTS

7.1.  General

Potential environmental impacts of the project including direct/indirect impacts were identified and quantified for the proposed project. The environmental impact assessments triggered the favorable and unfavorable impacts of the program from design, construction to the operational phases, as well as resettlements and land acquisition. Also, the assessment of the project significance such as likelihood, intensity risk, and environmental sensitivity, which was identified with emphasis on special features of the Yemeni environment. Once implemented and put into operation the project will have several positive impacts on Dhamar inhabitants. Some of the positive impacts are:

1. Improving the water supply ability to Dhamar residents and meet the increasing demand on drinking water;
2. Supplying good quality drinking water quality and improving the inhabitants' sanitation level;
3. Increasing the wastewater collection rate which will protect the city water resources and protecting the regional Environment;
4. Through the construction of infrastructure, investment environment is improved, channels of financial investment are opened up, and employment opportunity is increased.

7.2.  Environmental impacts during preparation and construction phase

Construction of the proposed activities will take place in stages over the period of short, medium and long term plans horizon. In addition, the impacts associated with the construction activities will be localized and limited to the areas along the water and sewer pipes rout, the road intersections and the wastewater treatment plant site which will be subjected for expansion.

The impact of the proposed project's components can be classified as negative or positive impacts, direct or indirect impacts and then the impacts due to the water supply project in comparison with the sanitation and wastewater treatment components. It is obvious that there are shared impacts of both the water and sanitation projects, but still the sanitation and wastewater treatment will generate more negative impacts during construction and operation.

These impacts will influence specifically the proposed project area and widely the surrounded areas. Specific non-technical impacts are also relevant and included as a macro impacts. The anticipated impacts from the construction and operational phases were identified and described in the following sections:

7.2.1.  Environmental impacts during Preparation and Construction Phases for the water resources development and water supply system

These are impacts which have been identified through the assessment process as those which will have a significantly negative influence on the receiving biological, physical and socio-economic environment and cultural resources. These impacts are
listed below as from the highly significant negative impacts down to the moderate. The highly significant is labeled as (HS), the moderate significant is (MS) and the low significant is (LS).

- Changes in the water regime and possible water cuts at certain districts of the city (HS);
- Traffic interference which is considered as the main negative impact on the city due to the narrow streets and the lack of service roads (HS);
- Noise levels will be scaled up due to the use of heavy machines specially the jack hammers for the rocky areas excavations (MS);
- Possible interference with the existing facilities such as electricity and communications (MS);
- Diminished air quality - exhaust fumes will scaled up due to the existence of the trucks, heavy machines and the increase traffic at the construction areas (MS);
- Social implications - mainly the health aspects due to the possible accidents and injuries of the local community and the labours at the project site (MS);
- Problem of construction wastes and the improper management of the contractors to collect and transport the debris outside the city towards the dumping sites (MS).
- Construction camp sites and its impacts on the surrounding communities (LS);
- Borrow pit areas and the chances of leaving these pits without recovering (LS);
- Aesthetic impacts due to the construction activities and changes of the nature of the city landscape (LS).
- Historical and cultural sites that may be impacted due to the construction activities (LS).

7.2.2. Environmental Impacts during Preparation and Construction Phases for the sanitation system and expansion of the existing wastewater treatment plant

These are impacts which have been identified through the assessment process as those which will have a significantly negative influence on the receiving biological, physical and socio-economic environment and cultural resources. These impacts are listed below as from the highly significant negative impacts down to the moderate. The highly significant is labeled as (HS), the moderate significant is (MS) and the low significant is (LS).

These impacts are:

- Land acquisition of the private properties near the existing wastewater treatment plant which need to be compensated before the commission of the project (HS).
- Expected interference of the operation of the existing WWTP due to the expansion components and the possibility of generating effluents not matching the Yemeni standards. This wastewater may be used by the farmers at the downstream areas as a continuous practice of their agricultural activities (HS).
- Misuse of the untreated wastewater for the un-restricted irrigation downstream the plant and the possible health impacts on the farmers and product consumers (HS).
• Changes in the existing wastewater collection system in terms of service cuts
  tility alternative

• Traffic Interference which is considered as the main negative impact on the
city due to the narrow streets and the lack of service roads (HS);
• Possible interference with the existing facilities such as electricity and
communications (MS);
• Noise levels will be scaled up due to the use of heavy machines specially the
jack hammers for the rocky areas excavations (MS);
• Diminished air quality – exhaust fumes will scaled up due to the existence of
the trucks, heavy machines and the increase traffic at the construction areas
(MS);
• Impacts of the WWTP on the value of lands around the plant (MS).
• Problem of construction wastes and the improper management of the
contractors to collect and transport the debris outside the city towards the
dumping sites (MS).
• Construction camp sites and its impacts on the surrounding communities (LS);
• Borrow pit areas and the chances of leaving these pits without recovering
(LS);
• Social implications – mainly the health aspects due to the possible accidents
and injuries of the local community and the labours at the project site (LS).
Aesthetic impacts due to the construction activities and changes of the nature
of the city landscape (LS).
• Historical and cultural sites that may be impacted due to the construction
activities (LS).

7.2.3. Description of the anticipated negative impacts during the preparation
and construction phase

Both the anticipated impacts of the water and sanitation can be elaborated as follows.
The color index will be used for the titles to reflect the highly significance by red color,
moderate by green and low significant by blue:

➢ Social Disruption and Land Acquisition

This aspect is significant and forms a concern for the areas close to the existing
WWTP. That could happen in other project areas mainly where the streets are narrow
and there are no room for the construction of the network and the areas which lacks
proper land organization and ownerships. Land Acquisition poses additional problems
for the project through significantly increased cost and the potential for the
misappropriation of funds. People should be in a better position than previously, and at
least not worse. It is possible to mitigate the potential impact on deviation around the
features.

The general policy in Yemen is to compensate for the lost property such as the land by
another land not far from the original one.

➢ Change in Water, sanitation and wastewater treatment existing services

It is anticipated that the existing water supply services and the wastewater collection in
addition to the treatment facilities will be interrupted due to the construction of the new
projects. This will result with water cuts for certain districts during the construction
periods. The same is applied for the services of wastewater collection where the beneficiary groups will face problems in discharging their wastewater. The same problem will face the existing wastewater treatment plant which will be interrupted by the expansion project which will temporarily stop the process of treatment and will generate effluents with poor quality and cannot be reused for irrigation purposes. All such challenges need to be studied during the preparation of the project in order to develop the required mitigation measures.

> Traffic Interferences

It is expected that there will be traffic interferences mainly at the minor roads due to the activities of excavation and laying the pipelines in the trenches. It is known that Dhamar city has narrow roads networks which make it more vulnerable for the possible interferences during the construction periods. That will impact negatively on the traffic flow and the necessary time for the residents to reach their destinations. This will only valid during the construction of the project and not during the operational stage. Construction may result in short-term impacts to local area residents, and uses of route. It is expected that traffic circulation will be negatively impacted in the city during the construction phase particularly in the areas where new sewer systems will be laid, such as in the southern area of the city (Figure 5.1). Traffic problems will occur when traffic must be moved through or around construction areas. This may lead to traffic accidents and injuries, especially in the narrow streets of the city. The proposed construction activities will also result in temporary congestion and longer travel times through the project area.

Figure 7.1 Example on areas that are expected to witness traffic congestions in Dhamar during the construction phase.

> Misuse of the untreated wastewater during construction

It is witnessed at present that the farmers are not controlled by the responsible agencies for the reuse of treated wastewater for the restricted irrigation. This problem will be scaled up during the expansion of the WWTP and the untreated quantities of effluents towards the farming activities. This will cause more health problems and possible contamination on the products that will be cultivated such as vegetables. All the reuse activities should be STOPED during the expansion of the treatment plant.
to avoid any misuse of the effluents for the irrigation purposes. Controlling the farming activities downstream the plant is a must and should be taken at the higher level of the local government.

Noise Impact
Noise will typically be an impact associated with the project as long as it is in construction. It is not envisaged that the daily operational activities will increase to such an extent that the noise levels will present a problem. Noise in significantly sensitive social areas can be mitigated by berms and barriers where and if required. The operation noise could bring about increased noise levels, which could disturb local residences, hospitals, schools or wildlife. Given anticipated operational level, this impact is considered to be relatively low, except where sites impact on hospitals, schools or identified sensitive habitats. The Contractor shall adopt the best practicable means of minimizing noise during construction. For any particular job, the quietest available plant/and or machinery shall be used. Equipment such as jack hammers, compressors, percussion tools and vehicles shall be fitted with attenuation facilities. Pneumatic drills and other noisy equipment shall not be used during days of rest or after normal working hours without the consent of the Beneficiary Committee.

Ambient Air Quality
Construction of water and wastewater facilities could release various types of gases which could bother the community living in the adjacent areas. Therefore, some people will leave these areas to stay far away from the created gases. The Contractor shall take all necessary measures to limit pollution from dust and any wind blown materials during the works and such measures are:
Utilize water spraying during operation on sections within 500 m of settlements or crops.
Trucks leaving the site are properly covered to prevent discharge of dust, rocks, sand, etc.
Crushers and other equipment conform to relevant dust emission control. Stored materials and heaps should preferably be located away from communities and farmlands; or materials should be covered and fugitive dust should be effectively controlled during delivery.

Nuisance Dust
The major effects on air quality during construction would be an increase in suspended particles from excavation as well as movement of heavy machinery and trucks over unpaved roads and the resultant dust caused when all traffic is diverted to unpaved detours. Many of these operations will take place near the populated settlements. During construction, fugitive dust emissions would occur from construction vehicles and equipment creating dust. Wind erosion may occur during the construction phase in areas where the soil is disturbed along the road widening. The dust deposition distance is estimated to be from 30-100 m of the activity with a wind velocity of 15 kmph (4m/s). The average wind speed in Dhamar is less than 4 m/s, which implies that in most of the cases the dust impact, will not be extended beyond the construction area (maximum 30 m from the excavated trench).
The detailed project design should ensure, that the cut and fill operations will be minimal to extent possible. However, these operations will include earthwork which will cause disturbance to the existing soil in case of cut operations and hauling of borrow materials from borrow pits and crusher plants.
Debris and Sludge Disposal
During the construction activities there will be debris, construction waste and sludge production and other wastes from the labors and the works itself. This requires facilities for disposal otherwise may pose health risk to the community and pollution of environment. The destination of transporting the wastes should be agreed upon with the local government and the municipality of the City.

Possible interference with the existing facilities such as electricity and communications
Due to the construction activities it is expected that certain interruptions will happen in terms of interruption of the current services to the communities such as the electricity and communications. The districts which will be under construction will face possible changes in the daily services due to the excavation, filling, crossing roads activities. These impacts are valid only during the construction period.

Pollution from wastewater, diesel spills from the contractor sites compounds and machinery
The source of these pollutants is uncontrolled as a result of disposing liquid or solid construction waste. Examples of these wastes are uncontrolled disposal of construction wastewater, spillage of diesel, oil and grease. Excessive pollutants discharge has adverse impacts on surface water and soils. Therefore, the contractor has to consider certain measures to minimize such pollutants from reaching the water body and soil. Locating a high-risk zone with a concrete pavement will help in reducing the impact of diesel, oil and grease spills.

Cross drainage and scour effects close to the existing WWTP
The constructions fill should be adequately compacted, and in failing to do so large number of scour points can be created around the sites facility especially the WWTP, which will eventually erode the various sites. The area around the plant is a domain for possible floods during rainy seasons which require flood protection measures during the construction period.

Safety Risk
During the construction phase, there may be an increased risk of accidents involving local population, especially children. These may result from one or combination of the following:
- unauthorized access to a construction site
- conflict with construction equipment and vehicle
- poor site safety
- inadequate management of the site

By their nature construction activities generate elevated levels of accidents risks. However, three factors suggest that the impacts from the proposed projects activities

in some cases are clearly dangerous and equally importantly important that off site activities, such as construction traffic, are poorly controlled.

Extensive linear construction sites along urban streets, especially when the roads are narrow (which is the case in Dhamar) will expose large part of population, especially children who use streets as a play area to risk.
Therefore, there will be an unavoidable increase in truck traffic during construction of the roads infrastructures. There is thus a potential safety issue associated with increase in traffic in the vicinity of residential areas and schools. There are also risks associated with infrastructure construction like injuries, falling etc. among the population and workers.

Off Site Works
As a result of the project construction activities, five types of offsite activities are expected to be developed off site to support the project:

1. Project offices and camps
   Project offices may be located anywhere within Dhamar, in any of the existing buildings. Labor camps will be established so as to accommodate the labor force. This camp will produce a wastewater, solid waste that should be collected and managed properly.

2. Materials Stockpiles
   The construction activities will require materials such as pipes, valves and backfill materials. These materials should be stockpiled in a special site assigned by the client. Although, there should not be any hazardous materials, there will be some impacts like dust and noise from the stockpile site.

3. Pre-Cast Yard
   Manholes of different sizes will be precast on a special precast yard. A yard will therefore be required to store cement, chemicals (oil) for mould, which is expected to generate oil spills. At the yard, materials will be stockpiled, such as cement, gravel and sand, which are expected to produce a dust. The site will require access to adequate water supply and suitable road access.

4. Equipment maintenance and cleaning workshop
   The contractor will establish a workshop for the equipment maintenance and cleaning. Such a workshop will produce a threat to the environment, as a result of chemicals that will be produced at the workshop. Oil and chemical spills may lead to contamination of soil and groundwater.

5. Borrow materials and aggregates
   Aggregate and backfill materials will be needed for the construction activities.

During construction, workers are expected to come from the project areas and other places. In this case there is a possibility of additional health risk related to migrant workers. Project activities may also lead to creation of stagnant water in borrow pits and quarries associated with the construction activities like tunnels and drainage systems. The resultant stagnant water bodies will favor breeding of mosquitoes, snails, and other disease vectors.

During construction, a lot of solid wastes will be produced at the campsites as well as at the construction sites. The type of waste to be produced includes scrapers, domestic waste, boxes, building materials etc.
The construction workers will require proper services for sanitation. The wastes to be produced necessitate providing good and hygienic sanitation facilities otherwise the waste produced, if not handled carefully would affect the aesthetic conditions of the area. Depending on the mode of management, construction camps may experience poor sanitation and poor waste disposal problems.

Aesthetic Impact
The construction of related infrastructure might be perceived as a degradation of the landscape. Other construction activities may also lead to landscape disfiguration. Upcoming construction structures excavations, presence of soil mounds, machinery and other materials on the construction site will be visually intrusive.

The presence of borrow pits, quarries and other structures in the project area are visually intrusive. The significance of the visual intrusion will, however, depend on several characteristics including the size, shape and color of the installations and their location on the site.

Historical and Cultural Impacts
There are several sites of cultural and heritage value in Dhamar governorate. However, in Dhamar city there are two main sites of historical value. The grand mosque and the Shami School in AlJarajeesh Area. The two sites may be affected during the excavation and construction works by the heavy equipment. Therefore, the contractor should avoid using equipment that will generate vibration which will threaten the stability of such sites.

Since Dhamar witnessed several civilizations during the history, during the construction activities and opening the trenches, historical and cultural sites and monuments may be discovered underground. Construction activity can destroy those monuments if no measure is undertaken by the contractor to protect those sites by inviting the historical and monumental specialists to propose a management plan. For the existing sites there should be avoidance measures to cause any vibrations or dust increase in order not to cause any negative impacts.

Flora and Fauna
During the site survey conducted by the project team, and based on the scoping session outcomes, there are no sensitive areas identified within the project area in Dhamar. However, since the Yemeni Environment Protection Law prohibits any activity which affects the quantity and quality of the vegetation cover, the designer should try to avoid any area that is covered with vegetation to be included within the construction process of any pipeline. In case of the existence of any vegetative cover that cannot be avoided, within the working area, this area should be offset by a new area that will be planted with the same if not better vegetation types available in the disturbed area.

There are no national parks and wildlife reserves along the project routes. The wildlife population and native habitat have been significantly impacted by subsistence urban practices and this has resulted in low wildlife diversity in Dhamar City, especially along the project roads. Therefore, impact on wildlife will be negligible as there is in any case very limited wildlife within the impact zones. There are no protected wildlife conservation areas identified within the project area.
7.3. Environmental Impacts during Operation

Negative impact can be considered as those induced by the activity, either directly or indirectly, that caused negative impacts to the local communities and receiving environment during the operational phase. Usually such impacts are very minimized and scaled due to the type of service project like water supply and sanitation services. In the following section there will be elaboration on the anticipated impacts due to the water and sanitation projects.

7.3.1. Negative impacts during operation phase due to the water development and supply project

The expected negative impacts due to the water project during the operation phase are very limited and all considered as low significant impacts:

- More pressure on the strategic groundwater reserve due to the additional water development quantities.
- More immigration from the peri-urban areas towards the city due to the high level of services.
- More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance.
- More financial burdens on the new subscribers for the water service.

7.3.2. Negative Impacts during operation phase due to the sanitation and wastewater treatment projects

The expected negative impacts due to the sanitation and wastewater treatment facilities are considered high, medium to low significant and can be listed as follows. The high is marked (HS), the medium significant is marked as (MS) and the low as (LS).

- Misuse of the treated wastewater for restricted irrigation and the increase of the sludge quantities (HS);
- Generation of odors, birds and flies due to the expansion of the WWTP (MS);
- Lowering the property value in the areas around the WWTP (LS);
- More immigration from the peri-urban areas towards the city due to the high level of services (LS)
- More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance (LS).
- Aesthetic impacts due to the expansion of the WWTP and its negative impact on the residents (LS).
- More financial burdens on the new subscribers for the sanitation services.

7.3.3. Description of the anticipated negative impacts during the operation and maintenance phase

Both the anticipated impacts of the water and sanitation during the operation phase can be elaborated as follows. The color index will be used for the titles to reflect the highly significance by red color, moderate by green and low significant by blue:
Misuse of the treated wastewater and increase of sludge quantities during operation

It is witnessed at present that the farmers are not controlled by the responsible agencies for the reuse of treated wastewater for the restricted irrigation. This problem will be scaled up during the expansion of the WWTP and the untreated quantities of effluents towards the farming activities. This will cause more health problems and possible contamination on the products that will be cultivated such as the vegetables.

It is the responsibility of the Client in cooperation with the Ministry of Agriculture and the local government to control the reuse of the treated wastewater for the restricted irrigation and take the necessary measures to implement the regulations.

The other side of the problem is the expected remarkable increase in the quantities of sludge that will be generated from the plant after expansion. With the absence of sludge disposal and treatment plant, this will be a big challenge for the operator and may cause negative impacts on the environment and the residents close to the plant.

Generation of odor and flies from the WWTP

It is expected that the new and expanded WWTP will generate more odors and flies during the operation. This will be worse in case of improper operation and maintenance of the plant. Since the dominant wind direction is eastern and as the WWTP is located in the north east side of the city of Dhamar (see Figure below), some parts of the northern side of the city will be suffering from WWTP odor. Necessary measures should be taken to minimize this impact on the surrounding residents and downstream farmers and the labors at the plant.

Figure 7.2 Location of the existing and proposed wastewater treatment plant with respect to Dhamar City

Aesthetic Impact

The construction of related infrastructure might be perceived as a degradation of the landscape. Other construction activities may also lead to landscape disfiguration.
Upcoming construction structures excavations, presence of soil mounds, machinery and other materials on the construction site will be visually intrusive.

The presence of borrow pits, quarries and other structures in the project area are visually intrusive. The significance of the visual intrusion will, however, depend on several characteristics including the size, shape and color of the installations and their location on the site.

- **Lowering the value of the areas around the WWTP**
  
  It is expected that due to the expansion of the WWTP at the same location of the existing plant, there will be more drop on the values of the lands and properties of the residents close to the plant. This will cause negative social impacts on the residents.

- **More Immigration from the peri-urban areas towards the city due to the high level of services**
  
  Due to the improvement of the facilities in the water and sanitation sectors at the city, it is expected that there will be more immigration from the peri-urban areas towards the city. This will cause more pressure on delivering the services of water, sanitation and other basic needs such as electricity and communication. Unless the peri-urban areas were considered in the future with development projects, there will be no doubt of continuous immigration from the peri-urban and rural areas towards the urbanized areas.

- **More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance**
  
  With the additional facilities at the city in terms of water and sanitation and treatment facilities, there will be more pressure on the local corporation to operate and maintain the facilities in the proper way. This will require additional human resources and equipments to conduct the necessary responsibilities.

- **More burden on the new subscribers in terms of service bills**
  
  The new subscribers for the water and sanitation will be facing incremental payments due to the new services of water and sanitation. The scale of this problem will depend on the ability to pay and the willingness to pay. The citizens will recognize that the generated benefits of using the new services will suffice any costs that will pay during the operation of the services.

### 7.4. Anticipated Positive Impacts for the water and sanitation projects during the construction and operation phase

The construction of the water and sanitation projects will generate numerous environmental and socio-economic benefits which are expected to occur following the construction and implementation of the project. The generated benefits during the operation phase are more than the benefits during the construction phase.
7.4.1. Benefits due to the construction of the water development and supply projects

Such benefits are:

- Creation of more jobs for the local communities during the construction and operation phase.
- Social welfare and economic improvement
- Upgrading and rehabilitation of current water and wastewater infrastructure
- Improve standard of living of the residents due to the new services.
- Improve health of the residents due to providing potable and reduce waterborne diseases;
- Creation more business for the shops, restaurants and hotels owners during the construction phase.

7.4.2. Anticipated Positive Environmental Impacts of the sanitation and wastewater treatment projects during construction and operation phase

Positive impacts can be considered as those induced by the activity, either directly or indirectly, that provides benefits to the local communities and receiving environment during the construction and operation phase. These can be identified as follows:

- Employment creation through involving local labour forces in the activities during the construction and operation periods;
- Providing more quantities of treated wastewater for more restricted irrigation activities.
- Reuse possibilities of treated wastewater and improving the vegetation coverage due to the incremental quantities of treated wastewater.
- Social welfare and economic improvement
- Upgrading and rehabilitation of current sanitation and wastewater treatment infrastructure;
- Improve standard of living of the residents due to the new services.
- Improve health of the residents due to providing proper sanitation facilities and phasing out the septic tanks;
- Creation more business for the shops, restaurants and hotels owners during the construction phase.

These impacts are discussed in more details in the following paragraphs:

7.4.3. Description of the anticipated positive impacts of the water and sanitation projects

In the following paragraphs there will be more elaboration on the anticipated benefits of constructing the water and sanitation projects in the city.

▶ Social Welfare and Economical Improvement

There is a tremendous positive impact in terms of socio-economic development since the project is aiming at improving the current infrastructure to low and medium-income areas where access this facility is not available. As the implementation of the project will contribute to the employment of the local community, there will be significant
improvement in the welfare of the households as most of the casual workers shall come from the area. Another positive impact is enhancing the water supply infrastructure in the project area and provides good quality water which will impact positively through the improvement of public health conditions and in terms of minimizing the probabilities of illness accidents due to water borne diseases. That will save a lot of lives and reduce the number of patients and so the number of deaths in the project’s region.

- **Upgrading and Rehabilitation of Current Infrastructure**
  The project will upgrade the existing infrastructure to an acceptable standard level through constructing a water supply network, water storage facilities, sanitation facilities and wastewater treatment plant. This will maintain a good water quality with the necessary quantities for the residents along the day. It should be noted that the new water supply regime should be accompanied by public awareness campaigns for promoting the ways of rational uses of water. From the other side the new sanitation and treatment facilities will improve the standards of services at the city which will have remarkable positive impacts on the residents.

- **Employment Creation**
  The implementation of the project will create more permanent jobs for operating the facilities. It is expected that the Client will hire more technical staff to operate and manage the extension of the water supply system. Also the project will assist in the dissemination and transfer of knowledge and modern technology from the Consultant and Contractor side to the Client side.

- **Social Implications – Health**
  Due to the improper taped water supply for parts of the project districts, water borne diseases were reported in high levels in the City such as Typhoid and Diarrhea mainly for the infants (1-4) years old. The delivery of good water quality through closed water system will remarkably scale down the number of cases and patients due to the bad water quality. That will improve the standard of life and suffice the worries of the families regarding the possible illness due to their current water resources. Also, this will improve the water quality after improving the wastewater facilities. The introduction of the sanitation system will phase out the use of septic tanks which are considered as a hot spots and sources of contamination of the residents. This will have positive impacts on the residents from the health aspects and financial aspects through saving the costs of discharging their septic tanks.

- **Treated wastewater reuse availability and improving the Flora of the project area**
  It is expected that the additional treated wastewater to the farmers will enable them to reuse more quantities for their irrigation activities which entail restricted farming and producing more products. That will positively impact the green areas and improve the flora of the project areas.
CHAPTER 8: PROPOSED MITIGATION MEASURES

Environmental management is concerned with the implementation of the proposed mitigation and preventive measures that are necessary to minimize or offset adverse impacts and to enhance beneficial impacts. In order to be effective, environmental management plan must be fully integrated within the overall project management efforts at all levels, which itself should be aimed at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions effectively throughout its life.

The key players in the implementation of the mitigation measures are the Contractor to be appointed to undertake the construction works, the Client and the Engineer. The Environmental Control Officer (ECO) will ensure and monitor the implementation of the Environmental Management Plan (EMP).

The mitigation measures of this study will be presented in the form of impact matrix that shows the type of the anticipated negative impact, the level of significance and the duration and the proposed mitigation measures.

8.1. Impact Matrix

The following evaluation matrices are used to show the possible impacts of the proposed project components on the environment and the proposed mitigation measures. The chapter will be divided into two main parts; the first is related to the water development and supply project and the second for the sanitation and treatment projects. Under each of these projects, the mitigations will be divided based on the phase of the project; either construction or operation. These proposed mitigations are the core of the environmental management plan which is considered as a binding document for the Client and the contractor and part of the tender documents that need to be implemented during the construction and operation of the project.

8.2. Mitigations Measures for the water development and supply projects

8.2.1. Mitigation during Construction Phase

For retrieving the negative impacts which can be expected to arise as a result of construction phase activities associated with water supply infrastructure projects as mentioned in chapter seven, these can be presented below:

- Changes in the water regime and possible water cuts at certain districts of the city (HS);
- Traffic interference which is considered as the main negative impact on the city due to the narrow streets and the lack of service roads (HS);
- Noise levels will be scaled up due to the use of heavy machines specially the jack hammers for the rocky areas excavations (MS);
- Possible interference with the existing facilities such as electricity and communications (MS);
- Diminished air quality - exhaust fumes will scaled up due to the existence of the trucks, heavy machines and the increase traffic at the construction areas (MS);
- Social implications - mainly the health aspects due to the possible accidents and injuries of the local community and the labours at the project site (MS);
Problem of construction wastes and the improper management of the contractors to collect and transport the debris outside the city towards the dumping sites (MS).

Construction camp sites and its impacts on the surrounding communities (LS);

Borrow pit areas and the chances of leaving these pits without recovering (LS);

Aesthetic impacts due to the construction activities and changes of the nature of the city landscape (LS).

Historical and cultural sites that may be impacted due to the construction activities (LS).

Mitigation measures are presented in the assessment tables in the coming pages.

Table 8.1 Mitigation Measures – Changes in water regime

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside the construction site</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods construction phase</td>
<td>Short term</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is High</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

Steps to avoid water pipeline damage should be take. This includes providing the contractor with water main as built drawing, and implementing inspection pits before the commencement of excavation works. Local corporation should start a plan of delivery for the citizens during the water cut durations. The plan should minimize the duration of water cut and provide water tankers and alternatives for the citizens. Water tankers should be subsidized by the LC to minimize the over prices of the water tankers owners. A public awareness campaigns should be started before starting the construction at each of the districts to aware the citizens of the possible water cuts and the expected periods of the cut.
Table 8.2 Mitigation Measures – Traffic Interference

<table>
<thead>
<tr>
<th>Environmental Description</th>
<th>Traffic interference which is considered as the main negative impact on the city due to the narrow streets and the lack of service roads: Negative impacts</th>
</tr>
</thead>
</table>

**Impact Description:**

It is expected that there will be traffic interferences mainly at the minor roads due to the activities of excavation and laying the pipelines in the ditches. It is known that Dhamar city has narrow roads networks which make it more vulnerable for the possible interferences during the construction periods. That will impact negatively on the traffic flow and the necessary time for the residents to reach their destinies. This will only valid during the construction of the project and not during the operational stage.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend past the study area</td>
<td>Local or immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods of construction</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The probability of the impact occurring is high</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is high</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

**Mitigation:**

A project construction phasing plan and appropriate traffic control plan would be developed as part of the final design to coordinate construction activities and minimize disruption of traffic flow. The Contractor should work with the Client on proposing a traffic plan for the roads that will be impacted and closed in order to find alternative roads and detours. This should be done before starting the construction of the project and in coordination with the traffic department and the local government.

A local campaigns should be started for the citizens to aware them about the changes in the traffic routes and the alternative travel opportunities. Proper sings and signals to direct and guide the drivers through detours should be in place, so as to minimize the travel time and traffic congestions.
Table 8.3 Mitigation Measures – Noise Generation

### Environmental Description

**Noise generation: Negative Impact**

**Impact Description:**

Noise is generated by construction activities such as clearing and grubbing, excavating, trenching and cement batching. Construction vehicles generate noise and quarrying for construction materials could also generate noise.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nature and Extent</strong></td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>The impact will be of short duration, limited to periods construction phase.</td>
<td>Short term</td>
</tr>
<tr>
<td><strong>Probability</strong></td>
<td>The impact has a high probability of occurring</td>
<td>Highly probable</td>
</tr>
<tr>
<td><strong>Intensity</strong></td>
<td>The intensity of the impact is medium</td>
<td>medium</td>
</tr>
<tr>
<td><strong>Significance</strong></td>
<td>The impact will have medium significance</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Mitigation**

Construction workers to adhere to health and safety standards as prescribed in the EMP.

Working hours should be restricted to reduce impacts on the neighboring residences at night.

The construction equipment and plants should be very well maintained and lubricated, so as to minimize the operational noise.

Use mobile site noise barriers
Mitigation Measures - Disturbance of current infrastructure

TABLE 8.4 Mitigation Measures - Disturbance of current infrastructure

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DESCRIPTION:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Disturbance of current Infrastructure: Negative Impacts</td>
<td></td>
</tr>
</tbody>
</table>

Impact Description:

It is expected that the construction activities will disturb the current infrastructure within the project area such as the water supply, sanitation, electricity poles and communications. Due to this, it is anticipated that the current services will be disturbed and the surrounding communities will be negatively affected due to the cut in the water and electricity services.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend past the study area</td>
<td>Local or Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods of construction</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The probability of the impact occurring is high</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is medium</td>
<td>medium</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have medium significance</td>
<td>medium</td>
</tr>
</tbody>
</table>

Mitigation

The contractor should implement inspection pits to identify the route of the existing infrastructure lines before the excavation. The Contractor should minimize the duration of interrupting the current services to the neighboring communities in terms of water and electricity cuts. It should be planned that minimum interference with the current infrastructure should be done during construction. In case of shifting any of the current infrastructures, an emergency plan should be adopted to continue the services to the citizens and minimize the durations of service cuts. Coordination committee should be formed from members of all concerned infrastructure authorities in Dhamar, so as to ensure smooth work with minimal impact on the level of the services during the project construction stage.
Table 8.5 Mitigation Measures - Dust generation and Air quality

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods construction phase.</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have medium significance</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Mitigation**

To eliminate the effect of the dust during the earth works, it is recommended that the contractor should continuously spray the areas of cutting and the fill material with water. All vehicles hauling dirt, sand, soil, or other loose materials should be covered or should maintain at least two feet of freeboard.

- Re-establish ground cover in disturbed areas quickly.
- Sweep streets at the end of the day if visible soil material is carried onto adjacent public paved roads.
- Dust suppression to be conducted through continuous watering using the water tanks.
- Construction activities to occur only along alignment or within construction camp.
- Natural vegetation to be left so as to curb the erosion protection.
- Construction workers to follow prescribed precautions when working in dusty conditions. Using masks is necessary during the working hours.
Table 8.6 Mitigation Measures – Social implications

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DESCRIPTION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Implications – mainly the health aspects due to the possible accidents and injuries of the local community and the labors at the project site: Negative Impact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>There will be an unavoidable increase in truck traffic during construction of the roads infrastructures. There is thus a potential safety issue associated with increase in traffic in the vicinity of residential areas and schools. There are also risks associated with infrastructure construction like injuries, falling etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and extend</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a medium probability of occurring</td>
<td>medium</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The contractor should provide all the safety measures and site plan management during the construction period. Proper road and construction signs with warning tapes should be provided at the construction areas. This should be done in full coordination with the Client representative and Engineer. Proper and safe access bridges should be provided over the trenches in front of the households and shopping centers to enable a safe access of the pedestrians. A health plan should be prepared, this plan shall include details of the following:</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Table 8.7  Mitigation Measures – Construction wastes and the improper management

| ENVIROMENTAL DESCRIPTION: | |
| Problem of construction wastes and the improper management of the contractors to collect and transport the debris outside the city towards the dumping sites: Negative impact |

| Impact Description: | The source of these pollutants is uncontrolled as a result of disposing liquid or solid construction waste. Examples of these wastes are uncontrolled disposal of construction wastewater, spillage of diesel, oil and grease. Excessive pollutants discharge has adverse impacts on surface water and soils. Therefore, the contractor has to consider certain measures to minimize such pollutants from reaching the water body and soil. Locating a high-risk zone with a concrete pavement will help in reducing the impact of diesel, oil and grease spills. |

<table>
<thead>
<tr>
<th>Impact Significances</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a medium probability of occurring</td>
<td>medium</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

Mitigation

The contractor should provide all the safety measures and site plan management during the construction period.

Proper waste collection and disposal plans should be prepared to minimize any risk of contaminating the soil and the environment.

Timely clean-up, and transport in covered vehicles or in closed container

This should be done in full coordination with the Client representative and Engineer.
Table 8.8 Mitigation Measures – Construction Camp and Site offices

**ENVIRONMENTAL DESCRIPTION:**

**Construction Camp and Site offices: Negative Impact**

**Impact Description:**

The construction camp and site offices could have an impact on the environment if the placement or design is poorly situated. Domestic waste as well as construction waste generated at the construction camp could also impact on the flora in the area as well as the human health of construction workers and the community if it is not removed to a landfill site.

*The management of construction camps throughout the project construction phase has to be managed effectively. Construction camps will have a significant impact on surrounding communities for the duration of the construction activity.*

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The Impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Mitigation:**

The placement of the construction camps must be negotiated with the local communities and community leaders.

The construction camps must be placed on a disturbed piece of land with a minimum distance of 500 meters from the nearest residential area.

Indigenous vegetation must not be disturbed by the contractor workers.

The contractor must supply the workers with gas cooking appliances, to ensure that wood is not harvested from the surrounding vegetation.
Table 8.9  Mitigation Measures – Aesthetic impacts

**ENVIRONMENTAL DESCRIPTION**

Aesthetic impacts due to the construction activities and changes of the nature of the city landscape: Negative Impact

**Impact Description**

The construction of related infrastructure might be perceived as a degradation of the landscape. Other construction activities may also lead to landscape disfiguration. Upcoming construction structures excavations, presence of soil mounds, machinery and other materials on the construction site will be visually intrusive. The presence of borrow pits, quarries and other structures in the project area are visually intrusive. The significance of the visual intrusion will, however, depend on several characteristics including the size, shape and color of the installations and their location on the site.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed.</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Mitigation**

The placement of the construction camps must be negotiated with the local communities and community leaders to reach an agreement on its location.

The contractor should provide barriers and proper temporary walls to minimize the impacts of aesthetic on the residents. The contractor should re-install all the areas that were under construction and return it as it used to be before construction, especially the vegetative cover.
Table 8.10 Mitigation Measures – Historical and Cultural Impacts

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Mitigation**

The Contractor in coordination with the client should work on minimizing all the negative impacts on the existing historical sites such as Dhamar old houses and Grand Mosques and the Shamsi School.

The contractor should avoid creating excess vibrations that may impact the existing historical structures. The contractor should prevent the dust generation in the vicinity of the historical sites.

In case of discovering new historical structures, the contractor should report immediately to the Client to manage this with the Department of Antiquities.
8.2.2. Water development and supply project – Operation Phase

For retrieving the negative impacts which can be expected to arise as a result of operation and maintenance phase activities associated with water supply infrastructure projects as mentioned in chapter seven, these can be presented below:

- More pressure on the strategic groundwater reserve due to the additional water development quantities.
- More immigration from the peri-urban areas towards the city due to the high level of services.
- More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance.
- More financial burdens on the new subscribers for the water service.

Description of the proposed mitigation measures are described in the following matrices:

Table 8.11 Mitigation Measures – Pressure on the strategic groundwater reserve

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside limit of project area</td>
<td>Regional</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

The Ministry of Water and Environment should start working on a national water master plan that will focus on water demand management in addition to supply management.

Alternative non conventional water resources should be considered as part of the future sustainable development plans for the water sector. The traditional sources should be considered as strategic reserves for the future generations.
Table 8.12 Mitigation Measures – More immigration from the peri-urban areas

<table>
<thead>
<tr>
<th>Environmental Description</th>
<th>More immigration from the peri-urban areas towards the city due to the high level of services: negative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Description</td>
<td>It is expected that the improvement of the water supply services will invite more immigrants from the rural and peri-urban areas to the city. This will cause a pressure on the current water services and other basic services to the new comers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
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</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
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</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

Mitigation

The local government should start a regional planning program to elevate the standard of services at the peri-urban and rural areas to the level that the residents at these areas will not immigrate to the city of Dhamar.
### Table 8.13 Mitigation Measures – More burden on the responsibilities of the local corporation of water and sanitation

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DESCRIPTION:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance: Negative impact</td>
<td></td>
</tr>
</tbody>
</table>

**Impact Description:**
With the additional facilities at the city in terms of water and sanitation and treatment facilities, there will be more pressure on the local corporation to operate and maintain the facilities in the proper way. This will require additional human resources and equipments to conduct the necessary.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside limit of project area</td>
<td>Regional</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>low</td>
</tr>
</tbody>
</table>

**Mitigation:**
The Ministry of Water and Environment should work closely with the LC in Dhamar for strengthening the capacities of the corporation in terms of human resources and logistical supports in order to be able to manage the incremental burden due to the increase of services.

Draft EIA Report of Dhamar City
August. 2009
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Table 8.14 Mitigation Measures – More financial burdens on the new subscribers

**ENVIRONMENTAL DESCRIPTION:**

More financial burdens on the new subscribers for the water service: Negative impact

**Impact Description:**

The new subscribers for the water and sanitation will be facing incremental payments due to the new services of water and sanitation. The scale of this problem will depend on the ability to pay and the willingness to pay. The citizens will recognize that the generated benefits of using the new services will suffice any costs that will pay during the operation of the services.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be within the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Mitigation**

The local corporation should start social campaigns before the starting of the project operation among the new subscribers to inform them about the financial implications that they have to take due to the new water services and show them the expected positive impacts due to this service.

Water tariff structure should take into consideration the low income to obtain the minimal water for sanitation and hygiene.
8.3. Mitigations Measures for the sanitation and wastewater treatment and reuse projects

8.3.1. Mitigation during Construction Phase

For retrieving the negative impacts which can be expected to arise as a result of construction phase activities associated with sanitation and treatment infrastructure projects as mentioned in chapter seven, these can be presented below.

- Land acquisition of the private properties near the existing wastewater treatment plant which need to be compensated before the commission of the project (HS).
- Expected interference of the operation of the existing WWTP due to the expansion components and the possibility of generating effluents not matching the Yemeni standards. This wastewater may be used by the farmers at the downstream areas as a continuous practice of their agricultural activities (HS).
- Misuse of the untreated wastewater for the unrestricted irrigation downstream the plant and the possible health impacts on the farmers and product consumers (HS).
- Changes in the existing wastewater collection system in terms of service cuts and the essentiality of proposing alternative solutions to the citizens during that period (HS).
- Traffic interference which is considered as the main negative impact on the city due to the narrow streets and the lack of service roads (HS);
- Possible interference with the existing facilities such as electricity and communications (MS);
- Noise levels will be scaled up due to the use of heavy machines specially the jack hammers for the rocky areas excavations (MS);
- Diminished air quality – exhaust fumes will scaled up due to the existence of the trucks, heavy machines and the increase traffic at the construction areas (MS);
- Impacts of the WWTP on the value of lands around the plant (MS).
- Problem of construction wastes and the improper management of the contractors to collect and transport the debris outside the city towards the dumping sites (MS).
- Construction camp sites and its impacts on the surrounding communities (LS);
- Borrow pit areas and the chances of leaving these pits without recovering (LS);
- Social implications – mainly the health aspects due to the possible accidents and injuries of the local community and the labours at the project site (LS).
- Aesthetic impacts due to the construction activities and changes of the nature of the city landscape (LS).
- Historical and cultural sites that may be impacted due to the construction activities (LS).

Mitigation measures are presented in the assessment tables below.
Table 8.15 Mitigation Measures – Land and property acquisitions

| Environmental Description: Land and property acquisitions: Negative impact |
|---|---|
| Impact Description: |
| Some of the private properties may be affected due to the construction of the new wastewater treatment plant or other facilities. In this case a possible resettlement of inhabitants could take place or acquisition of private lands. The Government has to take actions before the resettlement take place. Negotiations with the citizens regarding their private properties and possible compensations. Compensation can be in the form of monetary or alternative property. An over-riding aspect for the potential acceptance of the proposed project is the potential benefit which the project will bring in terms of social and economic upliftment to the communities affected. Care must be taken to ensure that any compensation and relocation benefits the community on the basis that they may be in a more favorable position after relocation. This is imperative to retain support for the project, and also in meeting the objectives of the assessment in minimizing social cost. |

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend to the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is high</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

Mitigation

Reasonable and appropriate compensation and resettlement program should be developed and implemented to reduce the impact on the affected people.

Compensation for resettlement of households should eliminate conflicts and ensure that the community is not impacted negatively.
It is witnessed at present that the farmers are not controlled by the responsible agencies for the reuse of treated wastewater for the restricted irrigation. This problem will be scaled up during the expansion of the WWTP and the untreated quantities of effluents towards the farming activities. This will cause more health problems and possible contamination on the products that will be cultivated such as the vegetables.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend to the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is high</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

All the reuse activities should be STOPPED during the expansion of the treatment plant to avoid any misuse of the effluents for the irrigation purposes. Controlling the farming activities downstream the plant is a must and should be taken at the higher level of the local government.
### Table 8.17 Mitigation Measures – Changes in the wastewater collection system and treatment facilities

<table>
<thead>
<tr>
<th>Environment Description</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside the construction site</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods construction phase</td>
<td>Short term</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is High</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

**Impact Description:**

It is anticipated that the existing wastewater collection and treatment services will be interrupted due to the construction of the new projects. This will result with service interruption for certain districts during the construction periods. All such challenges need to be studied during the preparation of the project in order to develop the required mitigation measures.

Local corporation should start a plan of providing the citizens with alternatives for the wastewater collection systems such as sanitary tankers. The plan should minimize the duration of service cut and provide septic tankers and alternatives for the citizens. Septic tankers should be subsidized by the LC to minimize the over prices of discharge. A public awareness campaigns should be started before starting the construction at each of the districts to aware the citizens of the possible service cuts and the expected periods of the cut. The effluents from the WWTP should be treated as a hazardous waste and prohibit any reuse of this water until the completion of the expansion project.
Traffic interference which is considered as the main negative impact on the city due to the narrow streets and the lack of service roads: Negative Impacts

Impact Description:
It is expected that there will be traffic interferences mainly at the minor roads due to the activities of excavation and laying the pipelines in the ditches. It is known that Dhamar cit has narrow roads networks which make it more vulnerable for the possible interferences during the construction periods. That will impact negatively on the traffic flow and the necessary time for the residents to reach their destinies. This will only valid during the construction of the project and not during the operational stage.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend past the study area</td>
<td>Local or immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods of construction</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The probability of the impact occurring is high</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is high</td>
<td>High</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have high significance</td>
<td>High</td>
</tr>
</tbody>
</table>

Mitigation:
The Contractor should work with the Client on proposing a traffic plan for the roads that will be impacted and closed in order to find alternative roads and detours. This should be done before starting the construction of the project and in coordination with the traffic department and the local government.

A local campaigns should be started for the citizens to aware them about the changes in the traffic routes and the alternatives. In order to minimize the duration of interrupting the current traffic flows.
### Table 8.19 Mitigation Measures – Noise generation

**ENVIRONMENTAL DESCRIPTION:**

**Noise generation: Negative impact**

**Impact Description:**

Noise is generated by construction activities such as clearing and grubbing, excavating, layer works, trenching and cement batching. Construction vehicles generate noise and quarrying for construction materials could also generate noise.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods construction phase.</td>
<td>Short term</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is medium</td>
<td>medium</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have medium significance</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**Mitigation:**

Construction workers to adhere to health and safety standards as prescribed in the EMP.

Working hours should be restricted to reduce impacts on the neighboring residences at night.

All machinery and plant to conform to Regional noise reduction standards.

All plant to be well maintained.
It is expected that the construction activities will disturb the current infrastructure within the project area such as the water supply, sanitation, electricity poles and communications. Due to this, it is anticipated that the current services will be disturbed and the surrounding communities will be negatively affected due to the cut in the water and electricity services.

### Table 8.20 Mitigation Measures – Disturbance of current infrastructure

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend past the study area</td>
<td>Local or immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods of construction</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The probability of the impact occurring is high</td>
<td>Highly probable</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is medium</td>
<td>medium</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have medium significance</td>
<td>medium</td>
</tr>
<tr>
<td>Mitigation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Construction activities such as clearing and grubbing, topsoil removal, trenching and storage as well as the movement of construction vehicles generate dust. The dust will influence the air quality in the immediate vicinity of the construction activity.

The impact will be restricted to the construction site. The impact will be of short duration, limited to periods construction phase. The impact has a low probability of occurring. The intensity of the impact is medium. The impact will have medium significance. Dust suppression to be conducted through continuous watering using the water tanks. Construction activities to occur only along alignment or within construction camp. Natural vegetation to be left so as to curb the erosion protection. Construction workers to follow prescribed precautions when working in dusty conditions. Using masks is necessary during the working hours.
Table 8.22 Mitigation Measures – Social Implications

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Implications – mainly the health aspects due to the possible accidents and injuries of the local community and the labors at the project site: Negative Impact</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>There will be an unavoidable increase in truck traffic during construction of the roads infrastructures. There is thus a potential safety issue associated with increase in traffic in the vicinity of residential areas and schools. There are also risks associated with infrastructure construction like injuries, falling etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a medium probability of occurring</td>
<td>medium</td>
</tr>
<tr>
<td>Intensity</td>
<td>The Intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The contractor should provide all the safety measures and site plan management during the construction period. Proper road and construction signs with warning tapes should be provided at the construction areas. This should be done in full coordination with the Client representative and Engineer.</td>
</tr>
</tbody>
</table>
Table 8.23 Mitigation Measures – Construction wastes and the improper management

<table>
<thead>
<tr>
<th>Environmental Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem of construction wastes and the improper management of the contractors to collect and transport the debris outside the city towards the dumping sites: Negative impact.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The source of these pollutants is uncontrolled as a result of disposing liquid or solid construction waste. Examples of these wastes are uncontrolled disposal of construction wastewater, spillage of diesel, oil and grease. Excessive pollutants discharge has adverse impacts on surface water and soils. Therefore, the contractor has to consider certain measures to minimize such pollutants from reaching the water body and soil. Locating a high-risk zone with a concrete pavement will help in reducing the impact of diesel, oil and grease spills.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a medium probability of occurring</td>
<td>medium</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The contractor should provide all the safety measures and site plan management during the construction period. Proper waste collection and disposal plans should be prepared to minimize any risk of contaminating the soil and the environment. This should be done in full coordination with the Client representative and Engineer.</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.24 Mitigation Measures – Construction Camp and Site offices

<table>
<thead>
<tr>
<th>Environmental Description</th>
<th>Construction Camp and Site offices: Negative Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Description:</td>
<td>The construction camp and site offices could have an impact on the environment if the placement or design is poorly situated. Domestic waste as well as construction waste generated at the construction camp could also impact on the flora in the area as well as the human health of construction workers and the community if it is not removed to a landfill site. The management of construction camps throughout the project construction phase has to be managed effectively. Construction camps will have a significant impact on surrounding communities for the duration of the construction activity.</td>
</tr>
<tr>
<td>Impact Significance</td>
<td>Description</td>
</tr>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
</tr>
<tr>
<td>Duration</td>
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<tr>
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<tr>
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<td>The intensity of the impact is low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
</tr>
<tr>
<td>Mitigation</td>
<td>The placement of the construction camps must be negotiated with the local communities and community leaders. The construction camps must be placed on a disturbed piece of land with a minimum distance of 500 meters from the nearest residential area. Indigenous vegetation must not be disturbed by the contractor workers. The contractor must supply the workers with firewood or preferably gas cooking appliances, to ensure that wood is not harvested from the surrounding vegetation.</td>
</tr>
</tbody>
</table>
## Mitigation Measures - Aesthetic Impacts

### Environmental Description:

Aesthetic impacts due to the construction activities and changes of the nature of the city landscape: Negative Impact

### Impact Description:

The construction of related infrastructure might be perceived as a degradation of the landscape. Other construction activities may also lead to landscape disfiguration. Upcoming construction structures excavations, presence of soil mounds, machinery and other materials on the construction site will be visually intrusive. The presence of borrow pits, quarries and other structures in the project area are visually intrusive. The significance of the visual intrusion will, however, depend on several characteristics including the size, shape and color of the installations and their location on the site.

### Impact Significance

<table>
<thead>
<tr>
<th>Nature and Extent</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>The impact will be restricted to the construction site.</td>
<td></td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is short, and will stop once the construction period has been completed</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

### Mitigation

The placement of the construction camps must be negotiated with the local communities and community leaders.

The contractor should provide barriers and proper temporary walls to minimize the impacts of aesthetic on the residents. The contractor should re-install all the areas that were under construction and return it as it used to be before construction.
Table 8.26 Mitigation Measures – Historical and Cultural Impacts

**ENVIRONMENTAL DESCRIPTION:**

**Historical and Cultural Impacts: Negative Impact**

**Impact Description:**
During the construction and opening the trenches, historical and cultural sites and monuments unknown can be found underground. Construction activity can destroy those monuments if no measure is undertaken by the contractor to protect those sites by inviting the historical and monumental specialists to propose a management plan. For the existing sites there should be avoidance measures to cause any vibrations or dust increase in order not to cause any negative impacts.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
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<td>Probability</td>
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</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact will have low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Mitigation:**
The Contractor in coordination with the client should work on minimizing all the negative impacts on the existing historical sites such as old houses and mosques. The contractor should avoid creating excess vibrations that may impact the existing historical structures. In case of discovering new historical structures, the contractor should report immediately to the client to manage this accident with the department of antiquities.
8.3.2. Wastewater collection and treatment projects – Operation Phase

For retrieving the negative impacts which can be expected to arise as a result of operation and maintenance phase activities associated with wastewater collection, treatment and reuse infrastructure projects as mentioned in chapter seven, these can be presented below.

- Misuse of the treated wastewater for restricted irrigation and the increase of the sludge quantities (HS);
- Generation of odors, birds and flies due to the expansion of the WWTP (MS);
- Lowering the value of the areas around the WWTP (LS);
- More immigration from the peri-urban areas towards the city due to the high level of services (LS).
- More burden on the responsibilities of the local corporation of water and sanitation in terms of operation and maintenance (LS).
- Aesthetic impacts due to the expansion of the WWfP and its negative impact on the residents (LS).
- More financial burdens on the new subscribers for the sanitation services.

Description of the proposed mitigation measures are described in the following matrices:
Table 8.27 Mitigation Measures – Misuse of the treated wastewater

<table>
<thead>
<tr>
<th>Environmental Description:</th>
<th>Misuse of the treated wastewater for restricted irrigation and the increase of the sludge quantities: negative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact Description:</td>
<td>It is witnessed at present that the farmers are not controlled by the responsible agencies for the reuse of treated wastewater for the restricted irrigation. This problem will be scaled up during the expansion of the WWTP and the untreated quantities of effluents towards the farming activities. This will cause more health problems and possible contamination on the products that will be cultivated such as the vegetables. The other side of the problem is the expected remarkable increase in the quantities of sludge that will be generated from the plant after expansion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be within the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is high</td>
<td>high</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of high significance</td>
<td>high</td>
</tr>
</tbody>
</table>

Mitigation

It is the responsibility of the Client in cooperation with the Ministry of Agriculture and the local government to control the reuse of the treated wastewater for the restricted irrigation and take the necessary measures to implement the regulations. Public campaigns for the farmers regarding the reuse possibilities and the restrictions of misusing this water for unrestricted irrigation should be planned and organized. With the absence of sludge disposal and treatment plan, this will be a big challenge for the operator and may cause negative impacts on the environment and the residents close to the plant.
**Table 8.28 Mitigation Measures – Generation of odors**

<table>
<thead>
<tr>
<th>Environmental Description:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation of odors, birds and flies due to the expansion of the WWTP and lowering the value of the areas around the WWTP</td>
<td></td>
</tr>
</tbody>
</table>

**Impact Description:**

It is expected that the new and expanded WWTP will generate more odors and flies during the operation. This will be worse in case of improper operation and maintenance of the plant. Necessary measures should be taken to minimize this impact on the surrounding residents and downstream farmers and the labors at the plant.

It is expected that due to the expansion of the WWTP at the same location of the existing plant, there will be more drop on the values of the lands and properties of the residents close to the plant. This will cause negative social impacts on the residents.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be within the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of medium significance</td>
<td>Medium</td>
</tr>
</tbody>
</table>

The operation and maintenance of the WWTP after expansion should be the first priority for the LC operational plan. This will reduce the possibilities of generating odors and flies. A water quality laboratory should be introduced at the WWTP to check the quality of the effluents to ensure the proper process of the treatment.
Table 8.29 Mitigation Measures – More immigration from the peri-urban areas

<table>
<thead>
<tr>
<th>Impact</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside limit of project area</td>
<td>Regional</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>Low</td>
</tr>
</tbody>
</table>

Mitigation

The local government should start a regional planning program to elevate the standard of services at the peri-urban and rural areas to the level that the residents at these areas will not immigrate to the city of Dhamar.
Table 8.30 Mitigation Measures – More burden on the responsibilities of the local corporation

<table>
<thead>
<tr>
<th>ENVIRONMENTAL DESCRIPTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>More burden on the responsibilities of the local corporation</td>
<td>of water and sanitation in terms of operation and maintenance:</td>
</tr>
<tr>
<td>Impact Description:</td>
<td>Negative Impact</td>
</tr>
<tr>
<td>With the additional facilities at the city in terms of water</td>
<td>and sanitation and treatment facilities, there will be more</td>
</tr>
<tr>
<td>and sanitation and treatment facilities, there will be more</td>
<td>pressure on the local corporation to operate and maintain the</td>
</tr>
<tr>
<td>pressure on the local corporation to operate and maintain the</td>
<td>facilities in the proper way. This will require additional</td>
</tr>
<tr>
<td>facilities in the proper way. This will require additional</td>
<td>human resources and equipments to conduct the necessary.</td>
</tr>
<tr>
<td>the facilities in the proper way. This will require additional</td>
<td></td>
</tr>
<tr>
<td>human resources and equipments to conduct the necessary.</td>
<td></td>
</tr>
<tr>
<td>Impact Significance</td>
<td>Description</td>
</tr>
<tr>
<td>Nature and Extent</td>
<td>The impact will extend outside limit of project area</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
</tr>
</tbody>
</table>

Mitigation

The Ministry of Water and Environment should work closely with the LC in Dhamar for strengthening the capacities of the corporation in terms of human resources and logistical supports in order to be able to manage the incremental burden due to the increase of services.
Table 8.31 Mitigation Measures – More financial burdens on the new subscribers

<table>
<thead>
<tr>
<th>Environment/Description</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>More financial burdens on the new subscribers for the wastewater services: Negative Impact</td>
<td>The new subscribers for the sanitation will be facing incremental payments due to the new services of sanitation and treatment. The scale of this problem will depend on the ability to pay and the willingness to pay. The citizens will recognize that the generated benefits of using the new services will suffice any costs that will pay during the operation of the services.</td>
<td></td>
</tr>
<tr>
<td>Impact Significance</td>
<td>Description</td>
<td>Summary</td>
</tr>
<tr>
<td>Nature and Extent</td>
<td>The impact will be within the limit of project area</td>
<td>Local</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact duration is permanent</td>
<td>Permanent</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a low probability of occurring</td>
<td>Low</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is of low significance</td>
<td>low</td>
</tr>
<tr>
<td>Mitigation</td>
<td>The local corporation should start social campaigns before the starting of the project operation among the new subscribers to inform them about the financial implications that they have to take due to the new water services and show them the expected positive impacts due to this service.</td>
<td></td>
</tr>
</tbody>
</table>

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### Table 8.32 Mitigation Measures – Creation of employment opportunities

**ENVIRONMENTAL DESCRIPTION:**

Creation of employment opportunities: Positive impact

**Impact Description:**

A significant impact is the short-term wealth expectation created by any development project. Direct local community involvement must be a prerequisite for the approval of the project. Unskilled labor should be used during the construction process, and if possible labor intensive construction methods should be employed where possible. This facilitates adequate transfer of skills.

However, this impact is transient and creates an unsustainable economic situation and short-term dependence.

<table>
<thead>
<tr>
<th>Impact Significance</th>
<th>Description</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature and Extent</td>
<td>The impact will be restricted to the construction site.</td>
<td>Immediate</td>
</tr>
<tr>
<td>Duration</td>
<td>The impact will be of short duration, limited to periods construction phase.</td>
<td>Short</td>
</tr>
<tr>
<td>Probability</td>
<td>The impact has a high probability of occurring</td>
<td>High</td>
</tr>
<tr>
<td>Intensity</td>
<td>The intensity of the impact is low</td>
<td>Low</td>
</tr>
<tr>
<td>Significance</td>
<td>The impact is positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>

**Mitigation**

Local unskilled labor (women included) should be used as far as possible during the construction of the project through a local labor recruitment plan.

Mechanisms and structures to ensure the appropriate development and transfer of skills to the local community should be established.

Labor intensive construction methods should be employed where possible.

An overall development / land use plan for the surrounding area should be implemented to ensure that potential future conflicts are identified and mitigated.
CHAPTER 9: ENVIRONMENTAL MANAGEMENT PLAN

9.1. General

Environmental management is concerned with the implementation of the proposed mitigation and preventive measures that are necessary to minimize or offset adverse impacts and to enhance beneficial impacts. In order to be effective, environmental management plan must be fully integrated within the overall project management efforts at all levels, which itself should be aimed at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions effectively throughout its life.

The EMP is a binding document and should be provided to the Contractor as a stand alone document and as part of the tender documents for the construction of the projects.

The key players in the implementation of the mitigation measures are the Contractor to be appointed to undertake the construction works, the Client and the Engineer. The Environmental Control Officer (ECO) who will be employed by the Client, Ministry of Water and Environment, will ensure and monitor the implementation of the Environmental Management Plan (EMP).

9.1.1. Responsibilities of the Client representative (ECO)

The ECO will have the following responsibilities:

- To advise the Engineer on the interpretation and enforcement of the environmental requirements;
- To monitor the implementation of the EMP by the concerned parties;
- To provide environmental information whenever its necessary;
- To undertake regular inspections and submit reports on the Contractor's compliance;
- With the environmental requirements; these reports shall be copied to the Employer and Engineer; and
- To demarcate particular sensitive areas and pass instructions through the Engineer concerning works in these areas.
- To maintain the communication among all the concerned parties including the local communities' representatives and NGOs.

9.1.2. Responsibilities of the Contractor

The Contractor shall:

- Comply with the environmental requirements contained in this document;
- Be familiar with the EMP;
- Notify the ECO and Engineer immediately in the event of any accidental infringements of the environmental requirements to enable appropriate remedial action to be taken;

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• Notify the ECO and Engineer, at least ten working days in advance, of any activity he has reason to believe may have significant negative impacts, so that mitigatory measures may be implemented timely;
• Ensure environmental awareness among his employees and subcontractors so that they are fully aware of, and understand, the environmental requirements and the need for them;
• Undertake rehabilitation of all areas affected by construction activities to restore them to their original states, as determined by the Engineer; and
• Undertake the required works within the designated working areas.

9.1.3. Responsibilities of the Engineer

The Engineer shall:

• Be familiar with the contents of the EMP;
• Monitor the Contractor's compliance with the environmental requirements on a daily basis and enforce compliance (the ECO should be monitoring compliance on a daily basis, in most instances it is difficult for the Engineer to monitor these tasks effectively as well as the construction programme);
• Communicate to the Contractor the advice of the ECO and the contents of the ECO reports and issue site instructions giving effect to the ECO requirements where applicable;
• Communicate to the ECO, at least ten working days in advance, any proposed actions which may have negative impacts on the environment;
• Designate all working areas;
• Communicate to the ECO any infringements of the environmental requirements and accompany the ECO during site inspections;
• Maintain a record of complaints from the public and communicate these to the Employer and Contractor;
• Facilitate communication between all role players in the interest of effective environmental management; and
• Monitor the compliance of the Contractor through the ECO reports.
9.2. **Arrangement for Implementation of mitigation measures**

The arrangements for the implementation of the mitigation measures are shown in the next table. Responsibilities of the main actors (ECO, Engineer and the Contractor) should comply with responsibilities that are mentioned above in section 9.1.

**Table 9.1 Environmental Impacts and Mitigation measures**

<table>
<thead>
<tr>
<th>Impact</th>
<th>Proposed mitigation measures</th>
<th>Resolved by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social disruption, land acquisition and possible involuntary resettlement/ relocation and other social aspects</td>
<td>Adequate compensation, enactment and enforcement of laws, careful sitting of labor camps, awareness creation</td>
<td>Client, Project Engineer, contractor, local government, Land and survey Department, NGOs and ECO</td>
</tr>
<tr>
<td>Interference with existing roads and traffic routes</td>
<td>Provide appropriate road sign, road diversion and footpath, introduce public awareness campaigns for the drivers and residents, provision of substitute roads during construction</td>
<td>Project Engineer, Contractor, Local community, local government, Department of roads and ECO</td>
</tr>
<tr>
<td>Interference with existing facilities such as water, sanitation, electricity and communication</td>
<td>Provide an installment plan by the contractor to minimize the duration of service cuts for the residents, provide alternatives for the water supply and sanitation facilities by the client, public awareness before starting the construction</td>
<td>Project Engineer, Contractor, Local community, local government, local service authorities and ECO</td>
</tr>
<tr>
<td>Misuse of the untreated wastewater during the expansion of the existing WWTP</td>
<td>Stop all the reuse activities for the farmers, public awareness for the farmers before starting the expansion project, provide alternatives for the farmers for irrigation</td>
<td>Project Engineer, Contractor, Local community, local government, local service authorities and ECO</td>
</tr>
<tr>
<td>Flood protection and minimize of soil erosion and siltation</td>
<td>Provide flood protection measures close to the WWTP during the construction, provide silt trap to prevent sedimentation, protection of steep slope with reinforcement, proper terracing and landscaping</td>
<td>Contractor, Project Engineer, EPA, and ECO</td>
</tr>
<tr>
<td>Loss of Biodiversity</td>
<td>Landscaping and tree plantings</td>
<td>Contractor, Client, EPA, Project Engineer, and ECO</td>
</tr>
<tr>
<td>Health problems (local communities and working laborers)</td>
<td>Fill the borrow pits and disused quarries, improve drainage in the impacted area, provide safe drinking water for project workers and the community, implement awareness programme and conduct a survey every six months, provide essential drugs and treatment, proper location for the contractor’s camp</td>
<td>Contractor, Project Engineer, Ministry of Health, Local community leaders and ECO</td>
</tr>
<tr>
<td>Visual intrusion</td>
<td>Landscaping and blend with environment</td>
<td>Contractor, Project Engineer, EPA and ECO</td>
</tr>
<tr>
<td>Pollution of soil due to oil spillings</td>
<td>Bund all tanks for fuel, oils to contain any possible spill, provide spill mitigation equipment</td>
<td>Contractor, Project Engineer, EPA and ECO</td>
</tr>
<tr>
<td>Solid waste and land filling of the solid waste including sludge</td>
<td></td>
<td>Project Engineer, local community,</td>
</tr>
<tr>
<td>Environment</td>
<td>Proposed Solutions</td>
<td>Responsible Parties</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Debris pollution and backfilling and leveling</td>
<td>Collection and combustion, Sorting and recycle</td>
<td>ECO and local Government</td>
</tr>
<tr>
<td>Dust and Gaseous emission</td>
<td>Use of more efficient mode of burning fuel like use of solar, gas cooking system, Provision of protective gear</td>
<td>Client, Contractor, ECO, Project Engineer</td>
</tr>
<tr>
<td>Noise on local communities and workers</td>
<td>Provision of hearing protective device for workers, Appropriate selection of machinery, Avoid working during night</td>
<td>Project Engineer, EPA, ECO, Contractor</td>
</tr>
<tr>
<td>Accidents on the service roads and at construction areas</td>
<td>Implement safety programmes for road safety for the citizens and main children, Preparation and implement emergency Plan</td>
<td>Project Engineer, Contractor, ECO, Ministry of Health and Local government</td>
</tr>
<tr>
<td>Historical and cultural sites</td>
<td>Protection of the existing historical and cultural sites from vibrations or damages, Report on any new historical sites to the Client</td>
<td>Project Engineer, Ministry of Tourism, ECO, Contractor</td>
</tr>
<tr>
<td>Employment of local labor forces</td>
<td>Make all the necessary measures to consider the employment of the local labor forces during the construction activities</td>
<td>Project Engineer, Ministry of Labor, ECO, Contractor</td>
</tr>
</tbody>
</table>

9.3. Implementation programme

These responsibilities and organizational framework within which will be implemented are set out in the sections as follows:

9.3.1. Pre-construction Phase

> Management

Prior to contractor mobilization and the commencement of construction, environmental management activities will include:

- Ensuring that the financing agency requirements relating to EIA are complied with. In this case the World Bank requirement is complied with;
- Preparation of tender and construction contract documents which contains appropriate clauses to allow the control of impacts arising from construction activities; and
- Implementation of land repossessions to accommodate the works.

EMP must be part of the tender and contract documentation. Environmental mitigation aspects which will have a cost implication must be priced for.

> Monitoring

Monitoring activities during the pre-construction phase of the projects will involve in ensuring that the appropriate environmental protection clauses have been included in

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the contract documents to allow control of actions by the contractors, which are potentially damaging the environments.

9.3.2. Construction Phase

Management
Most of the project environmental management activities will be carried out during the construction phase, since this is when most impacts can be expected to arise. Management will largely be concentrated on controlling impacts which may result from actions of the contractor, through enforcement of the construction contract clauses related to protection of the environment as a whole and the components within it. In this respect, it is important to recognize that success of the mitigation of construction impacts can only be achieved if environmental protection measures, as set out in the construction contract, are properly enforced.

Overall primary responsibility for environmental management during construction will be vested in the Project Engineer as to be defined in the construction contract. The ECO to be appointed by the Client will in liaison with the ward councils make sure that, implementation of this project taking into account, among others, the findings of Environmental Assessment.

Monitoring
Environmental monitoring during construction phase will comprise two principal groups of activities:

Review of the contractors' site environmental plans, method statements and temporarily works designs to ensure that environmental protection measures specified in the contract documents have been given due consideration in their preparation and, that the contractors' proposals will provide an acceptable level of impacts control. The contractor has to prepare site environmental plans and these reviewed by the Project Engineer;

Systematic observation on a day-to-day basis of all site activities and the contractors' offsite facilities, as a check that the contract requirements relating to environmental matters are in fact being complied with, and that no unforeseen impacts are occurring. These activities will be fully integrated with the construction supervision and monitoring activities to be carried out. Primary responsibility for ensuring that an adequate level of environmental monitoring is carried out will be vested in the power of the Project Engineer as defined in the construction contract. The Project Engineer from the Client's side will collaborate with ward councils and other stakeholders to execute the project. Site staff, under the direction of a Project Engineer, will carry out actual monitoring on a day-to-day basis.

It is recommended that the Project Engineer should delegate specific responsibilities for day-to-day site environmental monitoring matters to one of his subordinates to be carried out as an integral part of his site supervision activities, in coordination with ECO. To avoid the problems which often occur, responsibilities should be clearly defined and allocated. However, the Project Engineer will still retain overall responsibilities for environmental matters, and this should be reflected in the contract document.

Majority of monitoring will comprise visual observation, carried out at the same time as the engineering monitoring activities. Site inspection will take place with the emphasis
on early identification of any environmental problems and the initiation of suitable remedial actions. Where remedial actions have been required on the part of contractor, further checks will need to be made to ensure that these are actually being implemented to the agreed schedule and in the required form. As experience of the principle problem areas is gained, attention will be concentrated on locations and activities which are known to be the most troublesome, with a lower frequency of inspections at problem-free locations. Nevertheless, each part of the site needs to be formally inspected from an environmental view point at least once every month. The Client will decide on the appropriate course of action to be taken in cases where unsatisfactory reports are received from the field staff regarding environmental matters.

In addition to visual observation, it is particularly important that monitoring should also include limited informal questioning of people who live near to the worksites, since they may be aware of matters which are unsatisfactory, but which may not be readily apparent or recognized during normal site inspection and visits.

9.3.3. Operation and Maintenance Phase

Management
Following completion of construction of the works, it is expected that there will be a six months maintenance period, during which the contractor will be responsible for remedying any defects in the works. The Client will be responsible for supervising maintenance during this period, including responsibility for environmental management and monitoring. However, it is anticipated that, these latter aspects will be restricted to ensuring that site clearance has been carried out in an acceptable manner.

Long-term continued enjoyment of the benefits arising from implementation of the works will only be achieved if effective routine and periodic maintenance is carried out in a timely manner. Environmental management and monitoring in a long run will be vested to the local community in Project areas.

9.4. Environmental Monitoring

Environmental monitoring as an essential tool in relation to environmental management which will provide the basis for rational management decisions regarding impact control. Compliance monitoring (which checks whether prescribed actions have been carried out, usually by means of inspection or enquiries), as opposed to effects monitoring (which records the consequences of activities on one or more environmental components, and usually involves physical measurement of selected parameters or execution of survey, to establish the nature and extent of induced changes), is the most appropriate for the present project.

The monitoring programme will be undertaken with the objective to:

- Check on whether mitigation measures have actually been adopted, and are proving effective in practice;
- Provide a means whereby any impacts which were subject to uncertainty at the time of preparation of this EMP, or which were unforeseen, can be identified, and to provide a basis for formulating appropriate additional impact control measures; and
• Provide information on the actual nature and extent of key impacts and the effectiveness of mitigation measures which, through a feedback mechanism, can improve the planning and execution of future similar projects.

Environmental monitoring will involve the collection of data and information pertaining to project characteristics, quantities and functioning of environmental variables over space and time. Environmental monitoring will be an integral part of the environmental project management process. It will rationally complete the process that begins with establishing the environmental baseline, carrying out the environmental impact assessment, implementing of mitigation measures and finally monitoring the success of those measures.

There are three basic forms of monitoring:

• To check whether the implemented project is operating as planned;
• Compliance monitoring, which checks whether prescribed environmental action plan have been carried out, usually by means of inspection or enquiries; and
• Effects monitoring, which records the consequences of activities on one or more environmental components and to establish the nature and extent of induced changes?

9.4.1. Monitoring Activities

Environmental monitoring is envisioned as an important process in project management. The monitoring programme will reveal changes and trends brought about by presence and operations of the project. Such information will be useful in the formulation of sustainable project management, operations strategies and action plans.

The basic activities for a sound-monitoring programme should at least include the following parameters:

• Collection and analysis of relevant environmental and social (health) data of the project area.
• Preparation of periodical reports on the environmental status of the project area and liaison with other agents and stakeholders.
• Identification of unexpected environmental impacts
• Formulation of counter-measures to mitigate against the unexpected negative impacts.

The Project Engineer will monitor the Contractor’s performance in relation to the environmental requirements on a daily basis. He will be assisted in his monitoring by the ECO. The ECO shall inspect the site on a regular basis. After such visits a report will be submitted to the Engineer and the Employer. The reports will contain any infringements of the environmental requirements. The reports may also aim at anticipating problems and so alert the Contractor to potential environmental risks and the appropriate action that may be taken. The Engineer will make the content of these reports known to the Contractor. The ECO may undertake an Environmental Audit of the works.
9.4.2. Environmental Variables

In order to sustain a healthy environment in the project area, the project management should undertake to monitor the quality of the environment in project area and its environs as a routine practice.

Monitoring will involve measurements, observations, evaluations, assessment and reporting on the following variables during the construction and operation phases of the programme:

- Natural resources regeneration/depletion (i.e. Changes in biodiversity);
- Soil erosion and siltation;
- Socio-economic changes;
- Reclamation activities;
- Health and working conditions;
- Pollution management;
- Waste management (Chemical spills, soil waste etc);
- Environmental awareness;
- Ground and surface water quality due to possible oil and pollutant spills.

Samples will have to be collected from the nearest point as quick as possible and monitored for the spilled compounds. For example, if a gasoline truck has an accident, dissolved hydrocarbons will be measured. The above table shows examples of the parameters that need to be checked.

The key stakeholders in undertaking environmental monitoring include Client (NWSA), LC, Ministry of Health, ECO and NGOs.

9.4.3. Monitoring System

In the context of this project, the most crucial aspects of monitoring refer to maintaining the safety measures on the new infrastructure facilities such as pipelines, valves and storage tanks. That will entail the quality of the water that is supplied to the customers. Monitoring for the project should at least include routine visual inspection and flow measurements and laboratory analysis.
Environmental Cost

The environmental cost for implementing the mitigation measures should be involved in the engineering design and being embodied in the engineering costs. The following table entails the mitigation measures items with their related unit costs. These costs were stemmed based on the market prices and the on-going construction projects in Yemen.

Table 9.2 Environmental Costs for implementing the proposed mitigation measures

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation measures</th>
<th>Unit (U)</th>
<th>Unit Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land acquisition and loss of properties</td>
<td>Adequate compensation for the private lands Awareness creation</td>
<td>Per m² for land or building</td>
<td>Commercial lands 300 US$/m² Domestic lands 150 US$/ m² Buildings (stone facing) 250 US$ / m²</td>
</tr>
<tr>
<td>Loss of Biodiversity</td>
<td>Landscaping and tree plantings</td>
<td>Per tree</td>
<td>7 US$</td>
</tr>
<tr>
<td>Dust and Gaseous emission</td>
<td>Sprinkling and watering</td>
<td>Per m³</td>
<td>5 US$</td>
</tr>
<tr>
<td>Solid waste pollution</td>
<td>Land filling of the solid waste including sludge and backfilling and leveling</td>
<td>m³</td>
<td>25 US$</td>
</tr>
<tr>
<td>Noise on local communities, workers, and fauna</td>
<td>Provision of hearing protective devices for workers</td>
<td>Per person</td>
<td>300 US$</td>
</tr>
<tr>
<td>Accidents on the roads</td>
<td>Implement safety programs for road safety for the citizens and mainly children</td>
<td>Per campaign</td>
<td>2,500 US$</td>
</tr>
<tr>
<td>Interference with access route</td>
<td>Introduce public awareness campaigns for the drivers and residents</td>
<td>Per campaign</td>
<td>2,500 US$</td>
</tr>
<tr>
<td>Socio-economic changes</td>
<td>Measure the changes in the level of life through conducting two integrated survey</td>
<td>Field survey</td>
<td>Lump sum per survey</td>
</tr>
<tr>
<td>Health and working conditions</td>
<td>Measure the improvement in health through selecting samples of the communities and make the necessary examinations</td>
<td>Field survey</td>
<td>Per survey</td>
</tr>
<tr>
<td>Waste management (chemical spills, soil waste etc)</td>
<td>Contamination of soil and water due to spill of oil and fuel</td>
<td>Field tests</td>
<td>Per test</td>
</tr>
<tr>
<td>Environmental awareness</td>
<td>The overall programme</td>
<td>Per campaign</td>
<td>2,500 US$</td>
</tr>
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CHAPTER 10: PROCEDURES FOR IMPLEMENTATION OF THE ENVIRONMENTAL MANAGEMENT PLAN

10.1. Management Plan Concept

10.1.1. Introduction

This Environmental Management Plan (EMP) document describes mitigation measures to be implemented during the construction and rehabilitation phases of the project. It is partly prescriptive, identifying specific people to undertake specific tasks, in order to ensure that impacts on the environment are minimized.

This EMP is seen as a 'living' document. Methodologies can be updated and improved during implementation, as site conditions become clearer. However, the EMP attempts to provide the most practicable methods to promote sound environmental management during the construction and rehabilitation phases of the project. Some notes and recommendations on the operational aspects are also included.

10.1.2. Environmental Control Officer

The Environmental Control Officer (ECO) is the person involved with the development project, responsible for monitoring the implementation of the environmental management plan. It may be different parties during the different phases of the project.

This person should be employed by the local corporation in Dhamar. It must, however, be a person with adequate technical and environmental knowledge to understand and implement this management plan. The ECO may not be someone appointed by the contractor or the engineer. The ECO must report to the developer.

The ECO has the authority to stop works during construction if in his opinion there is a serious threat to, or impact on the environment caused directly from the construction operations. This authority is to be limited to emergency situations (see definitions) where consultation with the engineer or developer is not immediately available. In all such work stoppage situations the ECO is to inform the engineer and developer of the reasons for the stoppage as soon as possible.

Upon failure by the contractor or his employees to show adequate consideration to the environmental aspects of this contract, the ECO may recommend to the engineer to have the contractor's representative or any employee(s) removed from the site or work suspended until the matter is remedied. No extension of time will be considered in the case of such suspensions and all costs will be borne by the contractor.

10.1.3. Environmental Awareness Training for Site Personnel

All contractor teams involved in work on the development are to be briefed on their obligations towards environmental controls and methodologies in terms of this EMP prior to work commencing. The briefing will usually take the form of an on site talk and demonstration by the ECO. The education/awareness programme should be aimed at all levels of management within the contractor team.

Construction workers must also be given basic health awareness training to diminish the spread of diseases in the project area.
10.1.4. Communication Procedures on Site

Site Instruction Entries
The Site Instruction book entries will be used for the recording of general site instructions as they relate to implementation of the EMP with regard to the works on site. It will also be used for the issuing of stop work orders for the purposes of immediately halting any particular activities of the contractor in lieu of the environmental risk that they may pose.

ECO Diary Entries
The purpose of these entries will be to record the comments of the ECO as they relate to activities on the site.

Each of these books must be available in duplicate, with copies for the Engineer and ECO. These books should be available to the authorities for inspection or on request. The contract site meeting minutes must reflect environmental queries, agreed actions and dates of eventual compliance. These minutes form part of the official environmental records on site.

Method Statements
Method statements from the Contractor will be required for specific sensitive actions on request of the authorities or ECO. A method statement forms the base line information on which sensitive area work takes place and is a "live document" in that modifications are negotiated between the Contractor / Engineer and ECO, as circumstances unfold. All method statements will form part of the EMP documentation and are subject to all terms and conditions contained within the EMP main document.

A method statement describes the scope of the intended work in a step-by-step description in order for the ECO and RE to understand the Contractors intentions. This will enable them to assist in devising any mitigation measures, which would minimize environmental impact during these tasks. For each instance wherein it is requested that the Contractor submit a method statement to the satisfaction of the ECO, the format should clearly indicate the following:

What Brief description of the work to be undertaken;
How Detailed description of the process of work, methods and materials;
Where Description/sketch map of the locality of work (if applicable); and
When Sequencing of actions with commencement dates and completion date estimates.

The Contractor must submit the method statement before any particular construction activity is due to start. Work may not commence until the method statement has been approved by the ECO.

10.1.5. Record Keeping

All records related to the implementation of this management plan (e.g. site instruction book, ECO diary, and method statements during construction and other EMP records during operation) must be kept together in an office where it is safe and can be readily
retrieved. These records should be kept for two years and should at any time be available for scrutiny by any relevant authorities. It is recommended that photographs are taken of the site prior to, during and immediately after construction as a visual reference. These photographs should be stored with other records related to this EMP.

10.1.6. Environmental Completion Statement
An Environmental Completion Statement is a report by the ECO to the relevant authorities stating completion of the construction of the project and compliance with the EMP and conditions. This statement will be issued after a final external audit of EMP implementation.

10.1.7. Institutional Matters
The ECO is responsible for the day-to-day implementation of the EMP. The ECO will commission external audits of EMP implementation by an independent environmental auditor on a bi-monthly basis during the construction period. This external auditor will prepare a short audit report after each audit. These reports will be discussed at the construction site meetings and will be retained for record keeping purposes.

10.2. Site Establishment
10.2.1. Sensitive features and wetland areas

✓ Cultural and Historical Elements

Before commencement of the clearing activity, the Contractor must familiarize himself with the type and location of any sites of cultural or historical importance enumerated in this report but shall not limit himself to those mentioned. The elements ultimately to be affected can only be determined during construction.

The activities that are likely to result in these impacts include:

- Quarries and borrow areas
- Contractors' yards, labour accommodation, etc
- Storage
- Access roads
- New alignments and detours
- Cuts and fills
- Maintenance
- Earthworks

The Contractor must then present the Environmental Control Officer (ECO) as well as the Resident Engineer (RE) with a layout of his works including haul roads, borrow areas and construction camps and satisfy the ECO that the known elements mentioned in this study are either avoided altogether or, in the case of gravesites, will undergo translocation after thorough consultation with the affected communities and authorities.
Special features demarcated on the maps or matrices must be identified and located. Care must be taken to prevent accidental damage during the construction stage. Workers on site must be informed about the possible consequences of interfering with these elements.

✓ Gravesites

The issue of translocation of graves is an extremely sensitive one. There is a strict order of events, which must be adhered to. The gravesite like the one in the northern part of the project area must be reported to the RE who will then forward the information to the local Government. The local Government and LC must then negotiate with the family of the deceased to reach an agreement on exhumation and reburial.

Once an agreement is reached, the exhumation and reburial must be performed in accordance with the applicable rituals. It will be the duty of the contractor to supply caskets, dig new graves and perform the exhumation and reburial upon request by the civil authority. This will be over and above the cost of the ordinary contract requirements.

It is recommended that all gravesites remain in situ, and are avoided as far as possible, through road realignment.

Gravesites or other socially significant structures should be protected by means of physical barriers both during construction and operation to prevent disturbance, vandalism or destruction.

✓ Responsibility of the Compensation / Resettlement Unit

Compensation/resettlement plans should be based on socio-economic surveys describing the full resource base of the affected population including income derived from informal sector and non-farm activities and from common property, the extent to which the groups will experience total or partial loss of assets, and public infrastructure and social services that will be affected.

Legal frameworks should be set up in consultation with the community including the nature of compensation, in terms of the valuation methodology and the timing of payment, the legal and administrative procedures applicable including the appeals process and the normal time-frame for such procedures.

Ensure the community participates in planning/devising the most appropriate means of compensation. It is important that the communities' needs/losses are identified rather than assumed and are thereby appropriately compensated.

A list of names of affected families should be compiled as early as possible to prevent an influx of ineligible people claiming compensation.

Information relating to the laws and regulations affecting the valuation and compensation of eligible families' households/businesses/goods needs to be timeously disseminated.

Valuation of lost assets should be made at their replacement cost prior to the actual move.

Assessment of cash compensation for property should be carried out in a wholly transparent manner, resulting in payments, which truly reflect current rebuilding costs, taking into account the inevitable rise in building material prices, which occur when it is known that compensation money will be available.
All affected persons should be freely allowed to salvage building materials, trees and other assets on affected land as additional compensation for displacement. Some types of loss such as access to public services, customers and suppliers cannot easily be evaluated or compensated for in monetary terms. Attempts must therefore be made to establish access to equivalent and culturally acceptable resources and earning opportunities.

In the case of businesses, the compensation payments should be adjusted to take into account any anticipated loss of income which may arise as a result of the need for relocation to a less suitable location away from the main centre of business activities. Where replacement land is provided by the local authorities any costs associated with registration of right-of-use should be met by the project, and clear right-of-use titles should be granted. In the case of agricultural land, the area of replacement land should be determined so as to take into account productivity, so that crop production remains as previously.

Resettlement plans should be built around a development strategy and package aimed at improving or at least restoring the economic base for those relocated. Communities must be assisted in their efforts to improve their former living standards, income earning capacity and production levels, or at least to restore them. Absence of legal title to land by adversely affected population should not be a bar to compensation.

Any payment due to the hosts for land or other assets provided to re-settlers should be promptly rendered. Conflicts between hosts and the resettled may develop as increased demands are placed on land, services or if re-settlers are provided services and housing superior to that of the hosts. Compensation therefore needs to be equitable and the host populations included in resettlement discussions.

**Cultivated Fields, Fences and Livestock**

Care should be taken to ensure that the minimum of cultivated fields and crops are damaged by construction activities. If the pipelines route impacts on any cultivated field or cropland, fences and cultivated fields, then the owner thereof must be notified and the compensation plan be implemented. Residents should be compensated for the loss of crops and fences and care should be taken to ensure that the farmer is not worse off as a result of the construction activities.

Care must be taken during construction activities to ensure that livestock of the surrounding communities are not injured or killed as a result of the construction activities. If an incidence occurs, then proper compensation procedures must be instituted.

**Accommodation of Traffic**

The existing routes at the project areas are extensively used on a day-to-day basis by pedestrians, vehicle users as well as for the movement of stocks. The contractor must accommodate vehicle, human and animal traffic safety at all times, with the exception of limited short periods during trenching. The contractor must demarcate and/or fence unsafe areas to ensure that access is restricted until it is safe and must post appropriate signage to indicate these areas.
The contractor must ensure that the surrounding community is educated about the construction process and the constraints placed on them during this period.

✓ Rehabilitation of Old Roads

After construction has been completed the old roads must be rehabilitated according to the following procedure.

The surface material that can be recovered must be removed from the top soil layers and used as far as possible on the new alignment further on.

The compacted soil below must be ripped and covered with topsoil if available.

10.2.2. Clearing and Grubbing

✓ Topsoil

The area of ground clearance should be minimized and sensitive alignments avoided, such as those which include steep hillsides, as far as possible. Topsoil shall be cleared of woody vegetation before ripping and removing.

The topsoil is regarded as the top 150mm of the soil profile irrespective of the fertility appearance or physical depth. Topsoil is to be stripped when it is in as dry a condition as possible in order to prevent compaction.

The topsoil, including the existing grass cover is to be shallowly ripped (only the depth of the topsoil) before removal. This is to ensure that organic plant material, and the natural seed base is included in the stripping process.

Soil stockpiles shall not be higher than 2.5 m or stored for a period longer than one year. The slopes of soil stockpiles shall not be steeper than 1 vertical to 2.5 horizontal.

No vehicles shall be allowed access onto the stockpiles after they have been placed.

Stockpiles shall not be allowed to become contaminated with oil, diesel, petrol, garbage or any other material, which may inhibit the later growth of vegetation.

The contractor shall apply soil conservation measures to the stockpiles to prevent erosion. This can include the use of erosion control fabric or grass seeding.

If at any stage of the clearing operations archaeological artifacts are unearthed or identified the Archaeological Department is to be immediately contacted to conduct thorough scientific investigation of the finds and work suspended until further notice.

The contractor shall devise a soil conservation and stockpiling plan, to be approved by the ECO and RE, which shall detail stockpile sizes, layout and form and means of erosion (wind and water).

The rehabilitation measures to be taken for the area occupied by the stockpile, should the ECO deem it necessary.

✓ Fauna and flora

Natural vegetation shall be kept in as undisturbed a state as possible. Special attention shall be paid to preserve large trees and plant communities. Vegetation removals as part of the development requirements are excluded.

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All incidents of harm to any animal or natural vegetation (apart from the agreed areas) must be reported to the ECO. Endemic vegetation species listed in the EIA Report must be relocated to a suitable growing area, if at all possible.

✓ Fencing

The purpose of fenced areas shall be to secure the contractor’s equipment. Gravesites should be fenced during construction and removed as soon as construction is finalized in an area. Temporary demarcation with white boulders or other suitable materials such as white painted wooden stakes of 1.5m high will be required to demarcate sensitive environments as stipulated above to minimize construction damage. These boulders or other materials must be removed when construction is finished.

✓ Fencing at Construction Camps

Fencing shall be suitably secured

- No unauthorized pedestrian or vehicular access shall be allowed into fenced off-limits areas.
- Fencing shall be kept neat at all times. The contractor shall be responsible for the maintenance of all fences. Breaches in the fencing must be repaired immediately.
- All exclusion areas are strictly out of bounds.
- The clearing for permanent fencing shall be limited to the removal of shrubs within 1 m of the fence line. No grass cover and topsoil is to be removed within the fence alignment.
- Galvanized diamond mesh fencing, preferably with a matte coating, will be used.

10.2.3. Construction Camps

The planning and design for the Construction Camp must ensure that there is a minimum impact on the environment. The placement of the construction camp and compensation must be negotiated with the landowner. The construction camps must be placed away from residents in the surrounding area to ensure that the cultural heritages of the communities are not impacted upon by construction workers from different cultural backgrounds. Local labors must be used as far as possible to minimize cultural intrusion of the communities in the area.

All site buildings shall be founded on a platform, which will be compacted sub-soil or screed slab. The screed slab and compacted sub-soil will be removed from site on decommissioning of the structures. All buildings will be soundly built and will not pose a danger to personnel. No fires may be allowed outside the construction area / construction camp and adequate fire fighting equipment according to the fire hazard during the construction period must be available on site in good working order (at least one type ABC (all purpose) 12.5 kg extinguisher).

Welding, gas cutting or cutting of metal will only be permitted inside the working areas. Two separate activities fall under the scope of this EMP, namely the construction of a series of bridges and a major link road.
The construction camp to be set up for the bridge construction is to be constructed in one place for the duration of the construction activities and must be rehabilitated after construction is finished (permanent camp). The construction of the road could involve either of two scenarios

- A temporary camp which is moved as the road progresses
- A set of camps, which are placed midway along their respective sections of road for the duration of the construction phase (permanent camps).

10.2.4. Site Building at Construction Camps

✓ Permanent and Temporary camps

- All buildings will be soundly built for the benefit of the personnel. The relevant safety codes pertaining to inter alia load, structure, lighting, noise are applicable here. Buildings should preferably be pre-fabricated or constructed of re-usable/recyclable materials.
- The structure and its alignment, must, as far as possible, reduce the need for air conditioning and artificial lighting but it must be ventilated properly. Buildings should be built of materials, and aligned in such a way as to minimize the visual impact.
- Temporary site building footprints are to be rehabilitated and re-vegetated, to the satisfaction of the ECO, when construction is complete.

✓ Permanent camps

- All site buildings shall be founded on a platform of compacted sub-soil or screed slab. The screed slab and compacted sub-soil will be removed from site upon decommissioning of the structures.

✓ Temporary camps

- Containers are to be used for the storage of goods and to house any activity, which is small enough and which has the potential to release pollutants into the environment.
- There is to be as little preparation of the site as possible. Preparation should thus not involve more than scraping and limited compaction, to the satisfaction of the RE.

10.2.5. Initial Earthworks Platforms

Two types of platforms will be created, namely concrete and compacted earth platforms.

- Concrete platforms shall be required for all site buildings including offices, storage buildings, vehicle wash-bay and vehicle housing sheds. Compacted earth platforms will be required for storage of aggregate.
- Settling ponds are to be provided to allow for temporary detention of drainage water from the construction camp prior to discharge into a natural watercourse. Construction of the ponds shall take place prior to topsoil stripping or any other construction activity.
• The Contractor shall take appropriate and active measures to prevent erosion resulting from his own works, operations and activities as well as storm water control measures to the satisfaction of the ECO / Engineer. Restoration costs are likely to be for the contractor's account, should these measures not be reasonably implemented. Aspects normally covered in construction contracts in terms of "protection of works" are standard and are not to be billed or confused with any details covered under environmental requirements.

• During construction the Contractor shall protect areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. Measures can include cut off trenches, straw stabilizing, brush packing etc. A method statement is required from the Contractor prior to site clearing.

10.2.6. Fuels and Oils at Construction Camps

• All aboveground petroleum product (diesel, oil and petrol) storage tanks shall be placed in bunds with sumps. The minimum bund capacity will be at least 110% of the storage capacity.

• In the event of a spill, pumping of the product, either for recovery or for disposal must be done as quickly as possible to reduce the amount of vapors being released into the environment.

• All drainage from fuel storage areas shall be diverted to the settling ponds.

10.2.7. Cement at Construction Camps

• Cement shall be delivered in sound and property secured bags or in approved bulk containers.

• Cement products in sacks shall be stored in an enclosed storage area underlain by a concrete platform with the bags themselves raised off the ground with the use of pallets.

• The storage facility and surrounding area shall be swept and cleaned regularly as required to ensure that cement products do not enter the surrounding environment.

• Where cement silos are used in temporary camps, the ground cover surrounding the silo and dispatch area is to be a well graded non-compacted surface. This will ensure that any cement spill does not splatter or run over the otherwise hard surface and is therefore easier to remove.

10.2.8. Pipelines

The storage of pipelines will be permitted under the following circumstances:

• Pipelines are stored off site and brought in each as required.

• The contractor may establish a fenced stock area for the storage of pipelines on site.

• The contractor will be responsible for the safeguarding of such a fenced area.
10.2.9. Aggregate

- Fine aggregate shall be stored on a compacted earth platform.
- The contractor shall ensure so that no excessive amount of fine aggregate is washed from the storage area onto the rest of the site with the use of barriers designed to the satisfaction of the RE.
- Coarse aggregate shall be stored, as a minimum, on a surface of compacted inert sub-base material. Run-off from the stockpile shall be diverted to an evaporation pond where fines will be allowed to settle out.

10.2.10. Fill & Layer works Material

- The stockpiled area is to be re-vegetated upon removal of stockpiled material.
- Clearly defined borders for the stockpiling of material shall be stipulated by the RE and the contractor shall contain stockpile within these boundaries.
- Fine material shall be covered with tarpaulins in strong winds as instructed by the RE and Environmental Officer.

10.2.11. Parking Areas

- All vehicles and plant shall be maintained to ensure that there are no leakages.
- All contaminated surfaces, especially compacted sub-grade, shall be removed from site.

10.2.12. Wash Bay at Construction Camps

- A dedicated vehicle wash bay shall be created.
- The wash bay shall be upon a screed platform to prevent erosion and infiltration of the pollutants into the ground water.
- All run-offs from the platform shall be contained by bund walls. The wash water should be directed via a lined channel to a settling pond.
- The contractor shall provide and maintain bund walls around the wash bay within the site. Where the drain passes through or across the bund wall the contractor shall provide a means of preventing flow so that in the event of a leak all liquids can be contained by the bund walls.

10.2.13. Service Area

✓ Permanent and temporary camps

- Soil severely contaminated by oil, fuel or chemical leakages shall be removed and disposed of at a site identified by the RE.
- All major servicing of plant and vehicles will be done off site, at the contractor's premises.
- All used oil shall be retained and disposed of by removal for recycling at an urban centre or disposal in any other manner approved by the ECO.
• The contractor shall educate workers on the appropriate methods for workshop maintenance and fuel points to prevent fuel and oil being washed out of containment areas.

✓ Permanent camps
• The contractor will provide a concave concrete floor slab to prevent erosion and infiltration of the ground water by petroleum products.
• The slab shall drain into the temporary oil skimming tank. The contractor shall provide bunded walls around the maintenance area.
• Where the drain passes through or across the bund wall the contractor shall provide a means of preventing flow so that in event of a leak or overflow from the skimming tanks all liquids can be contained by the bund walls.

✓ Temporary camps
• Toxins and oil recovered shall be collected in drums and disposed of in the same manner as for used vehicle oil. All servicing must take place at the contractor's premises. Minor services to take place at the permanent camp.

10.2.14. Concrete Batching Plant

✓ Permanent and temporary camps
• The concrete plant shall be located on a compacted earth platform.
• Concrete shall only be mixed in areas which have been specifically demarcated and established for this purpose.
• Any large quantity of concrete spill shall be promptly removed by the contractor to an approved disposal site or saved for possible later use.
• After mixing is complete all waste shall be removed from the batching area. The contractor should first seek means of reducing the waste through re-use on site e.g. rubble or recycling. Disposal at an approved disposal site should only be a last resort.
• No storm water shall be permitted to flow through the batching site.

✓ Permanent camps
• All water left over from the concrete batching operation or surface run-off from batching area will be channelled to evaporation ponds. These ponds will be cleaned at least twice per year.
• The batching plant shall be enclosed by a bounded wall with divisions and dedicated compartments for the various types of materials.
• Air filters shall be monitored and cleaned and replaced on a regular basis.

✓ Temporary camps

Any concrete batching in temporary camps will be conducted on a well-graded uncompact surface as described in Concrete.
The batching area is to be bordered by temporary earth bunds, which will contain any large spills. In the event of a spill, the contaminant must be removed as thoroughly as possible while it is still fluid. Contaminated soil must be removed.

10.2.15. Sanitation

✓ Permanent camps
  • Adequate chemical latrines shall be provided for all staff at the camps and away from the construction camp.

✓ Temporary camps
  • Chemical latrines must be provided at temporary construction camps as well as nearer to the area of construction.

✓ Permanent and temporary camps
  • The latrines and septic tank system shall be located away from such sensitive areas as sponges, streams and springs and areas of cultural and historical importance.
  • They shall be serviced regularly so as to prevent overflowing.
  • Night-soil shall be removed to a waste water treatment works (WWTW) or disposed of in any other manner acceptable to the ECO.
  • All fees in this regard, whether it be to the WWTW or to the transporters are payable by the contractor.
  • The contractor’s staff shall use only the latrines for ablution.
  • Water used for sanitation purposes e.g. washing facilities, must be released into the septic tank system.

10.2.16. Temporary Storage of Waste

✓ Construction Waste
  • As far as possible, spoil shall be used in fill and contouring of slopes.
  • Only nominated spoil areas shall be used. These shall be located in an area decided by the ECO and shall preferably be previously disturbed areas.
  • Spoil areas shall be contoured to conform to the surrounding landscape and shall be covered with topsoil.
  • Spoil heaps shall be protected from run-off by cut-off and diversion trenches.
  • Temporary storage of construction spoil shall be limited, as far as possible, to the road reserve. Areas already disturbed or to be disturbed by construction activities shall be used for storage of spoil.
  • As much construction waste as possible must be re-used or recycled. The contractor will be responsible for removing and transporting all remaining waste material off site to an approved dumpsite.
✓ Domestic Waste

- Recyclable waste, including glass, paper and plastic shall be separated at source, stored and recycled, where economically feasible.
- Waste must be disposed of on a weekly basis in a manner approved of by the ECO at the Contractor's expense.
- Personnel shall be informed about the necessity to refrain from littering and about the need to keep hazardous substances separate from the domestic waste.
- The contractor shall, on alternating days, conduct site clean-ups for litter other than construction spoil, and dispose of it in refuse bins provided on site.

10.3. Construction Procedures

10.3.1. Cut

- Non-rock slopes shall not be steeper than 1:2 (vertical : horizontal) although the ideal profile for re-vegetation purposes lies between 1:3 and 1:4
- Steep slopes should be protected against erosion with soil stabilization mechanisms. The proposed method is detailed under Storm water Drainage. If the upper slope of the cut face is likely to be unstable, leading to rock fall, then it must be stabilized as soon as possible to prevent erosion.
- Do not cut slopes and embankments to an angle greater than the natural angle of repose for the local soil type.
- Bare rock on cut embankments, must not be top soiled, but only stabilized.

10.3.2. Fill

- Steep slopes must be protected against erosion.
- Bare rock on fill embankments must be stabilized and not top soiled.
- Care must be taken to ensure that large boulders (spoil material) do not roll down hill and demolish houses or crops or endanger people.
- Spoil that tumble down into cultivated fields must be removed. Where removal is not feasible, the field owners must be compensated by suitable means.

10.3.3. Unstable Slopes

- Ditches must be intercepted at the tops and bottoms of slopes and gutters and spillways can be used to control the flow of water down a slope.
- Stabilize the slope by building retaining structures such as gabions, cribs or other types of wooden barricades and grid work, usually battered against a slope.
- Constructed retaining walls can be built to withstand pressures at the base of the slope.
- Build reinforced earth and embankment walls, with anchors compacted into the fill material.
- Armour the surface against erosion and abrasion by intercepting raindrops (leaves).
• Support the slope by propping from the base (tree and shrub boles and roots)
• Reinforce the soil profile by increasing its shear resistance
• Drain the soil profile by drawing water out through the roots and releasing it to the air by transpiration
• Facilitate infiltration of water through the soil profile, thereby reducing the proportion of water flowing over the soil surface.

10.3.4. Retaining Wall Structures
A retaining wall will be constructed where required to stabilize steep slopes. These retaining walls will be stone pitching to reduce the visual impact of the structures and to ensure that it blends in with the natural environment. The use of these retaining walls will be limited to cases where slopes are unstable or where the natural slope is too steep and using a 1v:3h or 1v:2h fill slope will result in large fill areas, enlarging the footprint of the road on the natural environment.

10.3.5. Drilling
The contractor shall comply with the relevant Yemeni safety regulations in providing safe drilling conditions and working equipment for his personnel.
Drilling shall commence at specified times agreed to and approved by the RE, in order to minimize the noise impact.

10.3.6. Borrow pits
The position of borrow pits must be determined by the ECO and RE bearing in mind the following
• The visual impact of the borrow pit.
• The context of the borrow pit, i.e. will traffic, noise and air pollution created by the borrow pit going to adversely affect the surrounds.
• The loss of arable land.

All topsoil removed from the borrow pit site is to be stored for later rehabilitation of the land.
The progression of stripping and excavation shall allow for rehabilitation on areas that have been fully used. Cut slopes shall be a minimum of 1:3.
Borrow pits shall be used for excess rock spoil. Storm water cut-off drains shall be provided at the tops of cut slopes.
Excavations shall be undertaken in a safe manner in compliance with the relevant safety regulations. Safety operations to be observed by the contractor shall include the sloping, stepping or benching or shoring, timbering or otherwise supporting the sides of the excavations.
Maintaining the sides of the excavations in a safe condition shall at all times are the sole responsibility of the contractor. No under-cutting of the sides will be allowed.
Water and runoff collected in the excavation site will be pumped out of the excavation and released through a sump system into one of the sedimentation ponds before being released into the natural environment.

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10.3.7. Screening
The contractor shall suppress the dust and noise nuisance caused by the screening process. The screening process shall be positioned so as to cause minimal disturbance to surrounding properties and the construction staff.

10.3.8. Layer works
- Layer works shall be placed and compacted with dust being minimized through appropriate watering. No work shall be allowed in excessively windy or rainy conditions, as decided by the RE.
- Stabilizing agents shall be used such that they do not cause contamination of groundwater.

10.3.9. Asphalt Paving
- Heating of asphalt shall be conducted such that the possibility of injury to bystanders or workers is minimized.
- Care shall be taken to ensure that only those with suitable training and/or safety equipment are allowed near the laying of hot asphalt.
- Any unused asphalt shall either be stored appropriately (such that it does not contaminate any runoff) or it shall be safely disposed of.

10.3.10. Stockpiling
- Suitable material shall be stockpiled on a sub-base platform, which has been cleared of topsoil as per above. The sub-soil will be compacted to accommodate the spoil stockpile.
- All unsuitable and surplus spoil rock shall be removed from the site to a dumping site or sites, to be negotiated by the contractor and approved by the Engineer, dumped, spread and leveled, all to the satisfaction of the Engineer.
- No dumpsite shall be used without the prior written approval of the Engineer and the owner of the property.
- No spoil material shall be stockpiled in violation of any Statute or Ordinance or to obstruct any watercourse or drainage channel.
- The top surface of all permanent spoil dumps shall be left smooth and even and side-slopes, where required, are to be stable for the material concerned. Adequate drainage to the top surface and side-slopes shall be provided to prevent future erosion.

10.3.11. Personnel
- Working hours will be agreed upon with the affected communities prior to construction.
- Cooking facilities shall be provided for the construction staff within the confines of construction camps. No trees or natural vegetation shall be permitted to be removed for the making of fires.
- No fires shall be permitted, unless a specifically designated area has been identified and set aside by the Engineer for that purpose.
10.4 Rehabilitation of Construction Activities

10.4.1 Construction Camps

> Permanent camps

Rehabilitation will be necessary in the following areas:

- Concrete and compacted earth platforms
- Excavation for septic tank
- Access roads running into and through the camps

Concrete platforms will need to be broken up and rubble taken to an approved waste disposal site or used to rehabilitate borrow pits. The exposed surface must be checked for contaminant and if any is found, the contaminated soil is to be removed along with the concrete to a site acceptable to the ECO and the RE. The re-vegetation process must then be followed.
Soil containing contaminated soil in the compacted earth platforms is to be removed according to the method described above. The re-vegetation process is then to be followed.

Once the septic tank has been removed from site, the exposed excavation is to be covered over and re-vegetated.

Access roads running into and through the camps and any other well used thoroughfares (whether pedestrian or vehicular), which have been denuded of vegetation and have subsequently been compacted, are to be checked for any substantial spillage of contaminants including oils and fuels. The area is to be ripped and top soiled if necessary.

**Temporary camps**

Rehabilitation will be necessary in the following areas:

- Compacted earth and non-compacted earth platforms
- Access roads running into and through the camps
- Compacted and non-compacted earth platforms will be rehabilitated according to the method described above.
- Access roads will also be rehabilitated according to the method described above.

10.4.2. Borrow Pits

Borrow pits shall be filled with as much excess fill material as possible but shall be kept free of any other waste. They shall be covered in soil stockpiled either from the original excavation of the borrow pit or from other sources. If there are inadequate amounts of topsoil, then alternative rehabilitation measures must be implemented such as:

- Transforming quarries into lakes for recreation, aquaculture, or wildlife habitat
- Conversion of borrow pits and spoil dump sites into roadside picnic areas and scenic lookouts.

10.4.3. Stockpiles

Once stockpiles have been removed the ground surface is to be inspected for compaction. Should it be required, the surface is then to be ripped and the re-vegetation process follows.

10.4.4. Operational Phase

Regular monitoring and maintenance of the construction areas should be done by the LC to ensure that rehabilitation measures was successful and to observe whether unstable cut and fill areas need to be stabilized (especially after heavy rains). LC should make start a water quality monitoring program for the implemented water supply network in order to maintain the quality of water for domestic uses.
CHAPTER 11: CONCLUSIONS AND RECOMMENDATIONS

This Environmental Impact Assessment concluded that the proposed water supply and sanitation projects in Dhamar City—under Group I urban center development program is environmentally viable to be implemented as far as the mitigation measures proposed will be implemented.

The compensation for the acquitted private properties at the proposed expansion site of the WWTP and possibly some of the pumping stations areas should be made for sites expropriated by the Government for this project. The current socio-economic aspects at the project site should be maintained and preserved through following the proposed preventive and mitigation measures that were mentioned in Chapter seven of this report.

The project will improve the health aspects and raising the standard of living of the residents of Dhamar. The project will provide the residents with clean and drinkable water according to the required standards in Yemen. In addition to that it will relief the residents from the daily suffering via requesting the water from far distances and utilize their time in a more fruitful activities. Public awareness campaigns should accompany the implementation of the project and should target the residents at the impacted areas.

The provision of the wastewater collection system and expansion of the existing WWTP will improve the standards of life and reduce the risk of contaminating the water sources. The provision of the WWTP will ensure the reuse possibilities of treated wastewater for the restricted Irrigation. The farmers should be controlled and their irrigation activities should be watched by the Ministry of Agriculture and the local Government.

The untreated wastewater during the expansion of the existing WWTP should be avoided and diverted to prohibit the reuse of this water by the farmers.

The Contractor should minimize the interference and interruption of the current services to the citizens during the construction period. Re-instatement should be provided for all the services after the completion of the work as it were before.

The local corporation of water and sanitation in Dhamar should work closely, through the ECO with the Contractor and Engineer to guarantee the consideration of the EMP as requested in this report. That should be done during and after the construction of the project. Concerned parties such as National Environmental Protection Agency and the local Government need to be involved in the process from the beginning.

It is recommended that a site management plan should be agreed during the Contractor’s mobilization.

It is necessary that most of the mitigation measures will be implemented at local level in order to ensure the sustainability of the projects particularly during the construction and operation of the water supply system with an effective participation of local community. The Client, in cooperation with NGOs should ensure that local communities are involved in the progress of implementing the project and ensure proper usage of the new infrastructure.
It is also important to undertake monitoring programme in terms of water quality and implementation of the proposed environmental plan so that the proposed mitigation measures are implemented. The monitoring should also foresee other environmental impacts that are probable to emerge and lay down strategies to overcome these impacts.

Proper implementation of the EMP requires better cooperation and coordination among all the stakeholders that will participate in the planning, implementation and monitoring of all the proposed mitigation and preventive measures.

The Consultant introduced Annex no. 4 of this report which entails the environmental management plan and the implementation procedures as a stand alone document.

This Annex can be provided to the Contractor as part of the tender documents to be considered and implemented during the construction period.
ANNEX 1

YEMENI ENVIRONMENTAL LAWS AND RELATED EIA REGULATIONS AND POLLUTION CONTROL PROCEDURES
ANNEX 1

YEMENI ENVIRONMENTAL LAWS AND RELATED EIA REGULATIONS AND POLLUTION CONTROL PROCEDURES
قانون رقم (26) لسنة 1995م

بشأن حماية البيئة

باسم الشعب:

رئيس الجمهورية:

بعد الإطلاع على دستور الجمهورية اليمنية.

وبعد موافقة مجلس النواب:

(اصدرنا القانون الآتي نصه)

الباب الأول

الأحكام والمبادئ العامة

الفصل الأول

التسمية والتعريف

مادة (1):

يسمى هذا القانون (قانون حماية البيئة).

مادة (2):

يكون للفاتحات والعبارات التالية حيثما وردت من هذا القانون المعاني المبينة قريباً منها ما لم يدل سياق النص على خلاف ذلك:

1. الجمهورية:

الجمهورية اليمنية

2. المجلس:

مجلس حماية البيئة

3. البيئة:

المحیط الحيوي الذي يحتوي فيه مظاهر الحياة بأشكالها المختلفة، ويتكون هذا المحیط من عناصر:

عصر كوني يضم الكائنات الحية من إنسان وحيوان ونبات، ومواد طبيعية من هواء وماء ونتر، ومواد عضوية وغير عضوية، وكذلك الأنظمة الطبيعية.
وعصر الإنسان: يشمل كل ما اختلاف الإنسان إلى البيئة الطبيعية من منشآت ثابتة وغير ثابتة وطرق ووسائل.

4- المواد والمواد الملونة:

أي مواد صلبة أو سائلة أو غازية أو أدخنة أو طين أو مواد أو إشعاعات أو حارة أو كيمياء أو إضاءة أو احتراقات تلتقي بنية، وتؤدي بطريقة مباشرة غير مباشرة إلى تلوث البيئة وتدهورها أو الأضرار بالكائنات الحية.

5- لوله البيئة:

قيمة الإنسان بشكل مباشر أو غير مباشر، إعداد أو غير إعداد ملايين من المواد والمواد الملونة في عناصر البيئة الطبيعية، والذي ينشأ من جراثيم وأخطئ على صحة الإنسان أو الحياة الدبادية الحياة الوراثية أو أدى للموارد والأنظمة البيئية، أو تأثير على الاستخدامات المشروعة على البيئة أو تداخل باي شكل في الاستخدام بالحياة والاستفادة بالكائنات.

6- الأنظمة البيئية:

هي الأنظمة الشاملة والكاملة التي تتسم ككافة مكونات البيئة الطبيعية التي تتكون وتكافل فيما بينها.

7- المواد الطبيعية:

هي كافة المواد التي لا تدخل للانسان في وجودها.

8- حماية البيئة:

الفحص على مكوناتها وحاسبها وتوترها الطبيعية، ومنع الانترو أو الإذلال منه أو مكافحته، وحفظها على المواد الطبيعية وتوزيع استهلاكها، وحماية الكائنات الحية التي تعيش فيها، خاصة المهددة بالانقراض.

9- الأثر البيئي:

هو تغير في البيئة ناتج عن نشاط إنساني.

10- الضرر البيئي:

هو الأثر الذي يلحق بالبيئة ويؤثر بشكل مباشر أو غير مباشر في صخوصها الطبيعية والعضوية أو يؤثر في وظيفاتها في نقصنها أو تقليلها هذه الفرد.

الأثر الذي يلحق بالإنسان والكائنات الحية الأخرى والموارد الطبيعية نتيجة للتغير في خواص البيئة.

11- الحفاظ على المواد الطبيعية:

الإدارة الحكيمة للموارد الطبيعية المتجددة أو غير المتجددة، والتي تتضمن حسن استعمالها واستغلالها والحفاظ على استمرار قدرتها الاستدامة لمصلحة الشعوب الحاضرة والقادمة.

12- تقييم الأثر البيئي:

فحص وتحليل وتقييم الأنشطة المختلفة بوصفها ضمان التنظيم السلبي بيننا والقابل للانضام، وكذلك التوقع بالعوامل المحتملة والتدابير التي يقترح اتخاذها للتخفيف من هذه التأثيرات أو إبطال مفعولها.
13- بيان التنافر البيئي:

هي الدراسة التي تتضمن وصف التنافر البيئي لنشاط ما ولدائه في حالة عدم الموافقة على هذا النشاط.

14- التقييم الأولي للتأثير البيئي:

هو استعراض ملحوظ وسريع نسبيا لموضوع نموذج ويساعد في التحقق من التأثيرات المحتملة الرئيسية، وتتعدد ما إذا كان من المحتمل أن تكون هذه التأثيرات كبيرة إلى حد يستدعي إعداد تقييم كامل للتأثير البيئي.

15- التقييم الكامل:

هو دراسة جذور جميع موجة التأثيرات المتعددة على مشاريع التنمية المفترضة.

16- النفايات:

مواد وشيوع أو منتجات بحرية تخلىها منها أو هناك نية للتخليص منها، أو المطلوب التخلص منها طبقاً لإحكام القوانين البيئية، أو يرغب حاولاً في إعادة استخدامها أو تحويلها أو التخلص منها.

17- النفايات الخطرة:

في نفايات تتولد من العمليات الصناعية أو الكيميائية أو الإشعاعية وتكتسب صفة الخطرة بسبب ما تحتويه من مواد أو تركيزات لمواد أو بسبب تفاعلاتها الكيميائية أو ما تستند به من سمية أو قابلية للانتشار واحتلال الناقل أو أية خصائص أخرى ينجم عنها خطرًا على حياة الإنسان أو الحيوان أو النبات أو على البيئة سواء بمقدرها أو عند اتصالها بنايات أخرى.

18- تداول النفايات الخطرة:

كافة المعادلات التي تبدأ من وقت نبض النفايات إلى حين النخلات الأم من النوعية، وتشمل جميع النفايات أو تخزينها أو نقلها أو مكافحة النفايات من نوعها أو تدويرها، بما في ذلك عملية اللاحقة بمواقع التخلص منها أو دفعها.

19- المنطقة الخالية من التلوث:

هي البحر الإقليمي والمحيطات المتاخمة، والمنطقة الاقتصادية الخصوصية، والجزر القاري أو أي مناطق أخرى تحدها القوانين.

20- المحمية الطبيعية:

مساحة من الأرض أو المياه الداخلية أو البحرية أو كلاهما معاً تتمتع بحماية خاصة لصون بينها، أو تحمية أنواع النباتات أو الحيوانات أو الطيور أو الأحياء المائية المهددة بالانقراض وما في ذلك حماية الموقع الألمرية.

21- الحياة البرية:

أي نوع أو أنواع من الحياة الحيوانية أو النباتية أو الطيور التي تتخذ إقليم الجمهورية اليمنية موطناً لها، أو الطيور التي تتخذ من هذا الإقليم ساحة محطة للراحة أو التكاثر أو الاستعمار.

22- الحياة البحرية:

أية كائنات بحرية تعيش في المياه الإقليمية أو البحر القاري أو المنطقة الاقتصادية الخصوصية أو في قاع هذه المياه وترتبها بما في ذلك الشعب المرجانية.
23- المشروع:
أي مرفق أو مساحة أو تشطيب أيها كانت طبيعية يحتوي على مكون مما يُسمى اللثوث أو التدهور البيئي.

24- صحة البيئة:
الحالة الصحية للإنسان أو الحيوان أو البيئات وكل ما يتعلق بهيئة الإنسان في البيئة.

25- معايير نوعية البيئة:
الحدود القصوى أو تراكيز الملوثات التي لا يسمح بتثبيتها في مكونات البيئة الطبيعية (الهواء- الماء- التربة).

26- معايير المصدر:
حدود أو كميات الملوثات أو درجات تراكيزها التي تتبع من مصدر ثابت أو متحرك أو من مادة معينة خلال
وحدة زمنية معينة أو أثناء دورة تشغيل.

27- معايير التشغيل:
مجموعة من المعايير والاستدلالات الواجب توفرها في بعض المنتجات لحماية البيئة.

28- معايير المنتجات:
وتشمل:
1. الخصائص الطبيعية والكيميائية لسلعة بالنظر إلى ما تحتويه من مواد ملوثة أو ضارة.
2. الفوائد الخاصة بالمحافظة أو التليف أو العرض أو التعينة.
3. مستويات التلوث المتبعة من سلعة معينة (المصرارات.. الخ).

29- الوقود:
أي مادة تستخدم لإنتاج الطاقة.

30- المواد الخطرة:
هي المواد ذات الخصائص السمية أو الإشعاعية أو القائرة للانفجار أو إحداث الدمار أو أي حساسية أخرى تضر
بالإنسان أو الكائنات الحية أو البيئة.

31- التصريف:
أي إلغاء أو تسميد أو إنبعاث أو انبعاث أو استغلال بصورة مباشرة أو غير مباشرة لأي من
ملوثات البيئة في الهواء أو الماء أو المياه الداخلية أو الإقليمية.

32- المادة السامة:
أي مادة تدخل أو يمكن أن تدخل إلى البيئة بكميات أو تراكيز من شأنها الإضرار بالبيئة الطبيعية الضريورة
لحيات الإنسان والكائنات الحية الأخرى، سواء كان هذا الأثر فوريًا أو طويل الأمد، أو تشكل خطأ على الحياة
أو الصحة البشرية.

33- الجهة المخصصة:
34. ضوابط مرافق النثوث أو مراقب أو مفتش البيت:

الموظفون المعنيون الذين لهم صلاحية سلسلة تقديم التوصيات والملاحظات من الجهات المختصة تنفيذ أحكام هذا القانون وحلوته التنفيذية.

35. تداول المبيدات:

أ. عملية إنتاجية أو صناعية أو زراعية أو فنية تتناول استيراد أو تصدير أو نقل أو تخزين أو تعبئة أو تحريز أو تحياز أو استعمال مبيدات الآفات النباتية والحيوانية.

36. التسجيل للمبيدات:

الإجراءات التي تمضدها الجهود المخصصة قبل الموافقة على تداول المبيد وبالتالي وفك التوصل من مواصفاته وнемậyحه على حفظة الإنسان والحيوان وسلامة البيئة.

الفصل الثانى
الأهداف والأسس العامة

مادة (1):

بهدف هذا القانون إلى تحقيق الأهداف التالية:

1. حماية البيئة والحفاظ على سلامتها وتوارثها وصيانة أنظمة الطبيعية.

2. حماية النباتات بشكل خاص، وتثبيت أهداف أثرها أو اثرها سلبية على البيئة أو المهاجرة أو إعادة تشكيل النباتات أو الزراعة أو الزراعة أو الصناعية أو الزراعية أو البديلة أو غيرها من برامج التنمية التي تهدف إلى تحقيق منبسط الحياة بزيادة الرفاهية.

3. حماية الموارد الطبيعية وتمييزها وحماية واقعية على رؤية الحياة في البيئة الوطنية، واستغلالها الاستغلال الأمثل لصحة الأجيال الحاضرة والقادمة.

4. حماية المجتمع وصحة الإنسان والكائنات الحية الأخرى من كافة الإشارات والأعمال المضررة بيئياً، أو التي تغير الاستخدام أو الشروط البيئي.

5. حماية البيئة الوطنية من التأثيرات الضارة للأنشطة التي تتم خارج الإقليم الوطني، كحالة.

6. تنفيذ الإتفاقات الدولية المتعلقة بحماية البيئة وحماية النباتات والمحاصيل على الموارد الطبيعية التي تشكل جمهورية اليمنية وفقاً لشروط الدولة النافذة.

7. الإهام من خلال التقادم المتصور عليها في أحكام هذا القانون في حماية عناصر البيئة الدولية، من خلال تعديلات الأوزون والمناخ.

مادة (1):

في سبيل تحقيق الأهداف المشار إليها في المادة السابقة تقوم الجهات المختصة بمهامها كلاً في مجال اختصاصها بتنفيذ المهام الموكلة إليها على ضوء الأهداف التالية:

1. الإنسان جزءاً هاماً ومؤثر في البيئة الطبيعية التي يعيش فيها وينتمي بممارستها.

2. بكل موافقة كاساس في العيش في بيئة صحية وتناسق تناسب مع الكرامة الإنسانية تسمح له بالنمو الصحي الجسماني والعقلانية النفسي.
1. يلزم كل شخص يتناول ويحوز بالمحافظة على البيئة ومواردها الطبيعية ومنع الأضرار البيئية.

2. تتولى وكالة المحافظة على البيئة ومواردها الطبيعية وحماية البيئة وحماية الحياة البرية البحرية

3. على وسائل الاعلام والمؤسسات العامة والخاصة وكذلك الأفراد.

4. تُستخدم مساحات الأرض والمياه الداخلية والبحرية وما في بطنها وما يتبقيهما من فضاءات

5. وهو الذي يمارس عليه القيادة البيئية لتحكيم القانون الدولي والقانون الدولي عام 1982م

6. وأي اتفاقية دولية أخرى تساعد على الجمهورية اليمنية.

للمعنى حماية البيئة البحرية، تتمتع سلطات الدولة بالإجراءات الوعرة في القانون الدولي

حماية البيئة البحرية الخاصة لسبيدة الدولة، وكذلك المساحات التي تشملها المنطقة الاقتصادية.

7. تلتزم سلطات الدولة ومؤسسات الدولة والخاصة السيادية والخاصة والأفراد من

8. ممارسات أو تصرفات أو أفعال أي كانت طبيعتها بمنح الأولوية لمصداقية البيئة ورفع الثقوب

ويجب بعد إزالة الأضرار بعد حذفها أو التعرض عنها.

9. تلزم سلطات الدولة، خاصة تلك التي تقوم بإعداد خطط التنمية الاقتصادية، بجمع احتياجات البيئة

في التنمية الاقتصادية، في جميع مراحل ومستويات التخطيط، وجاء التخطيط البيئي جزءًا أساسياً من

التنمية التخطيطية في جميع المجالات الصناعية والزراعية والإقتصادية وما إلى ذلك.

اللائه البيئي في المستقبل.

10. تأخذ في الاعتبار عن سلطات الدولة وتوجيهاتها العامة والخاصة والتعاونية، وتلتزم

النسبة ذات الصلة عند تمنح نتيجة التخطيط البيئي، بحيث لا يتعرض إجراء

دراسات التقييم البيئي مع برامج الجودة الاقتصادية.

11. لا تجوز التخطيط العرقل والعراقتجديدات التي تضر أو تجف البيئة أو تهدأ في

تدهورها.

12. تتزامن المشروعات والمرافق الجديدة باستخدام أفضل التقنيات المتاحة لحماية البيئة

والبيئة والبيئة على التكلفة، أما المشروعات والعراق القائمة، فتقتضي موافقًا حماية البيئة التي

يصدرها مجلس حماية البيئة أو أي جهة أخرى مختصة، أو التزود بالتفاصيل والтехнологيات الأخرى التي

تضع إعداد أي اضرار محوراً ومسبوباً.

13. كل من أحدث ضرراً بالبيئة يتحمل مسؤولية جميع التكنولوجيا الناجمة عن إزالة الضرر، فضلاً عند

التزامه عبء.

14. تلتزم الجهود الدبلوماسية بالإعلام والتعميق والتفتيذ في حل وفق مساره الرسمي لدى الفرد

والمجتمع بتطبيق البيئة وأهمية حمايتها، وإدخال علم حماية البيئة ضمن المناهج والمقررات الدوازية

المحiconductor المختلفة.

الفصل الثالث

مجلس حماية البيئة

مادة (6):

oscopic (6)

1. يتولى رئيس مجلس الوزراء رئيسًا (مجلس حماية البيئة) يتولى قرار

2. اتخاذية، وتحديد الإستراتيجية، ومحاكمات التنفيذية.

3. وهو جهاز الدولة الرسمي الذي يتولى وضع السياسة العامة الوطنية لحماية البيئة والوقاية

4. عليها بالتعاون والتنسيق مع الجهات المختصة لتغذية تلك السياسة، بعد قرارها من مجلس الوزراء.

5. كل جهة مختصة التقديم والالتزام بالتفتيذ في القرارات والنصوص المهمة من مجلس.

الباب الثاني

حماية الحياة الريفية واستخدام المبيدات
الفصل الأول
حماية المياه والترميم وإنشاء المحميات الطبيعية

مادة (1):
على الجهات المختصة حماية المياه المسطحة والجوفية وعمل على تنمية موارد المياه والحد من إصدار تراخيص حفر أبار المياه الجوفية ووضع ضوابط وقوس محددة لذلك وعمل على منع إساءة استخدام موارد المياه أو ت بيديها أو السبب في كثرة وفيضانات العروض التي تتحدى الجهة المختصة.

مادة (2):
على الجهات المعنية رسم السياسات والخطط اللازمة في مجال إنشاء السدود والقنوات والوادي لمياه الأمطار وتخطيطها وتطوير هذا المصادر والعمل على دعم تشجيع الممارسات المحلية باتجاه هذه المشروعات طبقاً للدراسات والمؤشرات العلمية التي تضعها الجهه المختصة أو توافق عليها.

مادة (3):
على الجهات المسؤولة عن التخطيط لاستخدامات الأراضي الأخذ بعين الاعتبار العوامل البيئية عند إعداد وتنفيذ مخططات استخدامات الأراضي.

مادة (4):
1. يجوز القيام بتأشيف في الإضرار بترميم أو التأثير على خواصها الطبيعية أو تلوثها، على نحو يتوافق وتعادل الإنتاجية المطلوبة، ويؤخذ في الاعتبار عند تطبيق المواد الخاصة بالمقابليات والمعايير البيئية، والأنشطة المصير بإنتاجية وتشريعة الموارد بطريقة حماية المياه المحافظة على خصوصيتها.

مادة (5):
1. لا يجوز التوسع العمراني أو التطور الحضري للمنطقة على حساب الأراضي الزراعية إلا وفقاً للقوانين والقرارات النافدة.

مادة (6):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (7):
1. مع عدم الإخلال بحقوق الملكية الخاصة المنوطبة في المنطقتين:= القوانين النافدة.

مادة (8):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (9):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (10):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (11):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (12):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (13):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (14):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.

مادة (15):
1. يجوز إنشاء أو إقامة أي نشاط صناعي أو تجاري على الأراضي الزراعية أو في منطقة الأحواض المائية، وبصفة خاصة من تلك الصناعات المرتبطة بالزراعة وفقاً للقوانين والقرارات النافدة.
3. إلقاء التكوينات الجيولوجية أو الجغرافية أو المناطق التي تعد موطنًا لفصائل الحيوان أو النبات أو تكاثرها.
4. إدخال أجناس غريبة للمنطقة المححمة.
5. توثيق تربية أو هواء أو مواد منطقة المححمة.
6. المناظرات العسكرية وتدريبات الرمادة.
7. قطع الإشجار أو تكريس الزراعة.
8. كما يحظر أقامة المنشآت أو المباني أو شق الطرق أو تسبيح المركبات أو ممارسة أي أنشطة زراعية أو صناعية أو تجارية إلا بتصريح من الجهة المختصة التي يحددها مجلس الوزراء.

مادة (12):

1. تنظم بالحماية القانونية الحيوانات البرية والطيور التي تعيش في الأراضي اليمنية أو الطيور التي تتخذ من هذه الأرض أو سوائلها محطة للراحة أو الترفيه أو الاستبانء وكذلك موائلها وأمكن تكاثرها.
2. ومع ذلك يجوز بقرار من رئيس مجلس الوزراء بناءً على اقتراح المجلس أو أية جهة مختصة أخرى تحديد مواعيد وإجراءات الحيوانات أو الطيور المسموح بصديها لأغراض تجارية أو لأي أغراض أخرى.

مادة (13):

بحظر التمييز أو الإضرار بالنباتات البرية النادرة الكائن في الأراضي اليمنية وتتضمن عملية نقل أو بيع أو شراء أو تصدر النباتات البرية النادرة الكائن في الأراضي اليمنية ويحدد المجلس بالاشتراك مع الجهات المتخصصون نوع هذه النباتات ويصدر بذلك قرار من مجلس الوزراء.

مادة (14):

1. يجوز مبايعة أي نشاط من شأنه أن يضر بكمية أو نوعية الغطاء النباتي في أي منطقة مما يؤدي إلى التصدر، أو تثبيت البيئة الطبيعية.
2. يجوز طبق أو إلغاء أو الإضرار بأية غذية أو شجرة أو أعشاب من الغطاء العام إلا بتصريح من الجهات المتخصصة.

الفصل الثاني

استخدام المبيدات

مادة (15):

لا يجوز تداول المبيدات إلا بترخيص مسبق من الجهة المختصة وحسب القواعد المنظمة.

مادة (16):

للجهة المختصة بالتنسيق مع المجلس اقتراح اللوائح المنظمة للمسائل التالية:

1. أنواع مبيدات الآفات النباتية، ونوع المبيدات وكيفيات الأخرى التي يجوز تداولها وتحديد مواصلاتها وشروط التداول بها.
2. شروط وإجراءات تحرير تراخيص تداول المبيدات وتصاريح استيرادها.
3. إجراءات تسجيل المبيدات وإعادة تجليها.
4. كيفية أخذ عينات المبيدات وتحليلها وطرق الهر في تجلي التحليل.
5. كيفية التخلص من المبيدات الخالية والعوامل الضارة.
مادة (47):
في حالة الموافقة على تسجيل أي مبيد، تحديد فترة تسجيل هذا المبيد لمدة خمس سنوات ويجب إعادة تسجيل أو
العامة من أجل الجهة المختصة ضرورة ذلك.
مادة (48):

تضع الجهة المختصة مواصفات المبيدات وشروط تداولها بالتنسيق مع المجلس ويراعى فيها المواصفات
والشروط التي تضعها منظمة الصحة العالمية ومنظمة الأغذية والزراعة والمنظمة العربية للتنمية الصناعية.
مادة (49):

1. يجب أن تكون مستودعات أو مخازن مبيدات الأعابدة عبارة عن أماكن المأهولة بالمياه أو الأحياء
التجارية أو حظائر الواسعة، أو مصانع ومستودعات المواد الغذائية والمواد العازلة والعصائر،
ويجب أن تكون جيدة التهوية وأن توفر فيها الاتصالات الصحية والفنية والأمانة المطلوبة أو أية
الاتصالات أخرى تهددها الجهة المختصة.

2. يجب أن تكون الشخص المكلف بدوره والمبقتة بالمبيدات وكيفية تداولها

3. يجب الإلتزام في كل مستودع للمبيدات بضمان قدام جمعية المبيدات ومصادرها وثيقة صلاحيتها
وحركة البيع والشراء والتصدير والخرق.

مادة (20):

المبيدات ذات السمية العالية والتي يرد على استخدامها قيود خاصة أو تلك التي يمكن أن تشكل تهديدا خطرية لبيئة
أو صحة الإنسان أو الحيوان بخطر استيرادها أو استعمالها إلا من قبل الجهة المختصة وبعد إخطار المجلس.
مادة (21):

للمؤسسات الضبط القضائي التابعة للجهة المختصة وسائر قضائي حق الدخول إلى الأماكن التي توجد فيها
المبيدات المصنوعة عليها في المادة (20) من هذا القانون أو يشتبه في وجودها، وأخذ عينات من هذه
المبيدات بدون مسبق لتحليتها أو التحقق من صلاحيتها، أو توافر الاتصالات أو المواصفات التي يحترمها هذه
القانون أو لوازمه التنفيذية.

الباب الثالث

الأنشطة المضرة بالبيئة
الفصل الأول

التحكم في الأنشطة المضرة ببيئة

مادة (22):

لا يجوز لأي وزارة أو هيئة أو مؤسسة، أو شركة عامة أو خاصة أوتعاونية، وكذلك أي فرد
استخدام البيئة المضرة للأغراض أو تجميع أو تصريف أو رفع ملكيت البيئة للأغراض أو الكيميات التي
تضر بالبيئة أو تسهم في تدهورها، أو تلحق أي ضررًا ملموسًا أو الكائنات الحية، أو تخل أو
تمكح استخدامها أو الاستعمال أو الاستغلال المشروع للبيئة.
مادة (23):
كل شخص مسؤول عن تصميم أو تشغيل أي مشروع أو مبادرة أو نشاط يلتزم بالإحكام الواردة في هذا القانون، وكذلك بمعايير ومعايير ومعايير حماية البيئة المقررة بهذا الشأن.

مادة (42):

كل شخص طبيعي أو معمول يرغب في إقامة أي مشروع أو مبادرة أو أعمال أيها كانت طبيعتها، مما قد ينتج عنها تأثيرات سلبية بالبيئة، أن يقوم من خلال دراسة التقييم البيئي أو أي وسيلة أخرى على معرفة تلك التأثيرات المحتملة، واتخذ جميع الإجراءات الوقائية المناسبة بذلك والاستعانة بالأجهزة أو التقنيات المناسبة لمنع حدوث تلك التأثيرات.

مادة (45):

على أي شخص أو هيئة أو مؤسسة أو شركة أن ينظر فورًا الأمانة العامة الفنية للمجلس أو أحد فروعه عن أي تصريح يخالف هذا القانون أو لوائحه التنفيذية، أو أي حادث قد يؤدي إلى تلوث البيئة أو يشكل خطرًا عليها أو خلافًا في التنظيم، اتخذ نصاً على الترتيب تفصيل موضوع مراقبة التشغيل، مع بيان أسباب وطبيعة الحادث أو التصريح المخالف أو الحادث وما تداركه من تدابير لتصحيح الوضع وإزالة الأخطار.

مادة (46):

اتخاذ التدابير والإجراءات المضادة إليها في الماده السابقة ل يتمك يشبه الشخص المسبب للفعل المضر بالبيئة من تحمل مسؤولية الضرر الذي لحق بالبيئة نتيجة لمثل هذا. أو إهماله.

مادة (47):

يجوز للمجلس تحديد مناطق ومحميات أو أجزاء ومساحات خضراء خالية من التلوث في أقيمه الجمهورية، ويجوز فيها مراقبة أية أنشطة صناعية أو زراعية أو عمرانية من شأنها الضرر ببيئة هذه المنطقة تلوثها أو تلوثها مع مراعاة احترام الملكية الخاصة وتعويض عنها عند الضرورة وفقًا للدستور والقوانين النافذة.

مادة (48):

على جميع الوزارات والمؤسسات الحكومية بالتعاون مع المجلس اتخاذ كافة الإجراءات التدابير التي تضمن تأمين سلامة البيئة وحمايتها من التلوث والمحافظة على الموارد الطبيعية وحماية الحياة البرية والبحرية خاصة المهددة بالانقراض.

مادة (49):

1. في حالة الكوارث البيئية يلتزم أي شخص طبيعي أو معمول يستعمل أو ينوي استغلال مبادرة أو استخدام مواد أو مبادرة أنشطة من شأنها في ظروف غير اعتيادية قد تسبب أضرارًا خطيرة للبيئة، أو للإنسان بإعداد خطة الطوارئ البيئية اللازمة لحماية البيئة والسكان، كما يلتزم بتشكيل مفرق أمن لمنع نشاطها أو أنشطة أو تأثيرها، واتخاذ الإجراءات اللازمة للضرورة ووضع نظام لمراقبة المنتشأ أو النشاط، واتخاذ الإجراءات اللازمة للإذا، المبكر.

2. حظر الأنشطة أو استخدام بعض المواد أو طرق التصنيع إذا لم تكن هناك وسائل لضمان حماية فعال للسكان والبيئة.
مادة (38):

1. تتولى الهيئة المختصة البيت في المطالبات المتقدمة في طلبات ثلاثة أشهر من تاريخ تقديم الطلب، ويخطر مقدم الطلب بتحقيق الفحص إما بالموافقة أو الرفض، وفي حالة الرفض يخطر صاحب الطلب بالقرار مسبقاً.

2. يجوز للمحكمة الإدارية المختصة تحلل جزء منها من طريق الطلب، إذا كان الرفض يحول بعدم مطالب المراجع للمعترض والمصالح المعترضة، والجديد بين البيئة ويخبر صاحب الطلب والجهة المختصة بالقرار. نقل المحاكم الإدارية المختصة بموضوع التظلم، بما في ذلك سنة أشهر، ويحظر قرارها بهذه الخصوص نافذاً.

مادة (39):

يأخذ بين الاعتبار عند القرار بالموافقة أو الرفض على بيان تقيم الأثر البيئي بالاعتبارات التالية:

- حالة البيئة الحالية التي يتم فيها إنشاء المشروع أو المشروأ أو النشاط المفترض.
- الأثر الذي يمكن أن يحدث المشروع أو المشروأ أو النشاط على البيئة.
- أن تكون تلك تطورات أخرى يمكن توقعها بشكل مطلق في المنطقة المفترض إقامة المشروع أو المشروأ فيما، وبكونها أهمية من وجهة نظر حماية البيئة.
- الاعتراضات التي أثيرت أو يمكن أن تثار حول المشروع.

مادة (40):

1. على أصحاب المشروعات أو المشاريع أو الأنشطة القائمة قبل سريان أحكام هذا القانون أن يقدموا إلى الهيئة المختصة في خلال فترة لا تتجاوز سنة من تاريخ العمل بهذا القانون بيان ودراسة تقييم الأثر البيئي من قبل مكونات هذه المشروعات أو المشاريع أو الأنشطة.

2. تتولى الهيئة المختصة فحص هذه الدراسات والتاكده من مطابقاتها لل الواقع وإقرارها طبقاً لهذا القانون خلال ثلاثة أشهر من تاريخ وصول البيان والدراسة إليها ثم ترفعها إلى المجلس لمراجعته بمساءلة.

3. تقرر الهيئة المختصة خلال فترة لا تتجاوز خمسة أشهر، التدابير والإجراءات الواجب اتخاذها من قبل صاحب المشروع لكي تتوافق مع المقاييس والمعايير والممارسات البيئية المطبقة، والفترة الزمنية اللازمة لتنفيذ ذلك.

مادة (41):

1. يجوز إزالة أصحاب المشروعات أو المشاريع أو الأنشطة التي حصلت على الموافقة بالترخيص عليها، شراء أو بيع مواقف النصوص التشريفي والتولى الناتج عن هذه
المشروعة أو المنشأة أو الأنشطة، وحفظ مسجلات دائمة لهذه الأرصاد، وإرسال
تقارير هذه النتائج للجهة المختصة والمجلس.
1. يجوز للجهة المختصة إخطار أصدر الترخيص لشرط تقديم ضمانة مالية لضمان مراعاة
تنفيذ الالتزامات التي يجب أن يلتقي بها صاحب المشروع أو المنشأة أو للوفاء بالمسؤولية
عن الأضرار التي يحدثها المشروع أو المنشأة أو النشاط.
2. تحدد اللوائح التنفيذية مدة صلاحية الترخيص الصادرة من الجهات المختصة.
3. يلتزم صاحب المشروع أو المنشأة بالتحويض عن قيمة الأضرار الناتجة أو التي قد تحقق
من جراء التشغيل.
مادة (43):

いただく المحكمة تزويق مجلس بناءً في التراخيص التي تصدرها مع دراسات الأثر
البيئي للمشروع أو المنشأة.

الفصل الرابع
تداول المواد والتفايات الخطرة
مادة (44):

1. يجوز بغير ترخيص مسبق من الجهه المختصة تداول المواد الخطرة أو السامة أو المواد
التي يحمل أن تكون كذلك.
2. يضع المجلس بالتشاور مع الجهات المعنية والجهات العلمية المختصة قائمة بالمواد
الخطرة أو السامة أو تلك التي يحمل أن تكون كذلك تلائم قائمة تسمى (قائمة المواد
الخطرة والسامة) ويصدر يبتدع أن تادرها في مجلس الوزراء.
3. يقوم المجلس بالتشاور مع الجهات المشار إليها في الفقرة الثانية من هذه المادة بمعالجة
قائمة المواد المقترحة وتعديل أو إضافة أو تعديل القائمة المشار إليها ضوء التقدم
العلمي والتقني في هذا المجال ويصدر بهذا التعديل قرار من مجلس الوزراء.
4. يجوز في تحديد المواد التي تشملها القائمة الاستعانة بأي خبرة وطنية أو أجنبية، وكذلك
بما تصدره الجهات الدولية الحكومية وغير الحكومية من قوام تتعلق بهذه المواد الخطرة
السامة.
مادة (45):

1. يجوز لكل شخص طبيعي أو معنوي أن يطلب كتابياً من المجلس إضافة مادة أو أكثر إلى
القائمة مع بيان الأسباب والمواعيد التي تدعو إلى ذلك.
2. يقوم المجلس بدراسة الطلبات في خلال فترة تعجبها اللائحة التنفيذية، ويخطر صاحب
الطلب بالنتيجة والأسباب التي يشتمل عليها، وفي حالة الموافقة على إضافة مادة أو أكثر
إلى القائمة يخضع التحيل أو الإضافة طبقاً لما ورد في المادة السابقة.
مادة (46):  
1. يجوز للجهة المختصة من أجل تقييم مدى خطورة تركيب المواد السامة أو المنتج الذي
يحتوي على هذه المادة أن تطلب المعلومات التالية عن أي جهة عامة أو خاصة عن طبيعة
ومكونات المادة أو المنتج وكبيئتها واستخداماتها المختلفة بواسطة المختبرات الرسمية.
ومن ذلك:
1. تركيب المواد السامة والمنتجة.
2. انتشار وإبقاء هذه المادة في البيئة ومقاومتها للتحلل.
3. مدى قدرتها على التجمع في النسيج الحيوي وقدرتها في الإضرار بالبيئة.
4. الوسائل المتاحة لخفض الكميات المستخدمة والمنتجة أو التي تصرف في البيئة.
5. طرق التخلص أو المعالجة البيئية السليمة لها.
6. التحليل والتعليمات الأخرى بخصوص ضرورتها.
7. تقوم الجهة المختصة بتحليل وتقديم المعلومات التي تم الحصول عليها ونشر نتائج بحوث
التجارب المتعلقة بالمادة السامة أو الخطرة أو المحتمل أن تكون كذلك، أو بالمنتج الذي
يحتوي على هذه المادة.
8. تقدم للمادة المتصلة بخصوص توصيات بشأن المواد السامة أو الخطرة أو المحتمل أن تكون كذلك
أو أي نتيجة يجب على هذه المواد إلى جهة عامة أو خاصة بشأن التدابير التي
ينبغي اتخاذها لمنع أو إلقاء أو وجود أو انتشار هذه المواد في البيئة.

مادة (47):  
1. إذا قرر مجلس الوزراء إدراج أي مادة في القائمة المخصصة بالمواد الخطرة أو السامة
أو يحتوي أن تكون كذلك فإنه يقر ما ينبغي اتخاذه من تدابير بشأنها، ولعوامل وجوب
الخصوص أخذ الآتي:
1. الحظر الكلي أو الجزئي لاستيراد أو تصدير أو استخدام أو بيع أو توزيع أو أي
تدوار لهذه المادة.
2. التصريح بإستيراد أو تصدير أو استخدام أو بيع أو توزيع أو أي تداول لهذه
المادة.
3. كميات أو تركيزات المواد التي يجوز تصريفها في البيئة بمفردها أو تداخلها مع
مادة أخرى صادرة عن مصدر آخر.
4. طريقة وشروط وأماكن التصريف.
5. الكميات والتركيزات لهذه المادة التي يمكن أن تحتويها المنتجات المصدرة.
6. شروط تخزين أو نقل المادة أو المنتج الذي يحتويها.
7. تطليق وتعليمات هذه المادة.
8. أية تدابير أخرى يرى المجلس ضرورتها تطبيقاً لأحكام هذا القانون وانتحاها
التفسر.
2. لمجلس الوزراء إذا كانت هناك أسباب تدعو إلى ذلك إلغاء أو شرط أو حظر سبق وان
تقرر.
3. تنشر القرارات بشأن ما ورد في الفقرات الساقطة في الجريدة الرسمية.

مادة (48):
يلزمني أي شخص طبيعي أو اعتباري يحمل ترخيص بإصدار أو تصنيع أو تحويل أو بيع أو نقل أو توفر أو نقل آخر للمادة السامة أو خطرة أو يتحمل أن تكون كذلك باختيار الجهة المختصة بالمعلومات الموجودة بحوزته أو تحت تصرفه، والتي تسمح بتحديد ما إذا كانت هذه المادة سامة أو خطرة.

مادة (49):

على الجهة المختصة إصدار اللوائح المنظمة لتدوين المواد الخطرة أو السامة أو المنتجات التي تحتوي على هذه المادة والتي لم ترد في هذا القانون، وعلى وجه الخصوص:

1. تحديد المواد أو المجموعات التي تتضمن لالتزام تقديم المعلومات.
2. مواعيد تقديم المعلومات والكيفية التي تتم بها.
3. تحديد الأشخاص المسؤولين عن المواد السامة أو الخطرة.
4. حدود الكميات المسموحة تداولها.
5. الإجراءات التي تتبع لتفتيش غزارة أو مدى تركيبية السموم في المواد.
6. المعامل ومحاربة البكوث التي يتم من خلالها تحديد السموم أو الخطرة.

مادة (50):

1. يحظر على أي شخص اعتباري أو طبيعي أو أي جهة أخرى أي تصريف في البيئة لمواد سامة أو خطرة أو يتحمل أن تكون كذلك، واتخاذ كافة التدابير اللازمة لمنع أي خطرة لهذا التصريف أو تخفيف الخطر الناجم عنه بالنسبة للبيئة أو صحة الإنسان أو الكائنات الحية الأخرى.
2. إذا لم يتمكن الشخص المسؤول عن التصريف من اتخاذ التدابير الموصى بها في الفترة السابقة أو فشل في ذلك فلمجلس أو أي جهة أخرى مختصة أن تتخذ التدابير التي تنطوي على الظروف أو تكلف أي شخص أو أي جهة أخرى للقيام بذلك، ويجوز للجهة المختصة استدلال تلك إزالة الأضرار أو التدابير الأخرى من مسببها أو من أصحاب الشأن ذوي العلاقة.

مادة (51):

تشمل الدولة تطبيق النطاقات المباشرة أو غير المباشرة التي تنشأ عن التدابير الموصى بها في المادة السابقة، وعلى الجهة المختصة استمرار هذه النطاقات على الطرق الإدارية من المخالف أو من خلال دعوى قضائية.

مادة (52):

لكل من يتنبأ للمجلس أو أي جهة أخرى مختصة بمعلومات عن مادة سامة أو خطرة أو يتحمل أن تكون كذلك أن يطلب كتابة اعتبار المعلومات المقدمة سرية.

مع ذلك، يجوز الإطاء بالمعلومات المقدمة من قبل الجهة المختصة في الحالات التي تحددها وخاصة في الحالات التالية:

1. المعلومات العامة بشأن استعمال هذه المادة.
2. الاحتياطات الآمنة للتعامل مع هذه المادة.
3. الخواص الطبيعية والفيزيائية والكيميائية لهذه المادة بالقدر الذي لا يسمح بتحديدها.
4. طرق تدير هذه المادة أو التخصيص الأمن منها.

5. الدراسات الطبية والسمية والبيئية لها.

6. إذا كان الإفشاء بالمعلومات يحقق مصلحة للصحة العامة أو للاستفادة من النتائج.

من إخبار هذه المعلومات:

مادة (43):

يحة مطلقاً على أي جهة عامة أو خاصة أو أي شخص طبيعي أو معيتي استيراد أو إدخال أو
دفن أو إرغاق أو تخزين النفاط الخطرة أو السامة أو الإشعاعية أو التخلص منها بأي شك في
البيئة اليمنية.

مادة (44):

يحة على السفن أو الطائرات أو أي وسائل أخرى الدخول إلى المياه الإقليمية أو النزول بمطارات
الجمهورية اليمنية أو استخداً الإقليم اليمني كمنطقة عبور إذا كانت تتحمل نفايات خطرة أو سامة أو
إشعاعية إلا وفقاً للاتفاقيات الدولية ويأتي نصي من مجلس الوزراء وبعد موافقة مجلس النواب.

مادة (45):

تقوم الجهة المختصة بدراسة وتقييم حالة النظافة العامة ومدى خطورة مكونات أنواع مواد
القماة وتصريف مياه المجاري والمخلفات الصناعية والسائدة والتفايات، ولها على وجه
الموضوع اتخاذ الآتي:

1. تحديد مواقع تصريف الQuantum بالتنسيق مع الجهات المعنية بشؤون البيئة.

2. طرق وشروط التخلص من المخلفات الصناعية والسائدة والتفايات وتصريفها أو دفنها أو
تحويتها أو التخلص منها بأي شك في المياه الإقليمية.

3. اتخاذ التدابير الأخرى التي يرى المجلس ضرورتها لمنع أي خطورة لهذا التصرف.

وعلى الجهة المختصة إخطار المجلس بنتائج الدراسة والتقييم.

الفصل الخامس

حماية البيئة والتنمية الاقتصادية

مادة (51):

1. على كافة الجهات المختصة خاصة تلك المعنية بالتخطيط الاقتصادي والتنموي العمل على
إدخال اعتبارات حماية البيئة ومكافحة التلوث والاستهلاك الشديد للموارد الطبيعية في
خطط المشاريع والتنمية الاقتصادية الوطنية.

2. على كافة الجهات المسؤولة عن الترخيص لمنشآت الأعمال أو الاستثمارات الوطنية أو
الأجنبية عدم القبول أو الموافقة على المشاريع أو الاستثمارات التي من شأنها الإضرار
بالبيئة أو زيادة مفاعلات التلوث.

3. تنظم الجهات المعنية بإدار شرط حماية البيئة ومكافحة التلوث في كافة المشاريع
والعقود التي تبرم مع هيئات الاستثمار الوطنية والأجنبية أو المشاريع القائمة.

مادة (52):
على وزارة النفط والثروات المعدنية ومؤسسات العامة ذات العلاقة الالتزام بما يلي:

1. إدراج شروط حماية وصيانة البيئة في العقود البتروالية التي تبرمها مع الشركات الوطنية والأجنبية المصرف لها ب وعدم استغلال أو استنفاد أو استخدام نفاذ أو ماليا ما يتم تصريفه من مواد أو نفايات، وعلى هذه الشركة استخدام الوسائل الأمنية التي لا تزود عليها الإضرار بالبيئة.

2. العمل على أن تتضمن هذه العقود الشروط الجزائية والالتزام بنقاط إزالة الأضرار البيئية، وكذلك التعويض عنها. فضلا عن العقوبة المقررة.

الفصل السادس

الرصد البيئي

مادة (58):

1. يتولى المجلس بالاشتراك مع جهة أخرى مختصة الاشراف على إنشاء وتشغيل شبكات الرصد البيئي.

2. تتكون هذه شبكات من محطات وأجهزة قادرة على رصد مكونات البيئة الطبيعية والأنشطة المختلفة للملوثات التي تدخل معها، والتأثيرات التي تحق خواصها الطبيعية، وملاحظة حالة النقص وال المناخ.

3. للمجلس الاستعانة بمرافق البحث والهيئات العلمية الوطنية وال الأجنبية لتشغيل محطات الرصد وجمع البيانات والمعلومات المنصورة عنها وتسجيلها.

مادة (59):

تلتزم شبكات الرصد البيئي بإبلاغ المجالن وأية جهة مختصة أخرى فورًا بأي تجاوز للحدود المسموح بها لدرجة التلوث في عناصر البيئة الطبيعية.

مادة (60):

1. يجوز للمجلس بالإضافة إلى الشبكة العامة للرصد البيئي الزام أصحاب المشروعات أو الأنشطة بتشغيل أجهزة رصد مواقف التصرف والمعلومات التي تت deltaTime عن هذه المشروعات والأنشطة وحفظ سجلات دائمة لنتائج هذا الأداء. وإرسال تقارير بهذه النتائج إلى ثلاثة أشهرا إلى المجلس.

2. يجوز للمجلس النظر في مساعدة المشروعات العامة الخاصة في شراء وتركيب أجهزة الرصد المشار إليها في الفقرة السابقة وتدريب الكوادر المسؤولة عن تشغيلها في الداخل والخارج على نفقة تلك المشروعات.

مادة (61):

يقوم المجلس بالاشتراك مع الجهات المختصة على تكامل النظام الوطني وفقا للأنظمة العالمية لرصد البيئة خاصة إطار منظمة الأرصاد العالمية، وممنظمة الصحة العالمية.

الباب الرابع
التنوين والتبليغ وشروط التأمين

مادة (68): 

1. يجب على كل مركب نقل الزيت أو يحمل من أحد مسارات الموانئ أو النقل أو من أجهزة نقل الزيت والبترول داخل المنطقة الخالية من التلوث أو يحتفظ بسجل زيت ويقيد بالمواعيد الزمنية المحددة.

2. على كل ملك المركب أو أي شخص آخر مسؤول عن المركب الالتزام بما يلي:
   - تكريم اسم المركب ورقمه وسعة صهاريج الزيت والوقود في المركب.
   - تدوين التاريخ والساعة والوقت الجغرافي المحدد للمحرك في وقت إجرآي أي من العمليات التالية:
     1. القيام بمذببة التحميل أو التكرير أو غيرها من عمليات نقل الزيت الزيتية مع بيان نوع الزيت المعني بالتحديد.
     2. تزويد نقل نقل الزيت بالصهاريج الزيتية والوقود والوقود وتصريف الزيت الزيتية من هذه الصهاريج الزيتية وحشأها في الأماكن المصرح بها، مع بيان نوع الزيت الذي ينقله المركب أو يستعمله بالتحديد كما هو الحال، وذلك قبل تزويد نقل الزيت الزيتية وتصريفها.
     3. فصل الزيت عن الماء أو عن مواد أخرى في أي مزيج بحوثي على الزيت.
4. تصرف الزيت أو الأمزجة الزيتية من المركب من أجل ضمان سلامة المركب والحملة دون إلحاق ضرر بأي مركب أو حمولة أو إنقاذ الحمولة، مع بيان نوع الزيت المعني بالتحديد.
5. تصرف الزيت أو الأمزجة الزيتية من المركب نتيجة لاصطدام أو حادث مع بيان نوع الزيت المعني بالتحديد.
6. تبلغ المجلس والجهة المختصة بسرع وقت ممكن إذا ما حدث أثناء إبحار المركب في المنطقة الخالية من التلوث أي من العمليات البيئية الواصلة في الينابيع السابقة.
7. نشر السجل للتفتيش بناءً على طلب من الجهات المختصة لتحديد سير مواقع المركب أثناء وجود المركب في أحد موانئ الجمهورية أو داخل المياه الإقليمية للجمهورية.

مادة (۲۶):

يجب على كل مالك أو مسؤول الموقع البري أو لجهاز نقل زيت داخل المياه الإقليمية للمملكة أن ييخفي عليه تصرف مادة ملوثة في المنطقة الخالية من التلوث أن يبلغ الجهات المختصة على الفور بحذف أي تصرف من هذا النوع، ويجب أن يشمل البلاغ على نوع المادة الملوثة، وعلى الوقت والتاريخ والموقع الجغرافي المحدد الذي حدث فيه التصرف.

مادة (۲۷):

على مالك أي مركب مسجّل في الجمهورية أو غير مسجل فيها يحمل كميات من إحدى المواد الملوثة من أي ميناء في الجمهورية أو التي تأتي إلى الجمهفة المختصة شهادة مسؤولية مالية على شكل تأمين أو سند تعويض أو أي تعهد آخر مسؤولية مالية تتضمن مواقعة الجهنة المختصة وفقًا لأحكام هذا القانون والقوانين النافذة والاتفاقيات الدولية.

الفصل الثالث

الإدارة والتنفيذ

مادة (۲۸):

يقوم ضابط مراقبة التلوث بالجهة المختصة بدراسة وراجع الوثائق المتعلقة بإثبات مخالفة لأحكام هذا القانون، ويقدم تقريرًا بما توصل إليه بعد هذه الدراسة بما بلي:

1. هل ارتكب مخالفة لهذا القانون؟ وما هي العقوبات الواجبة فرضها على تلك المخالفة؟
2. هل نشأت مسؤولية مدنية تستحق التعويض نتيجة حدوث تصرف من مركب أو طائرة أو موقع بري أو أجهزة نقل زيت؟

مادة (۲۹):

يجوز للجهة المختصة أو أحد أفرادها بالتنسيق مع الجهات المعنية القيام بالآتي:

1. بناء أو صيانة أو تجديد مرافق استقبال المواد المحلية الملوثة على اليابسة أو داخل المياه الإقليمية للجمهورية.
إصدار القرارات والتعليمات التي تحدد الشروط التي يجب على المركب والمسالك المستخدمة للموانئ داخل الجمهورية أو المجرة عبر المنطقة الخالية من التلوث الالتزام بها عند تصريف المواد الملوثة أو أي أثار للسوازينة في مثل هذا المرق.

مادة (70):
يجوز للأجهزة المختصة أو أحد فروعها بالتنسيق مع الجهات المعنية أن تحدد نوع البدائل التي يجب أن تجزي بها المركب المسالك في الجمهورية كافية أو بعض أنواع المركب غير المسالك في الجمهورية التي تستخدم موانئ الجمهورية أو تجر عبر المنطقة الخالية من التلوث، وذلك من أجل خفض خطر التلوث.

مادة (71):
يتمتع ضابط مراقبة التلوث بسلطة الصعود إلى نهر أو مركب أو معدة نقل الزيت في المنطقة الخالية من التلوث أو دخول أي موقع بري في الجمهورية لتقييد البدائل أو السجلات أو إزال أحد الأشخاص بأجراءات على أسلسلة متعلقة بالتثبيت بهذه القانون، وذلك من أجل إجراءات الطوارئ اللازمة لمنع التلوث.

مادة (72):
يجب على الجهية المختصة في حالة وقوع حدث لأحد المراكب أو معدة نقل الزيت في الجزء الذي تصل إلى تلوث المنطقة الخالية من التلوث أن تتخذ كافة الإجراءات اللازمة لوضع حد التلوث أو خطره أو خفضه أو إيقافه بطرق ووسائل الممكنة، للذى الحق القانوني والمغربي أن تصل إلى كافة الثلاثين من المال المستحيل في الحادث ومن حقها أن تقرر الملاك أو الرسم أو الشخص المسؤول عن المركب أو الموقع البالي أو الجزء الذي تصل إلى تثبيت كافة الإجراءات اللازمة، فإذا فشلت هذه الإجراءات فإنه يجب فوراً;

المادة (73):
العرض على المحكمة المختصة لإصدار قرار بإغراق أو تدمير المركب أو أجزاء المركب أو أجزاء نقل الزيت أو قرار الحجر أو تدمير الموقع البري إذا اقتضت الضرورة ذلك استناداً إلى قرار الخبرة، ويوافق
قرار المحكمة بذلك نافذاً.

مادة (74):
يجوز للأجهزة المختصة حجز أي مركب داخل المنطقة الخالية من التلوث عند ارتكاب مالك أو ريباء أو الشخص المسؤول عنه مخالفتها المقرراً فيها، ولا يقوم بتسليمها أو تقدير ضمان تسليم أو اجتناب عن تنفيذ التعليمات الصادرة إلى المركب وفقاً للمادة (72) عندما يكون المالك أو الربان أو الشخص المسؤول عن المركب مسؤولاً عن التعويض أو الأضرار أو التكاليف ولا يقوم بتسليم مبلغ التعويض ولا يقدم ضمانًا بإلغائه، على أن يتم عرض قرار الحجز على المحكمة المختصة فوراً لتحكم بصحة الحجز وفقاً لأحكام هذا القانون والقوانين النافذة، وعلى الجهية المختصة أن تعد المركب في حالة وفاء ربانياً بما تعي عليه فوراً، وفي حالة إلغاء الحجز وفقه من قبل المحكمة المختصة.
في حالة حجز أحد المراكب وفقاً للمادة (73) وعدم تسديد قيمة الغرامات أو التزامات أخرى
منشئة بموجب هذا القانون وفي غضون خمسة وأربعين يوماً من تاريخ الحكم بصحة الحجز فإنه
يجوز للمحكمة المختصة بيع المركب أو حمولته أو لما معاً في مزاد على بعد اتخاذ إجراءاته
والنشر عنه وفقاً لأحكام القانون، وتسميد المبالغ المستحقة وتوزيع المبالغ الفائضة لصاحبها.

الباب الخامس
المخالفات والتعويض عن الأضرار البشرية
الفصل الأول
سلطات الضبط القضائي
مادة (75)
يتمتع مفتتش البينة بصفة الضبط القضائي.

مادة (76)
على المفتشين التابعين لمختلف الجهات المختصة بالبينة، والذين يتمتعون بصفة الضبط القضائي
وفقاً لحكم المادة السابقة القيام بضبط المخالفات والجرائم المنسية بالبينة وتحرير محضر ضبط
هذا النوع من المخالفات أو الجريمة ومرتكبيها وتاريخ ضبطها ومكان وقوعها، كما أن لهم
التلفظ عن المشاكل إذا وجدت الدلائل تتوفر إحدى الحالات الآتية:

1. تداول غير قانوني للنفايات الخطرة.
2. تشغيل محضر بينيًّا.
3. منشأة أو مشروع يتم تشغيلها دون الحصول على الترخيص البيئي.
4. تصريف مخالف للقانون.
5. إعداد الأحياء البرية والبحرية والنباتات البرية أو المحميات الطبيعية.
6. عدم الحصول على الترخيص والوثائق أو السجلات التي تتعلق بتنفيذ أحكام هذا القانون.

مادة (77)
إذا كانت الأنشطة التي تمارس أو الأدوات أو المواد أو الوثائق المطلوبة ضبطها يوجد في محل
أقيمة، خاص أو مسكيًّا، فلا يجوز لمفتش البينة دخولها دون الحصول على إذن من الجهات
القضائية المختصة.

مادة (78)
على أصحاب المشروعات أو الأنشطة أو المواد أو النفايات تمكن مفتتش البينة من القيام
بمهامهم وترؤيهم بالتعليمات والبيانات الضرورية المتعلقة بتنفيذ أحكام هذا القانون، وعليهم
على وجه الخصوص تمكنهم من:
الفصل الثاني
المسؤولية والتعويض عن الأضرار البيئية

مادة (79): كل من تسبب بفعله أو إهلاله في إحداث ضرر للبيئة أو لغير نتيجة خلافة الأحكام الواردة بهذا القانون أو اللوائح أو القرارات الصادرة تطبيقاً له أو للقوانين النافذة يعد مسؤولاً عن تفاقده أو باتخاذ مع غيره من تكليف النافذة عن معالجة أو إزالة هذه الأضرار، وكذلك بالتعويضات التي قد تترتب على هذه الأضرار، وتشمل عناصر التعويض عن الضرر البيئي ما يلي:

- تكلفة إزالة الضرر البيئي وتفتيدية البيئة.
- التعويض عن الأضرار التي تسبب الأموال أو الأشخاص.
- التعويض عن الأضرار التي تسبب البيئة ذاتها وتمنع من الاستخدام المشترك لها سواء كان ذلك بصفة مؤقتة أو دائمة أو تضر بقيمتها الجمالية.

مادة (80): استثناء من القواعد العامة. لا تسقط الدعوى الناشئة عن الأفعال الضارة بالبيئة بمضة المدة المحددة في القانون.

مادة (81): يجوز للجهة المختصة إلغام المشروعات القابلة لإحداث الضرر البيئي بإعداد ضمانة مالية تكفي

劳动合同 (82): يجوز لجمعيات حماية البيئة اليمنية ولكل شخص مباشرة الدعوى المدنية ضد أي شخص طبيعي أو اعتباري لسبب يفعله أو إهماله والإضرار البيئي وتكون صادرة بهدف مكافحة وإزالة الأضرار المنتشرة.

مادة (83): تطبقي قواعد المسؤولية على المخاطر بالنسبة للتعويض عن الأضرار التي تنشأ عن المواد الملوثة للبيئة وفقاً لأحكام الشريعة الإسلامية والقوانين النافذة.
مادة (84)

إذا صدر عن مركب أو سفينة أو طائرة أو موقع بري أو أجهزة نقل الزيوت تصريف مادة ملوثة في المنطقة الخالية من التلوث تنشأ مسؤولية على مالك ذلك المركب أو السفينة أو الطائرة أو مالك أو شاغل ذلك الموقع أو تلك الأجهزة لنقل الزيوت بالتعويضات المستحقة مع العقوبة المقررة وفقاً لأحكام القانون.

الفصل الثالث

العقوبات الجزائية

مادة (85)

مع عدم الإخلال بأي عقوبة أشد منصوص عليها في الشريعة الإسلامية والقوانين النافذة واللوائح التنفيذية لأحكام هذا القانون والقوانين الأخرى .. فإن كل شخص طبيعي أو اعتباري قام أو تسبب بصرف أي مادة ملوثة عمدًا في المياه أو التربة أو الهواء في الجمهورية اليمنية فأحدث ضرراً بالبيئة يعاقب بالسجن مدة لا تزيد عن عشر سنوات مع الحكم بالتعويضات المادية المناسبة.

الفصل الرابع

أحكام ختامية

مادة (86)

يجوز للأفراد وجمعيات حماية البيئة الإبلاغ عن المخالفات التي تقع بالمخالفة لأحكام هذا القانون أو أية قوانين أخرى تتعلق بحماية البيئة، وكذلك مساعدة الجهات المختصة في حالة الكوارث البيئية أو لإزالة الاعتداءات والإضرار التي تقع على البيئة.

مادة (87)

يجب على جميع الجهات المسؤولة عن التعليم بمراعاته المختلفة والأجهزة المعنية بالخطط، للمناهج والمقررات الدراسية العمل على إدخال المواد والعلوم البيئية في جميع مراحل التعليم، والعمل على إنشاء وتطوير المناهج المتخصصة في علم البيئة لتخريج الكوادر المؤهلة للعمل البيئي.

مادة (88)

على جميع الجهات المسؤولة عن الإعلام والتوجيه والإرشاد العمل على تعزيز برامج التوعية البيئية في مختلف وسائل الإعلام المسموعة والمفروضة والمختصة، وعلي أجهزة الإعلام توجيه برامجها العامة والخاصة بشكل يخدم أغراض حماية البيئة.

مادة (89)

على الأجهزة المعنية بالثقافة إعداد البرامج والكتب والمطبوعات والدوريات التي تهدف إلى تنمية الثقافة البيئية.

مادة (90)
لا يوجد نص يمكن قراءته بشكل طبيعي من الصورة المقدمة.
### Yemeni Standards for the quality of Treated Effluent for Reuse in Irrigation as compared to FAO guidelines

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Code</th>
<th>Unit</th>
<th>Permissible Limit</th>
<th>Yemen-EPA</th>
<th>FAO</th>
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<tbody>
<tr>
<td>1</td>
<td>Biochemical Oxygen Demand</td>
<td>BOD</td>
<td>mg/l</td>
<td>150</td>
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<td>2</td>
<td>Chemical Oxygen Demand</td>
<td>COD</td>
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<td>3</td>
<td>Dissolved Oxygen</td>
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<td>4</td>
<td>Sodium</td>
<td>Na</td>
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<td>5</td>
<td>Phosphate</td>
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<td>6</td>
<td>Aluminium</td>
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<td>Beryllium</td>
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<td>Cadmium</td>
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<td>10</td>
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<td>11</td>
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<tr>
<td>12</td>
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<td>13</td>
<td>Fluoride</td>
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<td>14</td>
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<td>Manganese</td>
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<tr>
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<td>Molybdenum</td>
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<tr>
<td>21</td>
<td>Vanadium</td>
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<td>Cyanide</td>
<td>CN</td>
<td>mg/l</td>
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</tr>
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</table>
### Yemeni Microbiological Quality Standards for Wastewater Reuse in Agriculture

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Re-use Conditions</th>
<th>Intestinal Nematodes (Arithmetic mean of no. of eggs per 1 liter)</th>
<th>Fecal Coliforms (Geometric mean of no. per 100 ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Irrigation of crops likely to be eaten uncooked</td>
<td>≤ 1</td>
<td>≤ 1000</td>
</tr>
<tr>
<td>2</td>
<td>Irrigation of sports fields, public parks &amp; garden with which the public may come into direct contact</td>
<td>≤ 1</td>
<td>≤ 200</td>
</tr>
<tr>
<td>3</td>
<td>Irrigation of cereal crops, industrial crops, fodder crops, pasture &amp; trees</td>
<td>≤ 1</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Irrigation of fruit trees (irrigation should cease 2 weeks before fruit is picked up and no fruit should be picked off the ground)</td>
<td>&lt; 1</td>
<td>-</td>
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</table>
ملحق رقم (5) الحدود القصوى لملوثات الهواء الخارجي (ميكروجرام/م³)

<table>
<thead>
<tr>
<th>الرقم</th>
<th>المدة العرض</th>
<th>الحد الأقصى</th>
<th>الملوث</th>
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<tr>
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<td>ساعة</td>
<td>250</td>
<td>ثاني أكسيد الكبريت</td>
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<td>ملليجرام/م²</td>
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<td>سنة</td>
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</tr>
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<td>ساعة</td>
<td>20 ملليجرام/متر³</td>
<td>أول أكسيد الكربون</td>
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<td>8 ساعات</td>
<td>10 ملليجرام/متر³</td>
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<td>ثاني أكسيد النيتروجين</td>
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<td>3</td>
<td>24 ساعة</td>
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<td>الأوزون</td>
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<td>الجسيمات العالية (مقاسة كدخان أسود)</td>
</tr>
<tr>
<td></td>
<td>سنة</td>
<td>60</td>
<td></td>
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<tr>
<td>5</td>
<td>24 ساعة</td>
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<td>الجسيمات الصدرية (pm10)</td>
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<tr>
<td></td>
<td>سنة</td>
<td>1</td>
<td>الرصاص</td>
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</tbody>
</table>

الحدود القصوى لملوثات الهواء الخارجي (ميكروجرام في المتر المكعب)
ملحق رقم (7)

قواعد التحكم في التلوث بالضوضاء في البيئة العامة

مادة (1) لغراض هذا الملحق تكون للعبارات والكلمات الواردة في هذه اللائحة المعنى الموضح قرين كل منها:

1- المجلس: مجلس حماية البيئة
2- الضوضاء العامة: الأصوات الناجمة عن مصادر خارجية وتأثر على نوعية الحياة البومية للناس.
3- الضوضاء الضاجة: الأصوات غير المزعجة والتي تكون مقبولة لدى بعض الأشخاص
4- الضوضاء الناشئة: الأصوات التي تصدر لفترة قصيرة وتكون مزعجة إذا كان مستوى الصوت عاليًا.
5- الدبسية: وحدة قياس حجم ضغط الصوت الذي تتعرض له الأذن البشرية.
6- تعديل (أ): مرشح صوت لقياس مستوى الأصوات العادية.
7- تعديل (ب): وحدة قياس ضغط الصوت الميكروبايسكال.
8- مستوى الصوت المستمر المعادل للدبسيل (أ): مستوى ضغط الصوت الذي يمثل ذات طاقة تدبب الضوضاء، محسباً خلال فترة زمنية يرمز إليها بالحدود المعادلة للدبسيل بالقياس إلى 10 ميكروبايسكال.
9- مستوى الصوت أثناء النهار وليل: متوسط تعديل (أ) للحدود المعادلة والمدة الزمنية خلال فترة محددة من النهار والمساء وليل معتبرًا عن بالدبسيل بالقياس إلى 20 ميكروبايسكال.

مادة (2) مصادر الضوضاء الخارجية هي:

أ- الوحدات الصناعية و الأنشطة العامة و تشتمل المصانع والتجهيزات التجارية المشابهة و غيرها، و أعمال التجميع و الفك و الإصلاح و كذلك الأنشطة العامة و مصطلحات الطاقة الكهربائية و منشآت الاستخلاص و الضخ و تحلية المياه و تكرير النفط و الغاز و معالجة مياه المجاري و غيرها.
ب- طرق التواصل: و تشتمل وسائل التواصل التي تعمل بالمحركات في المدن على الطرق العامة و المحلية و غيرها.
ج- المطارات: و تشمل العمليات الأرضية في المطارات الخاصة بالطيران التجاري و العام مثل عمليات النقل، و يشمل ذلك السيارات التي تخدم و تغذية الطائرات و المعدات و التجهيزات و غيرها، و كذلك التجهيزات مثل الورش و مكابس الاحتكار و محطات الوقود و غيرها.
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4.
الحدود المعادلة والمدة الزمنية (ديسيbel) على امتداد الفترة الزمنية

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<td>المناطق الصناعية و التجارية</td>
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مادة(8): تكون حدود الضوضاء الناجمة عن المصادر الباردة بالبنزين(ب) من المادة(2) بالنسبة لمدة زمنية لكل من (أ) و (ب) و (ج) من المادة (3) على أساس مستوى ضغط الصوت المستمر المعادل لتعديل (أ) هي:
### الحدود المعادلة والمدة الزمنية دبسيل (أ)

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<td>المناطق الصناعية والتجارية</td>
<td>70</td>
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</table>

مادة (1): تكون حدود الضوضاء الناجمة عن المصادر الواردة بالبنود (ج) من المادة (2) بالنسبة لمدة زمنية معينة لكل من (أ) و (ب) و (ج) من المادة (6) على أساس مستوى ضغط الصوت المستمر المعادل لتدويل (أ) هي:

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<td>المناطق السكنية الحضرية مع بعض ورش العمل و مراكز المدن</td>
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<td>المناطق الصناعية والتجارية</td>
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مادة (١): تكون حدود الضوضاء الناجمة عن المصادر الباردة بالبيئة (د) من المادة (٢) على أساس مستويات النهار و الليل و حدود النهار و الليل و المدة الزمنية، و يشمل (أ) على امتداد عام هي:
مادة (11): تسري الحدود السابقة على المباني الجديدة و المخطط لها و الأشغال الهندسية و الانشاءات و الطرق و المطارات و غيرها.

مادة (12): يحدد المجلس الأشخاص أو الجهات التي تقوم بأخذ القياسات و عمل الحسابات الخاصة بمراقبة تطبيق حدود الضوضاء و كتابة التقارير عنها و ذلك بعد التأكد من الحصول على التأهيل المناسب و توافر الإمكانيات اللازمة.

مادة (13): يجب أن تكون الآلات و المعايرة الخاصة بالقياسات المشار إليها في المادة السابقة مطابقة لمعايير القياسات الدولية المنصوص عليها في القياسات الدولية 1996 الصادرة عن منظمة القياسات الدولية و يجب الإبلاغ عن جميع البيانات المتعلقة بالآلات المستخدمة مثل الصناعة و النوع و الرقم المسلط و المعايرة و العمليات الحاسبية و الأساليب المستخدمة.

مادة (14): يجب أخذ القياسات مستوي الصوت بصورة عامة من مواقع خارج المباني.

مادة (15): يراعى عند أخذ القياسات المشار إليها ظروف الرياح و درجة الحرارة و الرطوبة النسبية.

مادة (16): إذا أظهرت القياسات أن حدود الضوضاء تزيد على الحدود المنصوص عليها بالنسبة للمصدر و المكان و الزمان في هذه اللائحة فيجب الالتزام بإجراءات اضافية تقررها المجلس لتفعيل الازعاج بالموضوع.
ANNEX 2

WORLD BANK SAFEGUARD POLICIES
World Bank
Environmental and
Social Safeguard
Policies
Environmental Assessment

This Operational Policy statement was revised in August 2004 to ensure consistency with the requirements of OP/BP 8.60, issued in August 2004. These changes may be viewed here.

1. The Bank requires environmental assessment (EA) of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus to improve decision making.

2. EA is a process whose breadth, depth, and type of analysis depend on the nature, scale, and potential environmental impact of the proposed project. EA evaluates a project’s potential environmental risks and impacts in its area of influence; examines project alternatives; identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts and enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation. The Bank favors preventive measures over mitigatory or compensatory measures, whenever feasible.

3. EA takes into account the natural environment (air, water, and land); human health and safety; social aspects (involuntary resettlement, indigenous peoples, and cultural property); and transboundary and global environmental aspects. EA considers natural and social aspects in an integrated way. It also takes into account the variations in project and country conditions; the findings of country environmental studies; national environmental action plans; the country’s overall...
policy framework, national legislation, and institutional capabilities related to the environment and social aspects; and obligations of the country, pertaining to project activities, under relevant international environmental treaties and agreements. The Bank does not finance project activities that would contravene such country obligations, as identified during the EA. EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social, and technical analyses of a proposed project.

4. The borrower is responsible for carrying out the EA. For Category A projects, the borrower retains independent EA experts not affiliated with the project to carry out the EA. For Category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns, the borrower should normally also engage an advisory panel of independent, internationally recognized environmental specialists to advise on all aspects of the project relevant to the EA. The role of the advisory panel depends on the degree to which project preparation has progressed, and on the extent and quality of any EA work completed, at the time the Bank begins to consider the project.

5. The Bank advises the borrower on the Bank’s EA requirements. The Bank reviews the findings and recommendations of the EA to determine whether they provide an adequate basis for processing the project for Bank financing. When the borrower has completed or partially completed EA work prior to the Bank’s involvement in a project, the Bank reviews the EA to ensure its consistency with this policy. The Bank may, if appropriate, require additional EA work, including public consultation and disclosure.

6. The Pollution Prevention and Abatement Handbook describes pollution prevention and abatement measures and emission levels that are normally acceptable to the Bank. However, taking into account borrower country legislation and local conditions, the EA may recommend alternative emission levels and approaches to pollution prevention and abatement for the project. The EA report must provide full and detailed justification for the levels and approaches chosen for the particular project or site.

**EA Instruments**

7. Depending on the project, a range of instruments can be used to satisfy the Bank’s EA requirement: environmental impact assessment (EIA), regional or sectoral EA, environmental audit, hazard or risk assessment, and environmental management plan (EMP). EA applies one or more of these instruments, or elements of them, as appropriate. When the project is likely to have sectoral or regional impacts, sectoral or regional EA is required.

**Environmental Screening**

8. The Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of EA. The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts.

(a) Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or
unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A project examines the project’s potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the “without project” situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an EIA (or a suitably comprehensive regional or sectoral EA) that includes, as necessary, elements of the other instruments referred to in para. 7.

(b) Category B. A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas—including wetlands, forests, grasslands, and other natural habitats—are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible, and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project’s potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of Category B EA are described in the project documentation (Project Appraisal Document and Project Information Document). 11

(c) Category C. A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

(d) Category F. A proposed project is classified as Category F if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.

EA for Special Project Types

Sector Investment Lending

9. For sector investment loans (SILs), 12 during the preparation of each proposed subproject, the project coordinating entity or implementing institution carries out appropriate EA according to country requirements and the requirements of this policy. 13 The Bank appraises and, if necessary, includes in the SIL components to strengthen, the capabilities of the coordinating entity or the implementing institution to (a) screen subprojects, (b) obtain the necessary expertise to carry out EA, (c) review all findings and results of EA for individual subprojects, (d) ensure implementation of mitigation measures (including, where applicable, an EMP), and (e) monitor environmental conditions during project implementation. 14 If the Bank is not satisfied that adequate capacity exists for carrying out EA, all Category A subprojects and, as appropriate, Category B subprojects—including any EA reports—are subject to prior review and approval by the Bank.

Financial Intermediary Lending

10. For a financial intermediary (FI) operation, the Bank requires that each FI screen proposed subprojects and ensure that subborrowers carry out appropriate EA for each subproject. Before
approving a subproject, the FI verifies (through its own staff, outside experts, or existing environmental institutions) that the subproject meets the environmental requirements of appropriate national and local authorities and is consistent with this OP and other applicable environmental policies of the Bank.  

11. In appraising a proposed FI operation, the Bank reviews the adequacy of country environmental requirements relevant to the project and the proposed EA arrangements for subprojects, including the mechanisms and responsibilities for environmental screening and review of EA results. When necessary, the Bank ensures that the project includes components to strengthen such EA arrangements. For FI operations expected to have Category A subprojects, prior to the Bank's appraisal each identified participating FI provides to the Bank a written assessment of the institutional mechanisms (including, as necessary, identification of measures to strengthen capacity) for its subproject EA work. If the Bank is not satisfied that adequate capacity exists for carrying out EA, all Category A subprojects and, as appropriate, Category B subprojects—including EA reports—are subject to prior review and approval by the Bank.  

Emergency Recovery Projects

12. The policy set out in OP 4.01 normally applies to emergency recovery projects processed under OP 8.50, Emergency Recovery Assistance. However, when compliance with any requirement of this policy would prevent the effective and timely achievement of the objectives of an emergency recovery project, the Bank may exempt the project from such a requirement. The justification for any such exemption is recorded in the loan documents. In all cases, however, the Bank requires at a minimum that (a) the extent to which the emergency was precipitated or exacerbated by inappropriate environmental practices be determined as part of the preparation of such projects, and (b) any necessary corrective measures be built into either the emergency project or a future lending operation.

Institutional Capacity

13. When the borrower has inadequate legal or technical capacity to carry out key EA-related functions (such as review of EA, environmental monitoring, inspections, or management of mitigatory measures) for a proposed project, the project includes components to strengthen that capacity.

Public Consultation

14. For all Category A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower consults with such groups throughout project implementation as necessary to address EA-related issues that affect them.

Disclosure

15. For meaningful consultations between the borrower and project-affected groups and local NGOs
on all Category A and B projects proposed for IBRD or IDA financing, the borrower provides relevant material in a timely manner prior to consultation and in a form and language that are understandable and accessible to the groups being consulted.

16. For a Category A project, the borrower provides for the initial consultation a summary of the proposed project's objectives, description, and potential impacts; for consultation after the draft EA report is prepared, the borrower provides a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs. For SILs and FL operations, the borrower/FL ensures that EA reports for Category A subprojects are made available in a public place accessible to affected groups and local NGOs.

17. Any separate Category B report for a project proposed for IDA financing is made available to project-affected groups and local NGOs. Public availability in the borrowing country and official receipt by the Bank of Category A reports for projects proposed for IBRD or IDA financing, and of any Category B EA report for projects proposed for IDA funding, are prerequisites to Bank appraisal of these projects.

18. Once the borrower officially transmits the Category A EA report to the Bank, the Bank distributes the summary (in English) to the executive directors (EDs) and makes the report available through its InfoShop. Once the borrower officially transmits any separate Category B EA report to the Bank, the Bank makes it available through its InfoShop. If the borrower objects to the Bank's releasing an EA report through the World Bank InfoShop, Bank staff (a) do not continue processing an IDA project, or (b) for an IBRD project, submit the issue of further processing to the EDs.

**Implementation**

19. During project implementation, the borrower reports on (a) compliance with measures agreed with the Bank on the basis of the findings and results of the EA, including implementation of any EMP, as set out in the project documents; (b) the status of mitigation measures; and (c) the findings of monitoring programs. The Bank bases supervision of the project's environmental aspects on the findings and recommendations of the EA, including measures set out in the legal agreements, any EMP, and other project documents.
5. For screening, see para. 8.

6. EA is closely integrated with the project's economic, financial, institutional, social, and technical analyses to ensure that (a) environmental considerations are given adequate weight in project selection, siting, and design decisions; and (b) EA does not delay project processing. However, the borrower ensures that when individuals or entities are engaged to carry out EA activities, any conflict of interest is avoided. For example, when an independent EA is required, it is not carried out by the consultants hired to prepare the engineering design.

7. The panel (which is different from the dam safety panel required under OP/BP 4.37, Safety of Dams) advises the borrower specifically on the following aspects: (a) the terms of reference for the EA, (b) key issues and methods for preparing the EA, (c) recommendations and findings of the EA, (d) implementation of the EA’s recommendations, and (e) development of environmental management capacity.

8. These terms are defined in Annex A. Annexes B and C discuss the content of EA reports and EMPs.

9. Guidance on the use of sectoral and regional EA is available in EA Sourcebook Updates 4 and 15.

10. A potential impact is considered “sensitive” if it may be irreversible (e.g., lead to loss of a major natural habitat) or raise issues covered by OP/BP 4.10, Indigenous Peoples, OP 4.04, Natural Habitat, OP 4.11 (forthcoming), Management of Cultural Property in Bank-Financed Projects, or OP 4.13, Involuntary Resettlement.

11. When the screening process determines, or national legislation requires, that any of the environmental issues identified warrant special attention, the findings and results of Category B EA may be set out in a separate report. Depending on the type of project and the nature and magnitude of the impacts, this report may include, for example, a limited environmental impact assessment, an environmental mitigation or management plan, an environmental audit, or a hazard assessment. For Category B projects that are not in environmentally sensitive areas and that present well-defined and well-understood issues of narrow scope, the Bank may accept alternative approaches for meeting EA requirements: for example, environmentally sound design criteria, siting criteria, or pollution standards for small-scale industrial plants or rural works; environmentally sound siting criteria, construction standards, or inspection procedures for housing projects; or environmentally sound operating procedures for road rehabilitation projects.

12. SILS normally involve the preparation and implementation of annual investment plans or subprojects as time slice activities over the course of the project.

13. In addition, if there are sectorwide issues that cannot be addressed through individual subproject EAs (and particularly if the SIL is likely to include Category A subprojects), the borrower may be required to carry out sectoral EA before the Bank approves the SIL.

14. Where, pursuant to regulatory requirements or contractual arrangements acceptable to the Bank, any of these reviews functions are carried out by an entity other than the coordinating entity or implementing institution, the Bank approves such alternative arrangements; however, the borrower/协调 entity/实施机构 remains ultimately responsible for ensuring that subprojects meet Bank requirements.

15. The requirements for FI operations are derived from the EA process and are consistent with the provisions of para. 6 of this OP. The EA process takes into account the type of finance being considered, the nature and scale of anticipated subprojects, and the environmental requirements of the jurisdiction in which subprojects will be located.

16. Any FI included in the project after appraisal complies with the same requirement as a condition of its participation.

17. The criteria for prior review of Category B subprojects, which are based on such factors as type or size of the subproject and the EA capacity of the financial intermediary, are set out in the legal agreements for the project.

18. For the Bank's approach to NGOs, see GP 14.70, Involving Nongovernmental Organizations in Bank-Supported Activities.

19. For projects with major social components, consultations are also required by other Bank policies—for example, OP/BP 4.10, Indigenous Peoples, and OP/BP 4.12, Involuntary Resettlement.


21. See OP/BP 13.05, Project Supervision.
These procedures were prepared for use by World Bank staff and are not necessarily a complete treatment of the subject.

Environmental Assessment

This Bank Procedures statement was revised in August 2004 to ensure consistency with the requirements of OP BP $60, issued in August 2004. These changes may be viewed here.

Note: OP and BP 4.01 together replace OMS 2.36, Environmental Aspects of Bank Work; OD 4.00, Annex A, Environmental Assessment; OD 4.00, Annex B, Environmental Policy for Dam and Reservoir Projects; OD 4.01, Environmental Assessment; and the following Operational Memoranda: Environmental Assessments: Instructions to Staff on the Handling of the Borrower's Consultations with Affected Groups and Relevant Local NGOs, 4/10/90; Environmental Assessments: Instructions to Staff on the Release of Environmental Assessments to Executive Directors, 11/21/90; and Release of Environmental Assessments to Executive Directors, 2/20/91.


1. Environmental assessment (EA) for a proposed Bank-financed operation is the responsibility of the borrower. Bank staff assist the borrower, as appropriate. The Region coordinates Bank review of EA in consultation with its Regional environment sector unit (RESU) and, as necessary, with the support of the Environment Department (ENV).

Environmental Screening

2. In consultation with the RESU, the task team (TT) examines the type, location, sensitivity, and scale of the proposed project, as well as the nature and magnitude of its potential impacts. At the earliest stage of the project cycle, the TT, with the RESU’s concurrence, assigns the proposed project to one of four categories (A, B, C, or D), see OP 4.01, para. 8, reflecting the potential environmental risks associated with the project. Projects are categorized according to the component with the potentially most serious adverse effects; dual categories (e.g., A:C) are not used.

3. The TT records in the Project Concept Document (PCD) and the initial Project Information Document (PID) (a) the key environmental issues (including any resettlement, indigenous peoples, and cultural property concerns); (b) the project category and the type of EA and EA instruments needed; (c) proposed consultation with project-affected groups and local nongovernmental
organizations (NGOs), including a preliminary schedule; and (d) a preliminary EA schedule. The TT also reports the project’s EA category in the Monthly Operational Summary of Bank and IDA Proposed Projects (MOS), and prepares (and updates as necessary) an Environmental Data Sheet (EDS) for the project. For Category A projects, the EDS is included as a quarterly annex to the MOS.

4. If, during project preparation, the project is modified or new information becomes available, the TT, in consultation with the RESU, considers whether the project should be reclassified. The TT updates the PCD/PID and the EDS to reflect any new classification and record the rationale for the new classification. The new classification that appears in the MOS is followed by "(R)" to indicate a revision.

5. Any exemption with respect to the application of this policy to any emergency recovery project processed under OP 8.50, Emergency Recovery Assistance, is subject to approval by the Regional vice president (RVP), in consultation with the Chair, ENV, and the Legal Department (LEG).

**EA Preparation**

6. During preparation of the PCD, the TT discusses with the borrower the scope of the EA and the procedures, schedule, and outline for any EA report required. For Category A projects, a field visit by an environmental specialist for this purpose is normally necessary. At the time of the Project Concept Review, the RESU provides formal clearance of the environmental aspects of the PCD/PID. For Category B projects, the Concept Review decides whether an environmental management plan (EMP) will be required.

7. EA is an integral part of project preparation. As necessary, the TT assists the borrower in drafting the terms of reference (TOR) for any EA report. The RESU reviews the coverage of the TOR, ensuring among other things that they provide for adequate interagency coordination and for consultation with affected groups and local NGOs. To support preparation of the TOR and the EA report, the TT gives the borrower the documents *Content of an Environmental Assessment Report for a Category A Project and Environmental Management Plan*. As applicable, Bank and borrower staff refer to the *Pollution Prevention and Abatement Handbook*, which contains pollution prevention and abatement measures and emission levels that are normally acceptable to the Bank.

8. For a Category A project, the TT advises the borrower that the EA report must be submitted to the Bank in English, French, or Spanish, and an executive summary in English.

9. For all Category A projects, and for Category B projects that are proposed for IDA funding and that will have a separate EA report, the TT advises the borrower in writing that (a) before the Bank proceeds to project appraisal, the EA report must be made available in a public place accessible to affected groups and local NGOs and must be officially submitted to the Bank; and (b) once the Bank officially receives the report, it will make the report available to the public through its InfoShop.

10. During the design phase of a project, the TT advises the borrower on carrying out the EA in accordance with the requirements of OP 4.01. The TT and the lawyer identify any matters pertaining to the project’s consistency with national legislation or international environmental treaties and agreements (referred to in OP 4.01, para. 3).
Review and Disclosure

11. When the borrower officially submits a Category A or Category B EA report to the Bank, the Region places a copy of the full report in the project file. It also sends the English-language executive summary of a Category A EA report to the Board Operations Division, Corporate Secretariat, under cover of a transmittal memorandum confirming that the executive summary and the full report (a) have been prepared by the borrower and have not been evaluated or endorsed by the Bank, and (b) are subject to change during appraisal. The results of a Category B EA, when there is no separate report, are summarized in the PID.

12. For Category A and B projects, the TT and the RESU review the results of the EA, ensuring that any EA report is consistent with the TOR agreed with the borrower. For Category A projects, and for Category B projects proposed for IDA funding that have a separate EA report, this review gives special attention to, among other things, the nature of the consultations with affected groups and local NGOs and the extent to which the views of such groups were considered; and the EMP with its measures for mitigating and monitoring environmental impacts and, as appropriate, strengthening institutional capacity. If not satisfied, the RESU may recommend to Regional management that (a) the appraisal mission be postponed, (b) the mission be considered a preappraisal mission, or (c) certain issues be reexamined during the appraisal mission. The RESU sends a copy of Category A reports to ENV.

13. For all Category A and B projects, the TT updates the status of the EA in the PID, describing how major environmental issues have been resolved or will be addressed and noting any proposed EA-related conditionalities. The TT sends the InfoShop a copy of all EA reports.

14. At the Project Decision stage, the RESU provides formal clearance of the environmental aspects of the project, including their treatment in the draft legal documents prepared by LEG.

Project Appraisal

15. For Category A projects and for Category B projects proposed for IDA funding that have a separate report, the appraisal mission normally departs only after the Bank has received the officially transmitted EA report and reviewed it (see paras. 11-13). For Category A projects, the appraisal mission team includes one or more environmental specialists with relevant expertise. The appraisal mission for any project (a) reviews both the procedural and substantive elements of the EA with the borrower, (b) resolves any issues, (c) assesses the adequacy of the institutions responsible for environmental management in light of the EA's findings, (d) ensures the adequacy of financing arrangements for the EMP, and (e) determines whether the EA's recommendations are properly addressed in project design and economic analysis. For Category A and B projects, the TT obtains the RESU's and LEG's concurrence with any change during appraisal and negotiations in any environment-related conditionality from that approved at the Project Decision stage.

Sector Investment and Financial Intermediary Lending

16. The appraisal mission develops clear arrangements with the borrower to ensure that the implementing institutions will be able to carry out or oversee EAs of proposed subprojects; specifically, the mission confirms the sources of required expertise and the appropriate division of responsibilities among the ultimate borrower, the financial intermediary or sector agency, and the agencies responsible for environmental management and regulation. As appropriate, the TT reviews Category A and B subproject EA reports in accordance with OP.4.01, paras. 2 and 11-12.
The TT advises Regional management of the actions taken and recommends any further measures. During implementation, the TT obtains the RESU's concurrence with any change in environment-related aspects of the project, including environment-related conditions cleared by LEG.

22. The TT ensures that the borrower's operating plan for the project includes actions required to carry out the project's environment-related aspects, including provision for continued functioning of any environmental advisory panel as agreed with the Bank.

23. The Implementation Completion Report evaluates (a) environmental impacts, noting whether they were anticipated in the EA report; and (b) the effectiveness of any mitigatory measures taken.

Role of the Environment Department

24. ENV supports the Regions throughout the EA process with advice, training, dissemination of good practice, and operational support. As appropriate, ENV provides to other Regions the EA reports, related materials, precedents, and experience that originate in any one Region or from external sources. ENV carries out project audits to help ensure compliance with the Bank's EA policy, and it conducts periodic reviews of the Bank's EA experience to identify and disseminate good practice and develop further guidance in this area.

Financing EA

25. Project Preparation Facility advances and trust funds may be available to potential borrowers that request Bank assistance in financing EA.

Specific Applications

26. Procedures for the environmental assessment of projects involving dams and reservoirs and pest management are set out in Annexes B and C, respectively.

1. "Bank" includes IBRD and IDA. "EA" refers to the entire process set out in OP-BP 4.01, "project" covers all operations financed by Bank loans or guarantees except development policy lending (for which the environmental provisions are set out in OP-BP 8.60, Development Policy Lending), and also includes projects under adaptable lending—adaptable program loans (APLS) and learning and innovation loans (LILs)—and projects and components funded under the Global Environment Facility; "loans" includes IDA credits and IDA grants; "borrower" includes a private or public project sponsor receiving from another financial institution a loan guaranteed by the Bank; "Project Concept Document" includes the Initiating Memorandum, and "Project Appraisal Document" includes the Report and Recommendation of the President (President's Report).

2. As of November 1998, the Regional environmental sector units are as follows: AFR — Environment Group; EAP, SAR, and ECA — Environment Sector Unit; MNA — Rural Development, Water, and Environment Sector Unit; LCR — Environmentally and Socially Sustainable Development Sector Unit.

3. "Location" refers to proximity to or encroachment on environmentally important areas, such as wetlands, forests, and other natural habitats. "Scale" is judged by Regional staff in the country context. "Sensitivity" refers to projects that may have irreversible impacts, affect vulnerable ethnic minorities, involve involuntary resettlement, or affect cultural heritage sites. For further discussion, see the Environmental Assessment Sourcebook, Update No. 2: Environmental Screening (available from the Environment Department).

4. See OP-BP 10.00, Investment Lending: Identification to Board Presentation, for the loan processing context in which decisions on the environment category and the EA process are made.

5. For the FDS, see Annex A.

7. LEG input is provided through the lawyer assigned to the project.

8. For sector investment and financial intermediary operations, Bank and borrower staff need to consider the potential for significant cumulative impacts from multiple subprojects.

9. Such a field visit by an environmental specialist may also be desirable for some Category B projects.

10. According to Guidelines: Selection and Employment of Consultants by World Bank Borrowers (Washington, D.C.: World Bank, January 1997, revised September 1997), the TT reviews the qualifications of and, if acceptable, gives a no-objection to any consultants retained by the borrower to prepare the EA report or to serve on a panel.

11. For these two documents, see OP 4.01, Annexes B and C.


13. In exceptional cases, the RVP, with the prior concurrence of the Chair, ENV, may authorize the appraisal mission's departing before the Category A EA report is received. In such cases, the RESU's clearance of the project is conditional on the Bank's receiving, before appraisal ends and negotiations begin, an EA report that provides an adequate basis for continued project processing.

14. It may be desirable to include environmental specialists on the appraisal mission team for some Category B projects, as well.

15. The TT provides to the implementing institutions, for use (as appropriate) in the preparation and appraisal of subprojects, copies of Content of an Environmental Assessment Report for a Category A Project (OP 4.01, Annex B), Environmental Management Plan (OP 4.01, Annex C), and Pollution Prevention and Abatement Handbook.

16. See OP/BP 13.05, Project Supervision.


Definitions

1. *Environmental audit*: An instrument to determine the nature and extent of all environmental areas of concern at an existing facility. The audit identifies and justifies appropriate measures to mitigate the areas of concern, estimates the cost of the measures, and recommends a schedule for implementing them. For certain projects, the EA report may consist of an environmental audit alone; in other cases, the audit is part of the EA documentation.

2. *Environmental impact assessment (EIA)*: An instrument to identify and assess the potential environmental impacts of a proposed project, evaluate alternatives, and design appropriate mitigation, management, and monitoring measures. Projects and subprojects need EIA to address important issues not covered by any applicable regional or sectoral EA.

3. *Environmental management plan (EMP)*: An instrument that details (a) the measures to be taken during the implementation and operation of a project to eliminate or offset adverse environmental impacts, or to reduce them to acceptable levels; and (b) the actions needed to implement these measures. The EMP is an integral part of Category A EAs (irrespective of other instruments used); EAs for Category B projects may also result in an EMP.

4. *Hazard assessment*: An instrument for identifying, analyzing, and controlling hazards associated with the presence of dangerous materials and conditions at a project site. The Bank requires a hazard assessment for projects involving certain incombustible, explosive, reactive, and toxic materials when they are present at a site in quantities above a specified threshold level. For certain projects, the EA report may consist of the hazard assessment alone; in other cases, the hazard assessment is part of the EA documentation.

5. *Project area of influence*: The area likely to be affected by the project, including all its ancillary aspects, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, and construction camps, as well as unplanned developments induced by the project (e.g., spontaneous settlement, logging, or shifting agriculture along access roads). The area of influence may include, for example, (a) the watershed within which the project is located; (b) any affected estuary and coastal zone; (c) off-site areas required for resettlement or compensatory tracts; (d) the airshed (e.g., where airborne pollution such as smoke or dust may enter or leave the area of influence); (e) migratory routes of humans, wildlife, or fish, particularly where they relate to public health, economic activities, or environmental conservation; and (f) areas used for livelihood activities (hunting, fishing, grazing, gathering, agriculture, etc.) or religious or ceremonial purposes of a customary nature.

6. *Regional EA*: An instrument that examines environmental issues and impacts associated with a particular strategy, policy, plan, or program, or with a series of projects for a particular region (e.g., an urban area, a watershed, or a coastal zone); evaluates and compares the impacts against those of alternative options; assesses legal and institutional aspects relevant to the issues and impacts; and recommends broad measures to strengthen environmental management in the region. Regional EA pays particular attention to potential cumulative impacts of multiple activities.

7. *Risk assessment*: An instrument for estimating the probability of harm occurring from the presence...
of dangerous conditions or materials at a project site. Risk represents the likelihood and significance of a potential hazard being realized; therefore, a hazard assessment often precedes a risk assessment, or the two are conducted as one exercise. Risk assessment is a flexible method of analysis, a systematic approach to organizing and analyzing scientific information about potentially hazardous activities or about substances that might pose risks under specified conditions. The Bank routinely requires risk assessment for projects involving handling, storage, or disposal of hazardous materials and waste, the construction of dams, or major construction works in locations vulnerable to seismic activity or other potentially damaging natural events. For certain projects, the EA report may consist of the risk assessment alone; in other cases, the risk assessment is part of the EA documentation.

8. **Sectoral EA**: An instrument that examines environmental issues and impacts associated with a particular strategy, policy, plan, or program, or with a series of projects for a specific sector (e.g., power, transport, or agriculture); evaluates and compares the impacts against those of alternative options; assesses legal and institutional aspects relevant to the issues and impacts; and recommends broad measures to strengthen environmental management in the sector. Sectoral EA pays particular attention to potential cumulative impacts of multiple activities.
Content of an Environmental Assessment Report for a Category A Project

1. An environmental assessment (EA) report for a Category A project focuses on the significant environmental issues of a project. The report's scope and level of detail should be commensurate with the project's potential impacts. The report submitted to the Bank is prepared in English, French, or Spanish, and the executive summary in English.

2. The EA report should include the following items (not necessarily in the order shown):

(a) Executive summary. Concisely discusses significant findings and recommended actions.

(b) Policy, legal, and administrative framework. Discusses the policy, legal, and administrative framework within which the EA is carried out. Explains the environmental requirements of any co-financiers. Identifies relevant international environmental agreements to which the country is a party.

(c) Project description. Concisely describes the proposed project and its geographic, ecological, social, and temporal context, including any off-site investments that may be required (e.g., dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement plan or indigenous peoples development plan (see also subpara. (h)(v) below). Normally includes a map showing the project site and the project's area of influence.

(d) Baseline data. Assesses the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. Also takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project location, design, operation, or mitigatory measures. The section indicates the accuracy, reliability, and sources of the data.

(e) Environmental impacts. Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the extent possible. Identifies mitigation measures and any residual negative impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention.

(f) Analysis of alternatives. Systematically compares feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental impacts, the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the extent possible, and attaches economic values where feasible. States the basis for selecting the particular project design proposed and justifies recommended
22. As a condition of appraisal of projects involving resettlement, the borrower provides the Bank with the relevant draft resettlement instrument which conforms to this policy, and makes it available at a place accessible to displaced persons and local NGOs, in a form, manner, and language that are understandable to them. Once the Bank accepts this instrument as providing an adequate basis for project appraisal, the Bank makes it available to the public through its InfoShop. After the Bank has approved the final resettlement instrument, the Bank and the borrower disclose it again in the same manner.\(^\text{23}\)

23. The borrower's obligations to carry out the resettlement instrument and to keep the Bank informed of implementation progress are provided for in the legal agreements for the project.

24. The borrower is responsible for adequate monitoring and evaluation of the activities set forth in the resettlement instrument. The Bank regularly supervises resettlement implementation to determine compliance with the resettlement instrument. Upon completion of the project, the borrower undertakes an assessment to determine whether the objectives of the resettlement instrument have been achieved. The assessment takes into account the baseline conditions and the results of resettlement monitoring. If the assessment reveals that these objectives may not be realized, the borrower should propose follow-up measures that may serve as the basis for continued Bank supervision, as the Bank deems appropriate (see also BP 4.12, para. 16).

Resettlement Instruments

Resettlement Plan

25. A draft resettlement plan that conforms to this policy is a condition of appraisal (see Annex A, paras. 2-21) for projects referred to in para. 17(a) above.\(^\text{24}\) However, where impacts on the entire displaced population are minor,\(^\text{25}\) or fewer than 200 people are displaced, an abbreviated resettlement plan may be agreed with the borrower (see Annex A, para. 22). The information disclosure procedures set forth in para. 22 apply.

Resettlement Policy Framework

26. For sector investment operations that may involve involuntary resettlement, the Bank requires that the project implementing agency screen subprojects to be financed by the Bank to ensure their consistency with this OP. For these operations, the borrower submits, prior to appraisal, a resettlement policy framework that conforms to this policy (see Annex A, paras. 23-25). The framework also estimates, to the extent feasible, the total population to be displaced and the overall resettlement costs.

27. For financial intermediary operations that may involve involuntary resettlement, the Bank requires that the financial intermediary (FI) screen subprojects to be financed by the Bank to ensure their consistency with this OP. For these operations, the Bank requires that before appraisal the borrower or the FI submit to the Bank a resettlement policy framework conforming to this policy (see Annex A, paras. 23-25). In addition, the framework includes an assessment of the institutional capacity and procedures of each of the FIs that will be responsible for subproject financing. When, in the assessment of the Bank, no resettlement is envisaged in the subprojects to be financed by the FI, a resettlement policy framework is not required. Instead, the legal agreements specify the obligation of the FIs to obtain from the potential subborrowers a resettlement plan consistent with this policy if a subproject gives rise to resettlement. For all subprojects involving resettlement, the resettlement plan is provided to the Bank for approval before the subproject is accepted for Bank financing.

28. For other Bank-assisted project with multiple subprojects\(^\text{26}\) that may involve involuntary resettlement, the Bank requires that a draft resettlement plan conforming to this policy be submitted
to the Bank before appraisal of the project unless, because of the nature and design of the project or of a specific subproject or subprojects (a) the zone of impact of subprojects cannot be determined, or (b) the zone of impact is known but precise sitting alignments cannot be determined. In such cases, the borrower submits a resettlement policy framework consistent with this policy prior to appraisal (see Annex A, paras. 23-25). For other subprojects that do not fall within the above criteria, a resettlement plan conforming to this policy is required prior to appraisal.

29. For each subproject included in a project described in paras. 26, 27, or 28 that may involve resettlement, the Bank requires that a satisfactory resettlement plan or an abbreviated resettlement plan that is consistent with the provisions of the policy framework be submitted to the Bank for approval before the subproject is accepted for Bank financing.

30. For projects described in paras. 26-28 above, the Bank may agree, in writing, that subproject resettlement plans may be approved by the project implementing agency or a responsible government agency or financial intermediary without prior Bank review, if that agency has demonstrated adequate institutional capacity to review resettlement plans and ensure their consistency with this policy. Any such delegation, and appropriate remedies for the entity’s approval of resettlement plans found not to be in compliance with Bank policy, are provided for in the legal agreements for the project. In all such cases, implementation of the resettlement plans is subject to external review by the Bank.

Process Framework

31. For projects involving restriction of access in accordance with para. 3(b) above, the borrower provides the Bank with a draft process framework that conforms to the relevant provisions of this policy as a condition of appraisal. In addition, during project implementation and before to enforcing of the restriction, the borrower prepares a plan of action, acceptable to the Bank, describing the specific measures to be undertaken to assist the displaced persons and the arrangements for their implementation. The plan of action could take the form of a natural resources management plan prepared for the project.

Assistance to the Borrower

32. In furtherance of the objectives of this policy, the Bank may at a borrower’s request support the borrower and other concerned entities by providing

(a) assistance to assess and strengthen resettlement policies, strategies, legal frameworks, and specific plans at a country, regional, or sectoral level;

(b) financing of technical assistance to strengthen the capacities of agencies responsible for resettlement, or of affected people to participate more effectively in resettlement operations;

(c) financing of technical assistance for developing resettlement policies, strategies, and specific plans, and for implementation, monitoring, and evaluation of resettlement activities; and

(d) financing of the investment costs of resettlement.

33. The Bank may finance either a component of the main investment causing displacement and requiring resettlement, or a free-standing resettlement project with appropriate cross-conditionalities, processed and implemented in parallel with the investment that causes the displacement. The Bank may finance resettlement even though it is not financing the main investment that makes resettlement necessary.
1. "Bank" includes IDA and "loans" includes IDA credits and IDA grants, guarantees, Project Preparation Facility (PPF), advances and grants, and "projects" includes projects under (a) adaptable program lending; (b) learning and innovation loans; (c) PPF and Institutional Development Funds (IDFs). If they include investment activities, (d) grants under the Global Environment Facility and Montreal Protocol, for which the Bank is the implementing agency; and (e) grants or loans provided by other donors that are administered by the Bank. The term "project" does not include programs under development policy lending operations. "Borrower" also includes, wherever the context requires, the guarantor or the project implementing agency.

2. In devising approaches to resettlement in Bank-assisted projects, other Bank policies should be taken into account, as relevant. These policies include OP 3.01, Environmental Assessment, OP 3.04, Natural Habitats, OP 4.10 Indigenous Peoples, and OP 4.11 (forthcoming), Management of Cultural Property in Bank-Financed Projects.

3. The term "displaced persons" refers to persons who are affected in any of the ways described in para. 3 of this OP.

4. Displaced persons under para. 3(b) should be encouraged to improve or restore their livelihoods in a manner that maintains the sustainability of the parks and protected areas.

5. Where there are adverse indirect social or economic impacts, it is good practice for the borrower to undertake a social assessment and implement measures to minimize and mitigate adverse economic and social impacts, particularly upon poor and vulnerable groups. Other environmental, social, and economic impacts that do not result from land taking may be identified and addressed through environmental assessments and other project reports and instruments.

6. This policy does not apply to restrictions of access to natural resources under community-based projects, i.e. those where the community, using the resources, decides to restrict access to those resources, provided that an assessment satisfactory to the Bank establishes that the community decision-making process is adequate, and that it provides for identification of appropriate measures to mitigate adverse impacts, if any, on the vulnerable members of the community. The policy also does not cover refugees from natural disasters, war, or civil strife (see OP 3.50, Emergency, Recovery, Assistance).

7. For purposes of this policy, "involuntary" means actions that may be taken without the displaced person's informed consent or power of choice.

8. "Land" includes anything growing on or permanently affixed to land, such as buildings and crops. This policy does not apply to resources such as watersheds, management, groundwater management, fisheries management, etc. The policy also does not apply to disputes between private parties in land titles projects, although it is good practice for the borrower to undertake a social assessment and implement measures to minimize and mitigate adverse social impacts, especially those affecting poor and vulnerable groups.

9. For the purposes of this policy, involuntary restriction of access covers restrictions on the use of resources imposed on people living outside the park or protected area, or on those who continue living inside the park or protected area during and after project implementation. In cases where new parks and protected areas are created as part of the project, persons who lose shelter, land, or other assets are covered under para. 3(a).

10. The Involuntary Resettlement Specialist provides guidance to staff on the policy.

11. "Replacement cost" is the method of valuation of assets that helps determine the amount sufficient to replace lost assets and cover transaction costs. In applying this method of valuation, depreciation of structures and assets should not be taken into account (for a detailed definition of replacement cost, see Annex A, footnote 1). For losses that cannot easily be valued or compensated for in monetary terms (i.e., access to public services, customers, and suppliers, or to fishing, grazing, or forest access, attempts are made to establish access to equivalent and culturally acceptable resources and opportunities. Where domestic law does not meet the standard of compensation at replacement cost, compensation under domestic law is supplemented by additional measures necessary to meet the replacement cost standard. Such additional assistance is distinct from resettlement assistance to be provided under other clauses of para. 6.

12. If the residual of the asset being taken is not economically viable, compensation and other resettlement assistance are provided as if the entire asset had been taken.

13. The alternative assets provided with adequate tenure arrangements. The cost of alternative residential housing, housing sites, business premises, and agricultural sites to be provided can be set off against all or part of the compensation payable for the corresponding asset lost.

14. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.
delineated, and systematic and continuous dissemination subsequent to the delineation to prevent further population influx.

22. For projects that are highly risky or contentious, or that involve significant and complex resettlement activities, the borrower should normally engage an advisory panel of independent, internationally recognized resettlement specialists to advise on all aspects of the project relevant to the resettlement activities. The size, role, and frequency of meetings depend on the complexity of the resettlement. If independent technical advisory panels are established under OP 4.01 Environmental Assessment, the resettlement panel may form part of the environmental panel of experts.


24. An exception to this requirement may be made in highly unusual circumstances (such as emergency recovery operations) with the approval of Bank Management (see BL 4.12, para. 8). In such cases, the Management's approval stipulates a timetable and budget for developing the resettlement plan.

25. Impacts are considered "minor" if the affected people are not physically displaced and less than 10% of their productive assets are lost.

26. For purpose of this paragraph, the term "subprojects" includes components and subcomponents.
Involuntary Resettlement

Note: OP and BP 4.12 together replace OD 4.30, Involuntary Resettlement. This OP and BP apply to all projects for which a Project Concept Review takes place on or after January 1, 2002. Questions may be addressed to the Director, Social Development Department (SDV).

1. The planning of resettlement activities is an integral part of preparation for Bank-assisted projects that cause involuntary resettlement. During project identification, the task team (TT) identifies any potential involuntary resettlement under the project. Throughout project processing, the TT consults the regional social development unit, Legal Vice Presidency (LEG) and, as necessary, the Resettlement Committee (see para. 7 of this BP).

2. When a proposed project is likely to involve involuntary resettlement, the TT informs the borrower of the provisions of OP/BP 4.12. The TT and borrower staff:

(a) assess the nature and magnitude of the likely displacement;

(b) explore all viable alternative project designs to avoid, where feasible, or minimize displacement;

(c) assess the legal framework covering resettlement and the policies of the government and implementing agencies (identifying any inconsistencies between such policies and the Bank's policy);

(d) review past borrower and likely implementing agencies' experience with similar operations;

(e) discuss with the agencies responsible for resettlement the policies and institutional, legal, and consultative arrangements for resettlement, including measures to address any inconsistencies between government or implementing agency policies and Bank policy; and

(f) discuss any technical assistance to be provided to the borrower (see OP 4.12, para. 32).

3. Based on the review of relevant resettlement issues, the TT agrees with the Regional social development unit and LEG on the type of resettlement instrument (resettlement plan, abbreviated resettlement plan, resettlement policy framework, or process framework) and the scope and the level of detail required. The TT conveys these decisions to the borrower and also discusses with the
borrower the actions necessary to prepare the resettlement instrument, agrees on the timing for preparing the resettlement instrument, and monitors progress.

4. The TT summarizes in the Project Concept Document (PCD) and the Project Information Document (PID) available information on the nature and magnitude of displacement and the resettlement instrument to be used, and the TT periodically updates the PID as project planning proceeds.

5. For projects with impacts under para. 3 (a) of OP.4.12, the TT assesses the following during project preparation:

(a) the extent to which project design alternatives and options to minimize and mitigate involuntary resettlement have been considered;

(b) progress in preparing the resettlement plan or resettlement policy framework and its adequacy with respect to OP.4.12, including the involvement of affected groups and the extent to which the views of such groups are being considered;

(c) proposed criteria for eligibility of displaced persons for compensation and other resettlement assistance;

(d) the feasibility of the proposed resettlement measures, including provisions for sites if needed; funding for all resettlement activities, including provision of counterpart funding on an annual basis; the legal framework; and implementation and monitoring arrangements; and

(e) if sufficient land is not available in projects involving displaced persons whose livelihoods are land-based and for whom a land-based resettlement strategy is the preferred option, the evidence of lack of adequate land (OP.4.12, para. 11).

6. For projects with impacts under para. 3 (b) of OP.4.12, the TT assesses the following during project preparation:

(a) the extent to which project design alternatives and options to minimize and mitigate involuntary resettlement have been considered; and

(b) progress in preparing the process framework and its adequacy in respect to OP.4.12, including the adequacy of the proposed participatory approach; criteria for eligibility of displaced persons; funding for resettlement; the legal framework; and implementation and monitoring arrangements.

7. The TT may request a meeting with the Resettlement Committee to obtain endorsement of, or guidance on, (a) the manner in which it proposes to address resettlement issues in a project, or (b) clarifications on the application and scope of this policy. The Committee, chaired by the vice president responsible for resettlement, includes the Director, Social Development Department, a representative from LEQ, and two representatives from Operations, one of whom is from the sector of the project being discussed. The Committee is guided by the policy and, among other sources, the Involuntary Resettlement Sourcebook, which will be regularly updated to reflect good practice.
8. The borrower submits to the Bank a resettlement plan, a resettlement policy framework, or a process framework that conform with the requirements of OP 4.12, as a condition of appraisal for projects involving involuntary resettlement (see OP 4.12, paras. 17-31). Appraisal may be authorized before the plan is completed in highly unusual circumstances (such as emergency recovery operations) with the approval of the Managing Director in consultation with the Resettlement Committee. In such cases, the TT agrees with the borrower on a timetable for preparing and furnishing to the Bank the relevant resettlement instrument that conforms with the requirements of OP 4.12.

9. Once the borrower officially transmits the draft resettlement instrument to the Bank, Bank staff—including the Regional resettlement specialists and the lawyer—review it, determine whether it provides an adequate basis for project appraisal, and advise the Regional sector management accordingly. Once approval for appraisal has been granted by the Country Director, the TT sends the draft resettlement instrument to the Bank’s InfoShop. The TT also prepares and sends the English language executive summary of the draft resettlement instrument to the Corporate Secretariat, under cover of a transmittal memorandum confirming that the executive summary and the draft resettlement instrument are subject to change during appraisal.

10. During project appraisal, the TT assesses (a) the borrower’s commitment to and capacity for implementing the resettlement instrument; (b) the feasibility of the proposed measures for improvement or restoration of livelihoods and standards of living; (c) availability of adequate counterpart funds for resettlement activities; (d) significant risks, including risk of impoverishment, from inadequate implementation of the resettlement instrument; (e) consistency of the proposed resettlement instrument with the Project Implementation Plan; and (f) the adequacy of arrangements for internal, and if considered appropriate by the TT, independent monitoring and evaluation of the implementation of the resettlement instrument. The TT obtains the concurrence of the Regional social development unit and LEG to any changes to the draft resettlement instrument during project appraisal. Appraisal is complete only when the borrower officially transmits to the Bank the final draft resettlement instrument conforming to Bank policy (OP 4.12).

11. In the Project Appraisal Document (PAD), the TT describes the resettlement issues, proposed resettlement instrument and measures, and the borrower’s commitment to and institutional and financial capacity for implementing the resettlement instrument. The TT also discusses in the PAD the feasibility of the proposed resettlement measures and the risks associated with resettlement implementation. In the annex to the PAD, the TT summarizes the resettlement provisions, covering, inter alia, basic information on affected populations, resettlement measures, institutional arrangements, timetable, budget, including adequate and timely provision of counterpart funds, and performance monitoring indicators. The PAD annex shows the overall cost of resettlement as a distinct part of project costs.

12. The project description in the Loan Agreement describes the resettlement component or subcomponent. The legal agreements provide for the borrower’s obligation to carry out the relevant resettlement instrument and keep the Bank informed of project implementation progress. At negotiations, the borrower and the Bank agree on the resettlement plan or resettlement policy framework or process framework. Before presenting the project to the Board, the TT confirms that the responsible authority of the borrower and any implementation agency have provided final approval of the relevant resettlement instrument.
Supervision

13. Recognizing the importance of close and frequent supervision[^9] to good resettlement outcomes, the Regional vice president, in coordination with the relevant country director, ensures that appropriate measures are established for the effective supervision of projects with involuntary resettlement. For this purpose, the country director allocates dedicated funds to adequately supervise resettlement, taking into account the magnitude and complexity of the resettlement component or subcomponent and the need to involve the requisite social, financial, legal, and technical experts. Supervision should be carried out with due regard to the Regional Action Plan for Resettlement Supervision.[^10]

14. Throughout project implementation the TL supervises the implementation of the resettlement instrument ensuring that the requisite social, financial, legal, and technical experts are included in supervision missions. Supervision focuses on compliance with the legal instruments, including the Project Implementation Plan and the resettlement instrument, and the TT discusses any deviation from the agreed instruments with the borrower and reports it to Regional Management for prompt corrective action. The TT regularly reviews the internal, and where applicable, independent monitoring reports to ensure that the findings and recommendations of the monitoring exercise are being incorporated in project implementation. To facilitate a timely response to problems or opportunities that may arise with respect to resettlement, the TT reviews project resettlement planning and implementation during the early stages of project implementation. On the basis of the findings of this review, the TT engages the borrower in discussing and, if necessary, amending the relevant resettlement instrument to achieve the objectives of this policy.

15. For projects with impacts covered under para. 3(b) of OP 4.12, the TT assesses the plan of action to determine the feasibility of the measures to assist the displaced persons to improve (or at least restore in real terms to pre-project or pre-displacement levels, whichever is higher) their livelihoods with due regard to the sustainability of the natural resource, and accordingly informs the Regional Management, the Regional social development unit, and LEG. The TL makes the plan of action available to the public through the InfoShop.

16. A project is not considered complete—and Bank supervision continues—until the resettlement measures set out in the relevant resettlement instrument have been implemented. Upon completion of the project, the Implementation Completion Report (ICR)[^11] evaluates the achievement of the objectives of the resettlement instrument and lessons for future operations and summarizes the findings of the borrower's assessment referred to in OP 4.12, para. 24.[^12] If the evaluation suggests that the objectives of the resettlement instrument may not be realized, the ICR assesses the appropriateness of the resettlement measures and may propose a future course of action, including, as appropriate, continued supervision by the Bank.

Country Assistance Strategy

17. In countries with a series of operations requiring resettlement, the ongoing country and sector dialogue with the government should include any issues pertaining to the country's policy, institutional, and legal framework for resettlement. Bank staff should reflect these issues in country economic and sector work and in the Country Assistance Strategy.
1. "Bank" includes IBRD and IDA; "loans" includes IDA credits and IDA grants, guarantees, Project Preparation Facility (PPF) advances, and grants; and "projects" includes projects under (a) adaptable program lending; (b) learning and innovation loans; (c) PPFs and Institutional Development Funds (IDFs), if they include investment activities; (d) grants under the Global Environment Facility and Montreal Protocol for which the Bank is the implementing/executing agency; and (e) grants or loans provided by other donors that are administered by the Bank. The term "project" does not include programs under development policy lending operations. "Borrower" also includes, wherever the context requires, the guarantor or the project implementing agency.


3. Unit or department in the Region responsible for resettlement issues.

4. The Bank satisfies itself that the borrower has explored all viable alternative project designs to avoid involuntary resettlement and, when it is not feasible to avoid such resettlement, to minimize the scale and impacts of resettlement (for example, realignment of roads or reduction in dam height may reduce resettlement needs). Such alternative designs should be consistent with other Bank policies.

5. Such actions may include, for example, developing procedures for establishing eligibility for resettlement assistance, conducting socioeconomic surveys and legal analyses; carrying out public consultation; identifying resettlement sites; evaluating options for improvement or restoration of livelihoods and standards of living; or, in the case of highly risky or contentious projects, engaging a panel of independent, internationally recognized resettlement specialists.


7. For projects with impacts covered under para. 3 (b) of OP 4.12, the analysis referred to in (b) and (d) above is carried out when the plan of action is furnished to the Bank (see para. 15 of this BP).

8. In case of resettlement policy framework, the borrower's obligation also includes preparing a resettlement plan in accordance with the framework, for each sub-project giving rise to displacement, and furnishing it to be the Bank for approval prior to implementation of the sub-project.

9. See OP/IBP 13.05, Project Supervision.

10. The Plan is prepared by the regional social development unit in consultation with the TI's and Legal.


12. The ICR's assessment of the extent to which resettlement objectives were realized is normally based on a socioeconomic survey of affected people conducted at the time of project completion, and takes into account the extent of displacement, and the impact of the project on the livelihoods of displaced persons and any host communities.
Forests

Note: OP and BP 4.36, Forests, replace OP and BP 4.36, Forestry, dated September 1993, and are based on a Revised Forests Strategy for the World Bank Group, endorsed by the Board of Executive Directors on October 31, 2002. Other related Bank policies include OP 4.01, Environmental Assessment, OP 4.04, Natural Habitats, OP 4.10, Indigenous Peoples, OP 4.11 (forthcoming), Management of Cultural Property in Bank-Financed Projects, and OP 4.12, Involuntary Resettlement. These OP and BP apply to all projects for which a Project Concept Review takes place after January 1, 2003. Questions may be addressed to the Director, Rural Development Department, or the Director, Environment Department, ESSD.

1. When the Bank identifies the potential for its Country Assistance Strategy (CAS) to have a significant impact upon forests, the country department ensures that the forest-related concerns are appropriately addressed in the CAS.

Project Preparation

2. Early in project processing, the task team (TT) consults with the Regional environmental sector unit and, as necessary, with ESSD and other Networks to identify forest issues likely to arise during the project.

3. For each project covered under the scope of the policy as set forth in OP 4.36, para. 3, Bank staff ensure that an EA category is assigned in accordance with the requirements of OP/BP 4.01, Environmental Assessment. A project with the potential for conversion or degradation of natural forests or other natural habitats that is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented is classified as Category A; projects otherwise involving forests or other natural habitats are classified as Category B, C, or F1, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its environmental impacts.1

4. During project preparation, the TT ensures that the borrower provides the Bank with an assessment of the adequacy of land use allocations for the management, conservation, and sustainable development of forests, including any additional allocations needed to protect critical forest areas. This assessment provides an inventory of such critical forest areas, and is undertaken at a spatial scale that is ecologically, socially, and culturally appropriate for the forest area in which the project is located. The assessment involves all affected parties in accordance with OP 4.04, Natural Habitats, and is subject to independent scientific peer review.3 In addition, in accordance with OP 4.12, Involuntary Resettlement, and OP/BP 4.10, Indigenous Peoples, the TT ensures that the borrower assesses the potential impact of the project on local communities, including their legal rights of access to, and use of, designated forest areas. If the project involves investments in forests under OP 4.36, para. 12, the TT ensures that the borrower also assesses the feasibility of giving preference to small-scale, community level harvesting approaches to harness the potential of forests to reduce poverty in a sustainable manner.

Harvesting Operations

5. If the project involves harvesting operations to be financed by the Bank under OP 4.36, paras. 9(b)
Environmental Management Plan

1. A project's environmental management plan (EMP) consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures. Management plans are essential elements of EA reports for Category A projects; for many Category B projects, the EA may result in a management plan only. To prepare a management plan, the borrower and its EA design team (a) identify the set of responses to potentially adverse impacts; (b) determine requirements for ensuring that those responses are made effectively and in a timely manner; and (c) describe the means for meeting those requirements. More specifically, the EMP includes the following components:

Mitigation

2. The EMP identifies feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective, or sufficient. Specifically, the EMP

(a) identifies and summarizes all anticipated significant adverse environmental impacts (including those involving Indigenous Peoples or involuntary resettlement);

(b) describes—with technical details—each mitigation measure, including the type of impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies), together with designs, equipment descriptions, and operating procedures, as appropriate;

(c) estimates any potential environmental impacts of these measures; and

(d) provides linkage with any other mitigation plans (e.g., for involuntary resettlement, Indigenous Peoples, or cultural property) required for the project.

Monitoring

3. Environmental monitoring during project implementation provides information about key environmental aspects of the project, particularly the environmental impacts of the project and the effectiveness of mitigation measures. Such information enables the borrower and the Bank to evaluate the success of mitigation as part of project supervision, and allows corrective action to be taken when needed. Therefore, the EMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed in the EA report and the mitigation measures described in the EMP. Specifically, the monitoring section of the EMP provides

(a) a specific description, and technical details, of monitoring measures, including the parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions; and
monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

**Capacity Development and Training**

4. To support timely and effective implementation of environmental project components and mitigation measures, the EMP draws on the EA’s assessment of the existence, role, and capability of environmental units on site or at the agency and ministry level. If necessary, the EMP recommends the establishment or expansion of such units, and the training of staff, to allow implementation of EA recommendations. Specifically, the EMP provides a specific description of institutional arrangements—who is responsible for carrying out the mitigatory and monitoring measures (e.g., for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training). To strengthen environmental management capability in the agencies responsible for implementation, most EMPs cover one or more of the following additional topics: (a) technical assistance programs, (b) procurement of equipment and supplies, and (c) organizational changes.

**Implementation Schedule and Cost Estimates**

5. For all three aspects (mitigation, monitoring, and capacity development), the EMP provides (a) an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project implementation plans; and (b) the capital and recurrent cost estimates and sources of funds for implementing the EMP. These figures are also integrated into the total project cost tables.

**Integration of EMP with Project**

6. The borrower’s decision to proceed with a project, and the Bank’s decision to support it, are predicated in part on the expectation that the EMP will be executed effectively. Consequently, the Bank expects the plan to be specific in its description of the individual mitigation and monitoring measures and its assignment of institutional responsibilities, and it must be integrated into the project’s overall planning, design, budget, and implementation. Such integration is achieved by establishing the EMP within the project so that the plan will receive funding and supervision along with the other components.

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1. The management plan is sometimes known as an “action plan.” The EMP may be presented as two or three separate plans covering mitigation, monitoring, and institutional aspects, depending on borrowing country requirements.

2. For projects involving rehabilitation, upgrading, expansion, or privatization of existing facilities, remediation of existing environmental problems may be more important than mitigation and monitoring of expected impacts. For such projects, the management plan focuses on cost-effective measures to remediate and manage these problems.

3. For projects having significant environmental implications, it is particularly important that there be the implementing ministry or agency an in-house environmental unit with adequate budget and professional staffing strong in expertise relevant to the project (for projects involving dams and reservoirs, see [OP 4.01, Annex B]).
Application of EA to Projects Involving Pest Management

Sector Review

1. The task team (TT) ensures that any environmental assessment (EA) of the agriculture or health sector evaluates the country's capacity to manage the procurement, handling, application, and disposal of pest control products; to monitor the precision of pest control and the impact of pesticide use; and to develop and implement ecologically based pest management programs.

Project EA

2. During project identification, the TT assesses whether the proposed project may raise potential pest management issues. Projects that include the manufacture, use, or disposal of environmentally significant quantities of pest control products are classified as Category A. Depending on the level of environmental risk, other projects involving pest management issues are classified as A, B, C, or D. When substantial quantities of highly toxic pesticide materials for use under the project are transported or stored, a hazard assessment may be appropriate.

3. The TT records in the Project Concept Document (PCD) and the initial Project Information Document (PID) any pest management issues that the EA will address. For Category A projects, the TT reports in the Monthly Operational Summary for Bank and IDA Proposed Projects (MOS) whether the project (a) will finance procurement of pest control products directly or will provide credit that may be used to purchase pest control products (and whether any specific products are excluded from financing), (b) will finance goods or services that significantly change pesticide use patterns, or (c) includes components—including support for development and implementation of integrated pest management (IPM) programs—aimed at reducing environmental and health hazards associated with pest control and the use of pesticides.

4. The TT ensures that the EA covers potential issues related to pest management and considers appropriate alternative designs or mitigation measures. Depending on the issues identified, the environmental management plan includes a pest management plan.

Pest Management Plan

5. A pest management plan is a comprehensive plan, developed when there are significant pest management issues such as (a) new land-use development or changed cultivation practices in an area, (b) significant expansion into new areas, (c) diversification into new crops in agriculture, (d) intensification of existing low-technology systems, (e) proposed procurement of relatively hazardous pest control products or methods, or (f) specific environmental or health concerns (e.g., proximity of...
protected areas or important aquatic resources; worker safety). A pest management plan is also developed when proposed financing of pest control products represents a large component of the project. 6

6. A pest management plan reflects the policies set out in OP 4.09, Pest Management. The plan is designed to minimize potential adverse impacts on human health and the environment and to advance ecologically based IPM. The plan is based on on-site evaluations of local conditions conducted by appropriate technical specialists with experience in participatory IPM. The first phase of the plan—an initial reconnaissance to identify the main pest problems and their contexts (ecological, agricultural, public health, economic, and institutional) and to define broad parameters—is carried out as part of project preparation and is evaluated at appraisal. The second phase—development of specific operational plans to address the pest problems identified—is often carried out as a component of the project itself. As appropriate, the pest management plan specifies procedures for screening pest control products. In exceptional cases, the pest management plan may consist of pest control product screening only. 7

Screening of Pest Control Products

7. Pest control product screening is required when a project finances pest control products. The screening establishes an authorized list of pest control products approved for financing, along with a mechanism to ensure that only the specified products will be procured with Bank funds. Screening without a pest management plan is appropriate only when all of the following conditions are met: (a) expected quantities of pest control products are not significant from a health or environment standpoint; (b) no significant environmental or health concerns related to pest control need to be addressed; (c) the project will not introduce pesticide use or other nonindigenous biological control into an area, or significantly increase the level of pesticide use; and (d) no hazardous products 8 will be financed.

Appraisal

8. Depending on the complexity of the issues involved and the degree of risk to human health or the environment, the appraisal mission includes appropriate technical specialists.

9. The TT records in the Project Appraisal Document (PAD) pest management concerns arising from the EA and any proposed project interventions pertinent to pest management, for example:

   (a) a list of pest control products authorized for procurement, or an indication of when and how this list will be developed and agreed on;

   (b) existing pest management practices; pesticide use; the policy, economic, institutional, and legal framework for regulating, procuring, and managing pesticides; and the extent to which all these are consistent with an IPM approach;

   (c) proposed project activities (or ongoing parallel activities, including other projects supported by the Bank or other donors) aimed at addressing (i) the shortcomings identified, and (ii) any constraints to adopting IPM;

   (d) proposed mechanisms for financing, implementing, monitoring, and supervising components relating to pest management or pesticide use, including any role envisaged for local nongovernmental organizations;
(e) the capacity of responsible institutions to carry out the activities described; and

(f) the overall sectoral context and other issues that will not be directly addressed under the project but that should be addressed as long-term objectives.

10. The main elements of the pest management measures are reflected in the legal agreements between the borrower and the Bank.²

Supervision and Evaluation

11. Depending on the nature and complexity of the pest management and pesticide-related issues confirmed at appraisal, supervision missions may need to include appropriate technical specialists. This need is reflected in the supervision plan.

12. The Implementation Completion Report evaluates the environmental impact of pest management practices supported or promoted by the project, as well as the borrower's institutional oversight capacity. It also discusses whether the project has resulted in improved pest management practices according to the criteria that define the IPM approach.

1. For the purposes of this statement, "environmental significance" takes into account the impacts (including benefits) on human health.
2. For environmental screening, see OP 4.01, para. 8.
3. For definitions, see OP 4.01, Annex A.
4. See OP 4.01, Annex C.
5. Particularly such crops as cotton, vegetables, fruits, and rice, which are often associated with heavy use of pesticides.
6. A pest management plan is not required for the procurement or use of impregnated bednets for malaria control, or of WHO Class III insecticides for intradomestic spraying for malaria control.
7. Bank staff can access more information from the BDV website.
8. Hazardous products include pesticides listed in Class 1a and 1b of the World Health Organization (WHO) Classification of Pesticides by Hazard and Guidelines to Classification (Geneva: WHO, 1994-95); materials listed in the UN Consolidated List of Products Whose Consumption and/or Sale have been Banned, Withdrawn, Severely Restricted, or not Approved by Governments (New York: UN, 1994); and other materials that are banned or severely restricted in the borrower country because of environmental or health hazards (see the country's national pesticide registration list, if it has one). Copies of the WHO classification and UN list, which are updated periodically, are available in the Bank's Sectoral Library. Staff may consult the Rural Development Department for further guidance.
9. Loan conditionality may be needed to ensure the effective implementation of project components; for example, (a) establishing or strengthening pesticide regulatory and monitoring framework and capabilities, (b) properly operating and/or constructing pesticide storage or disposal facilities, (c) agreeing on a time-bound program to phase out use of an undesirable pesticide and properly dispose of any existing stocks, or (d) initiating research or extension programs aimed at providing alternatives to undesirable pesticide use.
Natural Habitats

This Operational Policy statement was revised in August 2004 to reflect the term "development policy lending" (formerly adjustment lending), in accordance with OP/BP 8.60, issued in August 2004.

1. The conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions in its economic and sector work, project financing, and policy dialogue. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

Economic and Sector Work

2. The Bank's economic and sector work includes identification of (a) natural habitat issues and special needs for natural habitat conservation, including the degree of threat to identified natural habitats (particularly critical natural habitats), and (b) measures for protecting such areas in the context of the country's development strategy. As appropriate, Country Assistance Strategies and projects incorporate findings from such economic and sector work.

Project Design and Implementation

3. The Bank promotes and supports natural habitat conservation and improved land use by financing projects designed to integrate into national and regional development the conservation of natural habitats and the maintenance of ecological functions. Furthermore, the Bank promotes the rehabilitation of degraded natural habitats.

4. The Bank does not support projects that, in the Bank's opinion, involve the significant conversion or degradation of critical natural habitats.

5. Wherever feasible, Bank-financed projects are sited on lands already converted (excluding any lands that in the Bank's opinion were converted in anticipation of the project). The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall...
benefits from the project substantially outweigh the environmental costs. If the environmental assessment indicates that a project would significantly convert or degrade natural habitats, the project includes mitigation measures acceptable to the Bank. Such mitigation measures include, as appropriate, minimizing habitat loss (e.g., strategic habitat retention and post-development restoration) and establishing and maintaining an ecologically similar protected area. The Bank accepts other forms of mitigation measures only when they are technically justified.

6. In deciding whether to support a project with potential adverse impacts on a natural habitat, the Bank takes into account the borrower’s ability to implement the appropriate conservation and mitigation measures. If there are potential institutional capacity problems, the project includes components that develop the capacity of national and local institutions for effective environmental planning and management. The mitigation measures specified for the project may be used to enhance the practical field capacity of national and local institutions.

7. In projects with natural habitat components, project preparation, appraisal, and supervision arrangements include appropriate environmental expertise to ensure adequate design and implementation of mitigation measures.

8. This policy applies to subprojects under sectoral loans or loans to financial intermediaries. Regional environmental sector units oversee compliance with this requirement.

**Policy Dialogue**

9. The Bank encourages borrowers to incorporate into their development and environmental strategies analyses of any major natural habitat issues, including identification of important natural habitat sites, the ecological functions they perform, the degree of threat to the sites, priorities for conservation, and associated recurrent-funding and capacity-building needs.

10. The Bank expects the borrower to take into account the views, roles, and rights of groups, including local nongovernmental organizations and local communities, affected by Bank-financed projects involving natural habitats, and to involve such people in planning, designing, implementing, monitoring, and evaluating such projects. Involvement may include identifying appropriate conservation measures, managing protected areas and other natural habitats, and monitoring and evaluating specific projects. The Bank encourages governments to provide such people with appropriate information and incentives to protect natural habitats.

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1. See definitions in Annex A.
2. “Bank” includes IBRD and IDA. “Loans” includes IDA credits and IDA grants. “Borrower” includes, for guarantee operations, a private or public project sponsor receiving from another financial institution a loan guaranteed by the Bank; and “project” includes all operations financed by Bank loans (including projects under adaptable lending—adaptable program loans [APLs] and learning and innovation loans [LILs]) or guarantees except programs supported under development policy lending (with respect to which environmental considerations are set out in OP 1110 § 60, Development Policy Lending) and debt and debt service operations. The project financed by a Bank loan is described in Schedule 2 to the Loan/Development Credit Agreement for that project. The term project includes all components of the project, regardless of the source of financing. The term “project” also includes projects and components funded under the Global Environment Facility (GEF), but does not include GEF projects executed by organizations identified by the GEF Council as eligible to work with the GEF through expanded opportunities for project preparation and implementation (such organizations include, inter alia, regional development banks and UN agencies such as FAO and UNIDO).
3. For definitions, see Annex A.
Natural Habitats

This Bank Procedures statement was revised in August 2004 to reflect the term “development policy lending” (formerly adjustment lending), in accordance with OP/BP 5 60, issued in August 2004.

Project Processing

Project Preparation

1. Early in the preparation of a project proposed for Bank financing, the task team leader (TL) consults with the Regional environmental sector unit (RESU) and, as necessary, with the Environment Department (ENV) and the Legal Vice Presidency (LEG) to identify natural habitat issues likely to arise in the project.

2. If, as part of the environmental assessment process, environmental screening indicates the potential for significant conversion or degradation of critical or other natural habitats, the project is classified as Category A; projects otherwise involving natural habitats are classified as Category A or B, depending on the degree of their ecological impacts.

3. Other forms of mitigation measures referred to in the last sentence of OP 4.04, para. 5 are accepted only after consultation with the RESU, ENV and LEG, and approval by the Regional vice president (RVP).

4. Natural habitat components of a project are linked as appropriate to the schedule of implementation for the project. The costs of conservation of any compensatory natural habitats are included in the project's financing. Mechanisms to ensure adequate recurrent cost financing are incorporated into project design.

Documentation

5. The TL identifies any natural habitat issues (including any significant conversion or degradation that would take place under the project, as well as any other forms of mitigation measures proposed under the last sentence of OP 4.04, para. 5) in the initial Project Information Document (PID) and in the early versions of the Environmental Data Sheet. Updated PIDs reflect changes in the natural
habitat issues. The Project Appraisal Document indicates the types and estimated areas (in hectares) of affected natural habitats; the significance of the potential impacts; the project's consistency with national and regional land use and environmental planning initiatives, conservation strategies, and legislation; and the mitigation measures planned.

6. The Implementation Completion Report assesses the extent to which the project achieved its environmental objectives, including natural habitat conservation.

Regional and Sectoral EA Reports

7. Bank staff identify relevant natural habitat issues for regional and sectoral environmental assessment (EA) reports. Such reports indicate the present location of natural habitats in the region or sector involved, analyze the ecological functions and relative importance of such natural habitats, and describe the associated management issues. These analyses are used in subsequent project-specific environmental screening and other EA work.

Role of Bank Staff

8. RESUs coordinate the preparation and use of any supplementary critical natural habitat lists and assist with project preparation (including EA) and supervision when requested. ENV guides TLs, country departments, and RESUs in implementing OP.4.04 by disseminating best practices and providing training, reviews, advice, and operational support (including supervision).

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1. "Bank" includes IBRD and IDA. "Loans" includes IDA credits and IDA grants. "Borrower" includes for guaranteed operations, a private or public project sponsor receiving from another financial institution a loan guaranteed by the Bank; and "project" includes all operations financed by Bank loans (including projects under adaptable lending, adaptable program loans [APLOs], and learning and innovation loans [LILs]) or guarantees except programs supported under development policy lending (with respect to which environmental considerations are set out in OP/IBP.680, Development Policy Lending) and debt and debt service operations. The project financed by a Bank loan is described in Schedule 2 to the Loan/Development Credit Agreement for that project. The term project includes all components of the project, regardless of the source of financing. The term project also includes projects and components funded under the Global Environment Facility (GEF), but does not include GEF projects executed by organizations identified by the GEF Council as eligible to work with the GEF through expanded opportunities for project preparation and implementation (such organizations include, inter alia, regional development banks and UN agencies such as FAO and UNIDO).

2. See OP.4.01. Environmental Assessment.


Involuntary Resettlement

This Operational Policy statement was revised in April 2004 to ensure consistency with the requirements of OP/BP 6.00, issued in April 2004. These changes may be viewed here.

OP 4.12 (revised April 2004) applies only to projects that are governed by OP/BP 6.00, Bank Financing - that is, those in countries with approved country financing parameters. Other operational policy statements governing Bank financing that have been amended to reflect OP/BP 6.00 also apply to these projects, click here to view a full Table of Contents (blue).

Projects in countries without approved country financing parameters continue to be subject to other operational policy statements governing Bank financing, click here for a full Table of Contents (yellow) that includes these statements.

Note: OP and BP 4.12 together replace OP 4.30, Involuntary Resettlement. These OP and BP apply to all projects for which a Project Concept Review takes place on or after January 1, 2002. Questions may be addressed to the Director, Social Development Department (SDV).

1. Bank experience indicates that involuntary resettlement under development projects, if unmitigated, often gives rise to severe economic, social, and environmental risks. Production systems are dismantled; people face impoverishment when their productive assets or income sources are lost; people are relocated to environments where their productive skills may be less applicable and the competition for resources greater; community institutions and social networks are weakened; kin groups are dispersed, and cultural identity, traditional authority, and the potential for mutual help are diminished or lost. This policy includes safeguards to address and mitigate these impoverishment risks.

Policy Objectives

2. Involuntary resettlement may cause severe long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out. For these reasons, the overall objectives of the Bank's policy on involuntary resettlement are the following:

(a) Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs.
(b) Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits. Displaced persons should be meaningfully consulted and should have opportunities to participate in planning and implementing resettlement programs.
(c) Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.
Impacts Covered

3. This policy covers direct economic and social impacts\(^5\) that both result from Bank-assisted investment projects,\(^6\) and are caused by

(a) the involuntary\(^2\) taking of land\(^8\) resulting in
   (i) relocation or loss of shelter;
   (ii) loss of assets or access to assets; or
   (iii) loss of income sources or means of livelihood, whether or not the affected persons must move to another location; or

(b) the involuntary restriction of access\(^9\) to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

4. This policy applies to all components of the project that result in involuntary resettlement, regardless of the source of financing. It also applies to other activities resulting in involuntary resettlement that in the judgment of the Bank, are (a) directly and significantly related to the Bank-assisted project, (b) necessary to achieve its objectives as set forth in the project documents; and (c) carried out, or planned to be carried out, contemporaneously with the project.

5. Requests for guidance on the application and scope of this policy should be addressed to the Resettlement Committee (see OP 412, para. 7).\(^10\)

Required Measures

6. To address the impacts covered under para. 3 (a) of this policy, the borrower prepares a resettlement plan or a resettlement policy framework (see paras. 25-30) that covers the following:

(a) The resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are
   (i) informed about their options and rights pertaining to resettlement.
   (ii) consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives; and
   (iii) provided prompt and effective compensation at full replacement cost\(^11\) for losses of assets\(^12\) attributable directly to the project.

(b) If the impacts include physical relocation, the resettlement plan or resettlement policy framework includes measures to ensure that the displaced persons are
   (i) provided assistance (such as moving allowances) during relocation; and
   (ii) provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site.\(^13\)

(c) Where necessary to achieve the objectives of the policy, the resettlement plan or resettlement policy framework also include measures to ensure that displaced persons are

(i) offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living;\(^{14}\) and

(ii) provided with development assistance in addition to compensation measures described in paragraph 6(a) (iii), such as land preparation, credit facilities, training, or job opportunities.

7. In projects involving involuntary restriction of access to legally designated parks and protected areas (see para. 3(b)), the nature of restrictions, as well as the type of measures necessary to mitigate adverse impacts, is determined with the participation of the displaced persons during the design and implementation of the project. In such cases, the borrower prepares a process framework acceptable to the Bank, describing the participatory process by which

(a) specific components of the project will be prepared and implemented;

(b) the criteria for eligibility of displaced persons will be determined;

(c) measures to assist the displaced persons in their efforts to improve their livelihoods, or at least to restore them, in real terms, while maintaining the sustainability of the park or protected area, will be identified; and

(d) potential conflicts involving displaced persons will be resolved.

The process framework also includes a description of the arrangements for implementing and monitoring the process.

8. To achieve the objectives of this policy, particular attention is paid to the needs of vulnerable groups among those displaced, especially those below the poverty line, the landless, the elderly, women and children, indigenous peoples\(^{15}\), ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.

9. Bank experience has shown that resettlement of indigenous peoples with traditional land-based modes of production is particularly complex and may have significant adverse impacts on their identity and cultural survival. For this reason, the Bank satisfies itself that the borrower has explored all viable alternative project designs to avoid physical displacement of these groups. When it is not feasible to avoid such displacement, preference is given to land-based resettlement strategies for these groups (see para. 3(b)) that are compatible with their cultural preferences and are prepared in consultation with them (see Annex A, para. 11).

10. The implementation of resettlement activities is linked to the implementation of the investment component of the project to ensure that displacement or restriction of access does not occur before necessary measures for resettlement are in place. For impacts covered in para. 3(a) of this policy, these measures include provision of compensation and of other assistance required for relocation, prior to displacement, and preparation and provision of resettlement sites with adequate facilities, where required. In particular, taking of land and related assets may take place only after compensation has been paid and, where applicable, resettlement sites and moving allowances have been provided to the displaced persons. For impacts covered in para. 3(b) of this policy, the measures to assist the displaced persons are implemented in accordance with the plan of action as part of the project (see para. 30).

11. Preference should be given to land-based resettlement strategies for displaced persons whose
livelihoods are land-based. These strategies may include resettlement on public land (see footnote 1 above), or on private land acquired or purchased for resettlement. Whenever replacement land is offered, resettlers are provided with land for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the land taken. If land is not the preferred option of the displaced persons, the provision of land would adversely affect the sustainability of a park or protected area, or sufficient land is not available at a reasonable price. Non-land-based options built around opportunities for employment or self-employment should be provided in addition to cash compensation for land and other assets lost. The lack of adequate land must be demonstrated and documented to the satisfaction of the Bank.

12. Payment of cash compensation for lost assets may be appropriate where (a) livelihoods are land-based but the land taken for the project is a small fraction\(^\text{12}\) of the affected asset and the residual is economically viable; (b) active markets for land, housing, and labor exist, displaced persons use such markets, and there is sufficient supply of land and housing; or (c) livelihoods are not land-based. Cash compensation levels should be sufficient to replace the lost land and other assets at full replacement cost in local markets.

13. For impacts covered under para. 3(a) of this policy, the Bank also requires the following:

(a) Displaced persons and their communities, and any host communities receiving them, are provided timely and relevant information, consulted on resettlement options, and offered opportunities to participate in planning, implementing, and monitoring resettlement. Appropriate and accessible grievance mechanisms are established for these groups.

(b) In new resettlement sites or host communities, infrastructure and public services are provided as necessary to improve, restore, or maintain accessibility and levels of service for the displaced persons and host communities. Alternative or similar resources are provided to compensate for the loss of access to community resources (such as fishing areas, grazing areas, fuel, or ladder).

(c) Patterns of community organization appropriate to the new circumstances are based on choices made by the displaced persons. To the extent possible, the existing social and cultural institutions of resettlers and any host communities are preserved and resettlers' preferences with respect to relocating in preexisting communities and groups are honored.

Eligibility for Benefits\(^\text{18}\)

14. Upon identification of the need for involuntary resettlement in a project, the borrower carries out a census to identify the persons who will be affected by the project (see the Appendix A, para. 6(a)), to determine who will be eligible for assistance, and to discourage inflow of people ineligible for assistance. The borrower also develops a procedure, satisfactory to the Bank, for establishing the criteria by which displaced persons will be deemed eligible for compensation and other resettlement assistance. The procedure includes provisions for meaningful consultations with affected persons and communities, local authorities, and, as appropriate, nongovernmental organizations (NGOs), and it specifies grievance mechanisms.

15. Criteria for Eligibility. Displaced persons may be classified in one of the following three groups:

(a) those who have formal legal rights to land (including customary and traditional rights recognized under the laws of the country);

(b) those who do not have formal legal rights to land at the time the census begins but
have a claim to such land or assets—provided that such claims are recognized under the laws of the country or become recognized through a process identified in the resettlement plan (see Annex A, para. 7(f)), and 10

(c) those who have no recognizable legal right or claim to the land they are occupying.

16. Persons covered under para. 15(a) and (b) are provided compensation for the land they lose, and other assistance in accordance with para. 6. Persons covered under para. 15(c) are provided resettlement assistance in lieu of compensation for the land they occupy, and other assistance, as necessary, to achieve the objectives set out in this policy, if they occupy the project area prior to a cut-off date established by the borrower and acceptable to the Bank. 21 Persons who encroach on the area after the cut-off date are not entitled to compensation or any other form of resettlement assistance. All persons included in para. 15(a), (b), or (c) are provided compensation for loss of assets other than land.

Resettlement Planning, Implementation, and Monitoring

17. To achieve the objectives of this policy, different planning instruments are used, depending on the type of project:

(a) a resettlement plan or abbreviated resettlement plan is required for all operations that entail involuntary resettlement unless otherwise specified (see para. 25 and Annex A);

(b) a resettlement policy framework is required for operations referred to in paras. 26–30 that may entail involuntary resettlement, unless otherwise specified (see Annex A); and

(c) a process framework is prepared for projects involving restriction of access in accordance with para. 3(b) (see para. 31).

18. The borrower is responsible for preparing, implementing, and monitoring a resettlement plan, a resettlement policy framework, or a process framework (the "resettlement instruments"), as appropriate, that conform to this policy. The resettlement instrument presents a strategy for achieving the objectives of the policy and covers all aspects of the proposed resettlement. Borrower commitment to, and capacity for, undertaking successful resettlement is a key determinant of Bank involvement in a project.

19. Resettlement planning includes early screening, scoping of key issues, the choice of resettlement instrument, and the information required to prepare the resettlement component or subcomponent. The scope and level of detail of the resettlement instruments vary with the magnitude and complexity of resettlement. In preparing the resettlement component, the borrower draws on appropriate social, technical, and legal expertise and on relevant community-based organizations and NGOs. 22 The borrower informs potentially displaced persons at an early stage about the resettlement aspects of the project and takes their views into account in project design.

20. The full costs of resettlement activities necessary to achieve the objectives of the project are included in the total costs of the project. The costs of resettlement, like the costs of other project activities, are treated as a charge against the economic benefits of the project and any net benefits to resettlers (as compared to the "without-project" circumstances) are added to the benefits stream of the project. Resettlement components or free-standing resettlement projects need not be economically viable on their own, but they should be cost-effective.

21. The borrower ensures that the Project Implementation Plan is fully consistent with the resettlement instrument.