REPUBLIC OF YEMEN
MINISTRY OF WATER AND ENVIRONMENT
AND
MINISTRY OF AGRICULTURE AND IRRIGATION

# SECTOR WIDE ENVIRONMENTAL AND SOCIAL ASSESSMENT (SwESA)
## for the Water Sector Support Program

**FINAL REPORT**

**December 2008**

CONSULTING ENGINEERING SERVICES (INDIA) PRIVATE LIMITED NEW DELHI - SANA'A

## ACRONYMS / ABBREVIATIONS

| | |
|---|---|
| % | Percentage |
| A21A | Agenda 21 for Agriculture |
| ACAP | Anti Corruption Action Plan |
| ACGH | American Conference of Government Industrial Hygienist |
| AFPPF | Agriculture and Fisheries Promotion Production Fund |
| AGSIP | Agricultural Long-term Plan |
| AREA | Agricultural Research and Extension Authority |
| CBO | Community Based Organization |
| CES | Consulting Engineering Services, India |
| COCA | Central Organization for Control and Audit |
| CSA | Country Social Analysis |
| CWRAS | Country Water Resources Assistance Strategy |
| dB (A) | Decibel – A weighted instrument |
| DCG | Donor Core Group |
| DFID | Department for International Development |
| DPPR | Development Plan for Poverty Reduction |
| E | East |
| EA | Environmental Assessment |
| EGMA | Enhanced Groundwater Management Areas |
| EMO | Environmental Management Officer |
| EPA | Environmental Protection Authority |
| ESMF | Environmental and Social Management Framework |
| FGD | Focus Group Discussion |
| FMIS | Financial Management Information System (FMIS |
| GARWSP | General Authority of Rural Water and Sanitation Project |
| GDI | General Directorate Of Irrigation |
| GDP | Gross Domestic Product |
| GNP | Gross National Product |
| GOY | Government of Yemen |
| GSCRP | Groundwater and Soil Conservation Project |
| gtz | Deutsche Gesellschaft fuer Technische Zusammenarbeit (German Technical Cooperation) |
| HBS | House Budget Suvey |
| HDI | Human Development Index |
| IDA | International Development Agency |
| IIP | Improved Irrigation Project |
| JAR | Joint Annual Review |
| KfW | Kreditanstalt fuer Wiederaufbau (German Development Bank) |
| KII | Key Informant Interviews |
| $Km^2$ | Square Kilometer |
| $L_{eq}$ | Equivalent Noise Level |
| LWSSCs/LCs | Local Water Supply and Sanitation Corporations |
| M&E | Monitoring and Evaluation |
| MAI | Ministry of Agriculture & Irrigation |
| MDGs | Millennium Development Goals |
| mm | millimeter |
| MOF | Ministry of Finance |
| MOPIC | Ministry of Planning and International Cooperation |
| MTEF | Mid Term Expenditure Framework |
| MWE | Ministry of Water & Environment |
| N | North |
| NEAP | National Environmental Action Plan |
| NGO | Non Governmental Organization |
| NGOs | Non-Governmental Organizations |
| NWRA | National Water Resources Authority |
| NWSSIP | National Water Sector Strategy and Investment Program |
| $^oc$ | Degree Centigrade |
| PAF | Project Affected Family |
| PAP | Project Affected People |
| PAWS | Programmed Aid to the Water Sector (Dutch financing) |
| PCM | Public Consultation Meeting |
| PCU | Project Coordination Unit |
| PIP | Public Investment Program |
| PMU | Project Management Unit |
| PPC | Program Preparation Committee |
| PRSP | Poverty Reduction Strategy Paper |
| PSIA | Poverty and Social Impact Assessment |
| PTOP | Provincial Town Open Program |
| RAP | Resettlement Action Plan |
| RPF | Resettlement Policy Framework |
| SA | Social Assessment |
| SDR | Special Drawing Rights |
| SFYP | Second Financial Year Plan |
| SNACC | Supreme National Authority for Combating Corruption |
| SWAp | Sector-wide approach |
| SwESA/SESA | Sector-wide Environmental and Social Assessment |
| SWUFs | Scheme Water User Federations |
| TDA | Tihama Development Authority |
| TL | Team Leader |
| TOR | Terms of Reference |
| UBC | Uniform Building Code |
| UK | United Kingdom |
| ULCs | Urban Local Corporations |
| UWSSP | Urban Water Supply Project |
| WB | World Bank |
| WEC | Water and Environmental Center |
| WSSP | Water Sector Support Program |
| WUAs | Water Users Associations |
| WUGs | Water Users Groups |

# SECTOR WIDE ENVIRONMENTAL AND SOCIAL ASSESSMENT

## TABLE OF CONTENTS

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The Study team comprised M/s. Syed A. Naqvi (Team Leader/ Environment Expert), J. K Bhattacharya (Institutional Specialist), Dr. D NRao (Environmental Economist), Dr. P K Deb (Environmental Expert), Ms. Sanobar (Social Expert), Mr. Ali Abdulwali M Al-Kutabri (Environmental Expert), Dr. Souad O AbdulRahim (Social Scientist), Dr. Jaffer A Shotah (Legal Expert), and Mr. Syamal Chaudhuri (Project Co-ordinator)

In the end, thanks to the study team who has contributed in preparation of this report.

# EXECUTIVE SUMMARY

## INTRODUCTION

**ES:1** The Republic of Yemen is situated in the Arabian Peninsula, between 12$^{o}$ and 19$^{o}$N Latitude and 42$^{o}$ and 55$^{o}$E Longitude. Area of the country is 460,000Km$^{2}$. The country is bordered by Saudi Arabia in the North, Oman in the East, the Arabian Sea and the Gulf of Aden in the South and Red Sea in the West. The country is administratively divided in twenty one Governorates, in addition to the Capital Secretariat.

**ES:2** Yemen possesses a varied landscape, diversified terrain, and climate. The coastal plain ranges of low and high altitude mountains, many of which are terraced. There are mountains plateaus, hills, and plains. The mountains range from 1000m to 3600m. Green wadis are the riverbeds for rainwater runoff during the two rainy seasons. The desert extends eastward and northward.

**ES:3** The climate of the country has high temperatures and humidity during summer and moderate weather during winter. Moderate weather prevails in the western slopes, plateaus and flat lands. Temperatures vary between 10$^{0}$ and 30$^{o}$C, falling below 0$^{o}$C during peak winter. The annual rainfall ranges between 300mm and 1000 mm. In eastern Yemen, temperature exceeds 40$^{o}$C during summer and varies between 10$^{0}$ and15$^{o}$C during winter. The annual rainfall is about 100mm and Yemen is affected by monsoon winds blowing from the east with low air pressures from the west, accompanied by rain in summer and less rains in winter.

**ES:4** **Water Sector Context.** By world standards, Yemen is a country poorly endowed with water resources. There are essentially two major problems. First, groundwater is running out, and the large part of the rural economy dependent on the groundwater resource is consequently under threat. Second, Yemeni settlements are quite poorly provided with safe water and sanitation services. Government has been aware of these reform challenges for a number of years, and has over the last fifteen years taken some significant institutional steps. In 2003, the Ministry of Water and Environment (MWE) initiated a multi-stakeholder participatory process of preparing and launching a consolidated strategy, action plan and investment program for the water sector as a whole – the National Water Sector Strategy and Investment Program 2005-9 (NWSSIP). NWSSIP was validated in a series of workshops and adopted and published by government in 2004

**ES:5** The Government of Yemen in this context formulated a comprehensive National Water Sector Strategy and Investment Plan (NWSSIP) suggesting various polices, approaches for sustainable water use, and Action Plans for short/mid-term horizons, and a mid-term (2005-2009).

## OVERVIEW OF WATER SECTOR SUPPORT PROGRAM (WSSP)

**ES:6** In late 2007, the government took the decision to prepare an update of NWSSIP to run from 2009 to 2015. The objective was to incorporate changes in light of the experience and to provide a basis for a sector-wide approach to financing.

**ES:7** The US$436 million Water Sector Support Program (WSSP), including a grant of US$90 million from IDA, is a sustained partnership led by Government with the goal of financing a proportion of the updated NWSSIP and achieving its objectives in the context of a

## EXECUTIVE SUMMARY

coherent water sector. Under WSSP, implementation will be progressively entrusted to mandated national agencies through a Sector Wide Approach (SWAp) aligned behind NWSSIP. Government considers that SWAp should increase absorptive capacity and improve performance, and form the basis for government and donor commitment to increase levels of financing in support of NWSSIP. Government also anticipates that a SWAp approach will reduce both managerial and financial transaction costs. For the World Bank/IDA and for Germany, the Netherlands and the UK, who together make up the Donor Core Group, the main reason for endorsing a move to SWAp is to increase the momentum of sector reforms and development in a more integrated way within the NWSSIP framework. Donors also expect that a SWAp approach, relying more on national systems with appropriate improvements in transparent instruments and accountability, will help resolve the key governance issues affecting the water sector.

**ES:8** Salient features of the WSSP are discussed in **Section 2** of the report. Some of them are briefly presented in the following paragraphs.

**ES:9** The World Bank and other donors such as the Government of Netherlands, Germany, and the UK collaborated in the implementation of NWSSIP policies and started preparing a Water Sector Support Program (WSSP) by sending an identification mission to Yemen in 2007. A Donor Core Group (DCG) was formulated subsequently for supporting the WSSP.

**ES:10** GOY's commitment to the WSSP is evident through:

- Formulating a Program Preparation Committee (PPC) including among others five Deputy Ministers and supporting staff.
- Conducting Joint Annual Review (JAR) system for NWSSIP to assess the progress achieved by various water sector stakeholders and validation of polices.

**ES:11** WSSP is being devised to achieve key water sector development objectives namely,

- improved access to water supply and sanitation services,
- increase in returns to water use in agriculture,
- strengthening of sector institutions for sustainable water resources management and environmental protection

  Any proposal for large dams will not be financed under WSSP.

**ES:12** In this project background, the Government of Yemen (Ministry of Water and Environment and the Ministry of Agriculture and Irrigation) undertook this study for:

- An assessment of the potential positive/negative environmental, social, and economic impacts of the WSSP.
- Preparing an Environmental and Social Management Framework for integrated management of managing environmental, socio-economic impacts, covering inter alia:
  - An environmental and social monitoring program for facilitating implementation of the mitigation measures suggested.
  - Appropriate institutional measures for discharging effectively the monitoring functions.
- An assessment of socio-economic characteristics and prioritization of vulnerable groups, including women.
- A Resettlement Policy Framework for WSSP interventions (enclosed with this report).

**ES:13** Since, water sector-wide approach is adopted in the proposed WSSP and the critical nature of water resources management in Yemen, the WSSP has been classified an

# EXECUTIVE SUMMARY

Environmental Category "A" project (requiring a full environmental assessment) under the Bank's Environmental Assessment safeguard policy (OP/BP/GP 4.01).

## BASELINE WATER SECTOR DATA

**ES:14** In order to establish water sector baseline data, various available documents/reports were reviewed to study the existing environmental, social, legal, institutional and, administrative set-up. Review of secondary was supplemented by Field Visits to Sana'a, Ibb, Taiz, Aden, and Hadramawt governorates in addition to two (2) rounds of Public Consultation Meetings. One before the field visits and the second one, after the field trips and before finalizing the SwESA report. During the Field Visits meeting various stakeholders including Focus Group Discussions (FGDs) at village level were also organized. Key Informant Interviews at Head Quarter, Governorate and Local Levels, and were conducted during the study.

**ES:15** Water sector baseline data pertaining to the Physical Environment, Social Environment, and salient economic features are discussed briefly **in Section 3** of the SwESA report. Some of the major issues are presented in ensuing paragraphs.

**ES:16** There is no major surface water body in the country. Only flashfloods during heavy rainfall in hills generate surface water in the wadis. A total of Seventy Eighty (78) wadi catchment basins exist in Yemen.

**ES:17** Yemen is an extremely water scarce country with a per capita availability of water of 150$m^3$/cap/year compared to 1250 $m^3$/capita/year in the MENA region and 7500 $m^3$/capita/year world wide. This amounts, approximately, to 10% of the regional and 2% of the world average per capita availability. The problem is more acute in the western part of the country (Highlands, Tihama, and Arabian Sea area) where 90% of the population lives and per capita availability of water is 90$m^3$. Moreover, the relative water scarcity is exacerbated by physical and temporal variations as well as serious water allocation problems.

**ES:18** The quantity of groundwater exploitation is exceeding the average recharge of around 900 million cubic meters. It has resulted in lowering the water tables. In some basins, this decrease in the water level is between 2 and 6 meters annually. Overdraft of groundwater is a major factor contributing to the depletion of water resources.

- On an average, the depletion rate in Yemen is about 138% of the replenishment rate; however in some critical aquifers, it varies between 250% and 400%.
- The number of wells in the country is estimated at around 45,000 together with about 200 drilling platforms.

**ES:19** If such overdraft continues, it is most likely that the majority of aquifers would run dry in a period of 15 to 50 years. Such a critical situation calls for immediate remedial measures for treating water as a scarce and strategic commodity

**ES:20** Renewable resources, estimated at about 2,100 million cubic meters a year, are being supplemented by groundwater mining at a rate of about 1,300 million cubic meters a year from deep aquifers (with desalination and reclaimed wastewater accounting for a negligible percentage). This is creating problems of equity between users, and an unsustainable "bubble" of agricultural use. The concentration of population in the

relatively water-scarce highland basins - especially in Sana'a and Taiz - is leading to extreme water constraints in towns and to aggravated competition for water between urban and rural. In the Sana'a Basin, for example, there are over 8,000 operational wells – but only 70 for public water supply. New supplies for the city will depend on moderating agricultural use.

**ES:21** Coastal areas are better endowed, but coastal aquifers are also being mined, bringing quality deterioration and saltwater intrusion. Uncontrolled and continuing abstraction of groundwater is worsening the situation and wells are drying up every year. Coastal areas are facing problem of sea water intrusion.

**ES:22** The irrigated agriculture is estimated to use more than 90 percent of Yemen's water and irrigation efficiencies are low (nationwide average about 40%). Irrigated agriculture in Yemen is facing a number of challenges such as:

- Sustainability of spate irrigation
- Sustainability of groundwater irrigation
- Low productivity of irrigated agriculture

**ES:23** Qat cultivation is further aggravating environmental problems related with water availability. This is also degrading the soil quality as it consumes considerable plant nutrients from soils.

**ES:24** Water consumption in the irrigation sector is continuously increasing with an average rate of 30 MCM/year or 5% per year. If such expansion were to continue, the overdraft would reach 200% by 2025 – although many aquifers would be pumped dry before then.

**ES:25** Ministry of Agriculture and Irrigation (MAI) has piloted a range of irrigation efficiency and watershed management innovations. It is currently adopting participatory management approach by formation of water user organizations and facilitating technical advisory services. The ministry proposes a comprehensive approach to water resource management integrating rainfall and run-off management, rangeland, forestry, recharge and dams. This approach to watershed management follows the national strategy of integrated water resources management and basin management plans.

**ES:26** The National Water Resources Authority (NWRA) has been assigned to carryout water-well inventories in a number of basins involved in issuing licenses for drilling of wells.

**ES:27** The social survey focuses on cultural and economic features that differentiate social groups, is based on field visits to Sana'a, Ibb, Taiz, Lahej, Aden and Hadramawt. The findings were based on focus group discussions and the use of questionnaires and include basic household data as well as information related to water availability and the role of WUAs/WUGs, among others. The sample included a total of 82 participants and covers a variety of local stakeholders. More detailed findings as well as the questionnaire used have been included in the main document

**ES:28** A National water sector strategy and investment program (NWSSIP) for 2005 -2009, prepared by the MWE, have been formulated which deals comprehensively with the water sector related issues and proposes a set of institutional, financial, and policy measures. It also addresses discrepancies in the sub-sectors (water resources, urban WSS, rural WSS and irrigation) in order to harmonize and promote the interests of all the stakeholders. The objectives of the NWSSIP are to:

# EXECUTIVE SUMMARY

- Ensure coordination among all partners working in urban and rural water supply and sanitation sub-sectors, within and outside the MWE
- Ascertain that policies in each of these two sub-sectors are unified and that investments are equitably allocated among governorates according to unified rules and that no projects are duplicated, especially in rural areas, so as to ensure that investments complement each other.
- Ascertain integration of water policies and national policies of sustainable growth and poverty reduction.
- Ensure that sector financing effectively supports sector goals.
- Monitor and evaluate performance.

Details of the upstream polices are discussed in **Section 3** of this report.

## POLICY, LEGAL, ADMINISTRATIVE AND INSTITUTIONAL FRAMEWORK

**ES:29** Legal and institutional aspects in the water sector are discussed in **Section 4**. Some of the major water sector and Environmental law are listed below.

- Water law #. (33) of August 2002.
- Water law (Amendment) # 41 of December 2006.
- Environmental Protection Law #(26) of 1995.

**ES:30** MWE was established in 2003 to consolidate the government plans and activities in the water, sanitation, and environment sectors. The agencies are operating in this sphere are namely, Environmental Protection Authority (EPA), National Water Resources Authority (NWRA), General Authority Rural Water Supply and Sanitation Project (GARWSP),Local Water Supply and Sanitation Corporations (LWSSC).

**ES:31** The MAI is mainly responsible for irrigation, dams, reservoirs, and water harvesting system including preparation of technical and economic feasibility for better agricultural water management aspects such as:

- Groundwater irrigation.
- Watershed management.
- Spate irrigation improvement.

**ES:32** Besides these two, other important ministries for the development of water sector are as under:

1. The Ministry of Planning and International Cooperation (MOPIC) is responsible for policies and programs relating to the sustainable development, poverty reduction as well as investment planning and programming;
2. The Ministry of Finance (MoF) deals with budgeting, resource allocation for schemes, investment subsidies and trade policy, regulations of diesel price and the like;
3. The Ministry of Local Administration (MoLA) oversees decentralization programs and activities of the Local Authorities, as well as implementation of the Water Policy and laws at the local level and finally,
4. The Ministry of Interior is responsible for enforcement of laws, rules and regulations, including the Water Law.

# EXECUTIVE SUMMARY

## ANALYSIS OF ENVIRONMENTAL AND SOCIAL IMPACTS

**ES:33** Review of past studies and field visits indicate that **overall environmental impacts of the WSSP's interventions are expected to be positive** as it involved, namely, Strengthening of water resources management, Use of improved irrigation techniques, Enhanced groundwater conservation, Improved urban and rural sanitation systems).

**ES:34** Analysis of upstream policies and the program development objectives covered under the WSSP reveal **substantial positive environmental and social impacts** which have discussed in **Section 5** of this report.

**ES:35** Adoption of modern irrigation techniques will reduce water requirement because of increased efficiency. This will also help expand existing irrigated area, enhance crop productivity and quality of high value fruits, vegetables and commercial crops. Further, program will promote farmers' participation in irrigation management at all levels which will facilitate transfer of water resource and irrigation management schemes to Water User Associations (WUAs). More effective community participation will help enforcement of laws.

**ES:36** One of the major positive impacts of the modern irrigation techniques would be in the form of water savings which will be13 to 20 percent in pumped groundwater from improved piped-conveyance and more than 30 percent from localized on-farm irrigation techniques.

**ES:37** WSSP will provide better coordination between water sector stakeholders would facilitate program execution at national, governorate, and local level. Joint Annual Review (JAR) will offer an opportunity to assess the implementation of various components of the program and identify data gaps or difficulties faced at the project level.

**ES:38** An assessment of positive/negative environmental impacts during the implementation/operation of WSSP interventions is presented in **Section 5** of the report. The range of potential impacts of projects implemented under the WSSP is assessed over three phases (preconstruction, construction and operation) for the type, likelihood, and degree of impact. These include socio-economic, public health, and gender concerns as well as environmental and social impacts.

**ES:39** Safeguards Policy Issues: The WSSP triggers the following World Bank safeguard policies: (a) Environmental Assessment (OP/BP/GP 4.01), because WSSP interventions will involve infrastructure investments in urban and rural water supply and sanitation and irrigation improvement activities in the agriculture sector; (b) involuntary Resettlement (OP/BP 4.12), because WSSP interventions may result in limited resettlement of local populations and/or acquisition of land; and (c) Pest Management (OP/BP 4.09), because WSSP interventions will involve irrigation improvement activities that may affect the use of agricultural chemical inputs in the agriculture sector.

# EXECUTIVE SUMMARY

| 6. Safeguard Policies Triggered | Yes | No |
|---|---|---|
| Environmental Assessment (OP/BP 4.01) | X | |
| Natural Habitats (OP/BP 4.04) | | X |
| Forests (OP/BP 4.36) | | X |
| Pest Management (OP 4.09) | X | |
| Physical Cultural Resources (OP/BP 4.11) | | X |
| Indigenous Peoples (OP/BP 4.10) | | X |
| Involuntary Resettlement (OP/BP 4.12) | X | |
| Safety of Dams (OP/BP 4.37) | | X |
| Projects on International Waterways (OP/BP 7.50) | | X |
| Projects in Disputed Areas (OP/BP 7.60) | | X |

## RECOMMENDED PREVENTIVE ACTIONS AND MITIGATION MEASURES

**ES:40** Short term impacts from various construction activities during the implementation phase can be mitigated through proper measures. **Section 6** of this report presents an analysis of appropriate mitigation measures to offset/reduce/mitigate the negative impacts, if any, during implementation and operation of the subprojects. These measures range from managing the impacts of construction activities (including public safety, access, worker health and safety, and noise/air/water quality) to managing the loss of vegetation or land as a result of project interventions. Mitigation measures along with institutional responsibilities are presented in the following table.

# EXECUTIVE SUMMARY

| Table Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | Project Activity/ Environmental Issues | Mitigation Measure | Responsible organization | Monitoring Institution | Monitoring Frequency | Regulatory Agency |
| IMPLEMENTATION PHASE: | | | | | | |
| 1 | Air quality and noise quality due to construction yard activity | • Select sites for construction camp and storage yard on the downwind side of the village and about 500m from the nearest residential area. | Contractor | WUA/EMO of the Project Proponent | Once, before setting up the construction camp. | EPA |
| 3 | Noise Pollution at site | • Workers working in the vicinity of equipment generating high noise levels provided with earplugs, proper maintenance of construction equipment /machinery and vehicles. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 4 | Air Pollution | • Construction equipment/ machinery and vehicles to be maintained in good condition.<br>• Dust cover to the vehicles carrying construction material.<br>• Sprinkling of water in dusty area. Vehicles shall be covered with tarpaulin sheets. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 5 | Equipment storage and maintenance yard | • Waste collection, storage and disposal in proper manner.<br>• Whenever possible (in case of lubricants) should be reused. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 6 | Occupational Health and Safety | • Regular health check-ups for the workers, HIV and AIDS tests. | Contractor | WUA/EMO of the Project Proponent | half yearly | EPA |
| 7 | Transportation of Construction material | • Routine check of vehicles used for transportation for adequate maintenance and compliance with emission norms. | Contractor | WUA/EMO of the Project Proponent | half yearly | EPA |
| 8 | Pollution (Water, soil quality) | • No waste shall be allowed to discharge into the existing valley or water body. No water logging shall be allowed at construction site. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 9 | Severance due to trench opening | • Proper signboards/caution board shall be placed near the construction sites | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |

# EXECUTIVE SUMMARY

| Table Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | Project Activity/ Environmental Issues | Mitigation Measure | Responsible organization | Monitoring Institution | Monitoring Frequency | Regulatory Agency |
| 10 | Use of water on and off-site | • All water on site will be transported in tankers by the Contractor of its own. No new well be allowed to dug for construction activity without proper approval from NWRA and EPA | Contractor | WUA/EMO of the Project Proponent | weekly/Once before digging up any new well | EPA |
| 11 | Borrow pits and quarrying | • Firm-up contact with approved quarry and borrow pit sources owner, obtain balance output and requirement of material, if available. No new Quarry will be opened unless clearance obtained from the EPA. | Contractor | WUA/EMO of the Project Proponent | Once | EPA |
| 12 | Disposal of Construction debris | • Disposal of debris to the approved landfill sites located away from habitations and well fields. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 13 | Top soil | • Top 150 mm soil from virgin construction sites, borrow areas shall be stored properly and should be reused. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 14 | Earthwork, Rock cutting, grading, and compaction | • Proper safety measures shall be taken at site, construction sites shall be properly demarcated and entry or trespassing through such sites shall be prohibited.<br>• Worker shall use personnel protective equipments such as helmets, earmuffs, and helmets | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 15 | Traffic Management | • Secure assistance from local police for traffic control during construction phase.<br>• Warning signs/cautionary boards shall be placed near the construction site in urban areas/populated areas | Contractor | WUA/EMO of the Project Proponent | monthly | EPA |
| 16 | Public safety | • Proper warning sign shall be placed at the construction sites.<br>• Speed of construction vehicles shall be restricted to 50Km/hr. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |

# EXECUTIVE SUMMARY

| Table Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| Sl. No. | Project Activity/ Environmental Issues | Mitigation Measure | Responsible organization | Monitoring Institution | Monitoring Frequency | Regulatory Agency |
| 17 | Nuisance to Public | • Proper access shall be provided to the religious structures, markets, schools, and hospitals.<br>• Use of Noise generating equipments at such points shall be restricted. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 18 | Flushing and disinfecting | • Strict control of the material. Material shall be transported to the site in appropriate vehicles.<br>• Provision of first aid facility at construction camp and contacts with nearby clinics.. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 19 | Drilling of wells/Rehabilitation of Wells | • Regular maintenance of DG sets, reuse of the drilling mud, wastewater generated during drilling shall be properly drained off. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 20 | Disposal of Sewer pipes debris | • Disposal of debris to the approved landfill sites located away from habitations and well fields. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 21 | Environmental Monitoring | • Establish monitoring system. | Contractor | WUA/EMO of the Project Proponent | Quarterly | EPA |

# EXECUTIVE SUMMARY

## ANALYSIS OF ALTERNATIVES

**ES:41** Various aspects of the "Without WSSP scenario" and "WSSP scenario" have been studied the SwESA. Analyses of these two scenarios have been discussed in **Section 7** of SwESA report. A summary of the analysis is presented in the following Table.

## ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

**ES:42** As the precise type/location of proposed WSSP interventions are not known, the potential social and environmental impacts cannot be identified as are normally done in project specific Environmental Impact Assessment (EIA) studies. Hence, an Environmental and Social Management Framework (ESMF) is presented in **Section 8** of this report. This is a mechanism for enabling the project proponent to:

- Identify potential environmental and social impacts of the WSSP interventions.
- Assess the environmental/social impacts and suggest mitigation measures to reduce/offset/eliminate the degree of impacts.

# EXECUTIVE SUMMARY

**Comparison of the Environmental and Socioeconomic impacts 'With WSSP' and 'Without WSSP'**

| Issues | With out WSSP | With WSSP |
|---|---|---|
| **Policies** | • Short term policies and plans | • Long term strategic plans will be prepared. |
| **Abstraction of groundwater** | • Unsustainable and inequitable. | • Abstraction to be made sustainable and equitable by emphasizing intensive participation of users through the WUG's and the WUA's.<br>• Uncontrolled abstraction of groundwater will be minimized by regular and efficient monitoring and information sharing among various stakeholders. |
| **Water sources conserving/ protecting** | • Currently only small dams are built which often do not improve overall basin efficiency.<br>• Watersheds are deteriorating as appropriate measures such as terracing, plantation of trees, etc. are not being adopted. | • Integrated Watershed management programs with focus on upstream communities and poverty reduction would be evolved.<br>• Basin planning approach will be adopted. One successful example is Sana'a Basin Water Management Project.<br>• Focus on groundwater protection will include emphasis on water use efficiency, involvement of water User Associations, community management and gradual use of as well as tradable water rights. |
| **Inventory of wells** | • Currently, no consistency making inventory of wells. | • WSSP will facilitate well inventory process through Joint Annual Reviews among all the stakeholders. |
| **Maintaining water quality** | • Water quality of private sector suppliers is not being checked. | • Better and more efficient coordination among the stakeholders will help in monitoring the water quality properly. |
| **Millennium Development Goals (MDGs) in potable water and sanitation services**. | • Pace of coverage of population is very low<br>• In Rural areas, coverage in sanitation system is very poor. | • Increase in pace and quality of coverage.<br>• Better population coverage with water supply and sewerage system in rural areas. |
| **Poverty Reduction** | • Consideration of poverty reduction strategy is very weak.<br>• Lack of participatory approach.<br>• Limited role of WUA in water management<br>• Lack of capacity to water resource management | • Due consideration to equity and poverty aspects<br>• Promote water productivity in agriculture, particularly for poorer farmers<br>• Develop participatory approaches and promote "increased efficiency of water use"<br>• Increase participation of local communities/ WUAs, CBOs/ capacity building and education, in water resources management |

## EXECUTIVE SUMMARY

| Issues | With out WSSP | With WSSP |
|---|---|---|
| | | • Reinforce extension and further development of WUAs with a view to "ultimately handing over schemes to them" |
| **Gender Concern** | • Weak understanding of gender mainstreaming | • Strong focus on gender awareness, capacity building, and linked to policy/ strategy and action plan |
| **Water Conservation and Water Resources** | • Follow traditional water conservation techniques<br>• Weak enforcement of law<br>• Use of conventional water resources<br>• Conflict over water resources<br>• Lack of efficiency of water use | • Promote water conservation techniques among farmers and other water users<br>• Implement the necessary legislations to enforce and update regulations on water use and strictly enforcement of regulations<br>• Appropriate development of conventional and non-conventional water resources<br>• Equitable Resolution of conflicts over shared water resources<br>• Improve efficiency of water use |
| **Water Supply and Sanitation** | • Inadequate water supply<br>• Lack of public-private partnership<br>• Lack of sanitation facilities and programs | • Increase water supply through improved operation and loss reduction , development of new water resources, including reuse of water<br>• Sector wide management through involvement of Local Corporations with private sector participation<br>• Provide affordable sewerage facilities that ensure environmental protection and permit reuse of wastewater for agriculture or artificial recharge |
| **Decentralization process** | • Pace of decentralization is slow. | • Program will help to speed up the decentralization process |
| **Community Participation** | • Lack of community participation | • Programs will be designed and implemented through community participation |
| **Awareness campaign Programs** | • Lack of awareness programs | • Improve extension services and programs for raising awareness among farmers and public about economic value of water as precious , scarce and viable source<br>• Introduce awareness programs to address social issues like education and health and its relation to water issue |
| **Improved Irrigation System** | • Using traditional irrigation system | • Improve the efficiency of traditional irrigation system<br>• Introduce appropriate modern irrigation technology<br>• Provide subsidy and soft loans to encourage the application of |

## EXECUTIVE SUMMARY

| Issues | With out WSSP | With WSSP |
|---|---|---|
| | • No subsidy for the poor | modern irrigation system |
| **Involuntary Resettlement** | • Land acquisition and compensation issues are not properly addressed | • Resettlement Policy Framework (RPF) will be developed in parallel with SwESA to address relevant social safeguard as specified on OP 4.12 on involuntary Resettlement |
| **Monitoring and Evaluation** | • Inadequate because of lack of coordination amongst various agencies/ stakeholders. | • Joint Annual Reviews and Technical Audits will improve the monitoring and evaluation system and would promote inter-sectoral coordination. |
| **Capacity Building** | • Existing agencies require capacity building at different level. | • Focused and sustained capacity building efforts in various spheres. |

# EXECUTIVE SUMMARY

**ES:43** Since the project location, type, and details are precisely are not known, an ESMF has been devised in **Section 8** for assessing and managing the relevant issues pertaining to various WSSP interventions. The suggested ESMF covers the following issues:

- A baseline data collection program,

  This would be established by studying various significant environmental parameters which might be affected by the subproject interventions. Baseline studies will be a combination of desk studies (gathering existing documents, data sets, accumulating past lessons learned) and field surveys to address key issues outlined during scoping. The available information from secondary sources should be thoroughly reviewed before initiating field study for establishing baseline environmental status.

- An environmental and social screening process for WSSP interventions.

  The screening process is relevant to determine whether a comprehensive environmental impact assessment study would be required for the project interventions. This will lead to some of the interventions' being automatically excluded. Screening will enable the project authorities to assess:

  - Likelihood of future project interventions having potential negative environmental and social impacts.
  - Appropriate mitigation measures for activities with adverse impacts.
  - Incorporation of the mitigation measures into project design
  - Reviewing/ approving proposals
  - Monitoring environmental parameters during the project implementation phase

**ES:44** ESMF will be used as a reference material by key stakeholders involved in WSSP and will help them in assessing and mitigating the environmental impacts of the WSSP interventions. Major users of ESMF will be as follows:

- Environmental Management Officers (EMO) at central level/governorate/local level of the concerned agencies such as:
- Non Governmental Organizations (NGOs) and Women Associations
- Representative of Water User Associations and Water Users Groups
- Funding agencies/donors for WSSP

## INSTITUTIONAL CAPACITY BUILDING PROGRAM

**ES:45** Capacity building of various Governmental and non-governmental agencies is a prerequisite for successful implementation of the WSSP and the ESMF. As part of the SwESA, a need assessment performed on the current capacity of various Governmental agencies and non-governmental groups working in the water sector – both in Sana'a and in the field using various tools such as key informant interviews, consultation meetings and discussions at national, governorate and agency levels - indicated capacity building needs across the board. In this context, a number of capacity building measures are outlined in **Section 9** of this report, aimed particularly at professionals involved in planning, programming, executing, monitoring and evaluating various activities. Various environmental issues have been identified for imparting the training to professionals involved in WSSP and ESMF. The Institutional Capacity Program (Information, Education, and Communication) for proper implementation of ESMF are given the following Table.

# EXECUTIVE SUMMARY

| Institutional Capacity Program (Information, Education, and Communication) | | | | | |
|---|---|---|---|---|---|
| **Sl. #** | **Training Issues** | **Trainees** | **Trainer** | **Minimum number of staff trained per year** | **Time and Location** |
| 1. | ☞ Global concern for Environmental protection<br>☞ International treaties on Environment by the ROY and their importance<br>☞ Global warming and climate change<br>☞ Role of respective organization in conservation of Environment<br>☞ Relevant Environmental Protection and Water Laws<br>☞ Discuss Water Sector Support Program<br>☞ Environmental and social impact assessment<br>☞ Environmental and Social screening process of the subprojects<br>☞ Discuss Environment and Social Management Framework | Head Quarter staff of MWE, MAI<br>✓ EPA,<br>✓ NWRA,<br>✓ LWSSC,<br>✓ GARWSP,<br>✓ GDI<br>✓ IIP<br>✓ GSCP | International Trainers/consultants in association with national training institutes such as Water and Environment Center of Sana'a University | At least Seven (7) staff per year, one from each agency | 3 days training in Sana'a |
| 2. | ☞ Role of respective organization in conservation of Environment<br>☞ Relevant Environmental Protection and Water Laws<br>☞ Global warming and climate change<br>☞ Discuss Water Sector | ✓ Environmental Management officers<br>✓ Representatives of the EPA, NWRA, GARWSP, LWSSC, and MAI branch offices | Water and Environment Center of Sana'a University, and Trained staff from the Head Quarter | At least (25) staff per year, one from each agency<br>14 from basin committee – one from each basin | At Governorate Level with the help of EPA and NWRA branch offices |

## EXECUTIVE SUMMARY

| Institutional Capacity Program (Information, Education, and Communication) | | | | | |
|---|---|---|---|---|---|
| **Sl. #** | **Training Issues** | **Trainees** | **Trainer** | **Minimum number of staff trained per year** | **Time and Location** |
| | Support Program and project interventions<br>☞ Environmental and social impact assessment<br>☞ Environmental and Social screening process of the subprojects<br>☞ Discuss Environment and Social Management Framework | ✓ Representative Basin Committees | | | |
| 3. | ☞ Relevant Environmental Protection and Water Laws<br>☞ Global warming and climate change<br>☞ Discuss Water Sector Support Program and project interventions<br>☞ Environmental and social impact assessment<br>☞ Environmental and Social screening process of the subprojects<br>☞ Discuss Environment and Social Management Framework<br>☞ Health and Hygiene covering water supply and sanitation, solid waste disposal<br>☞ Social Issues such as HIV, AIDS, Girls Educations | Representative of WUA's, WUGs who is in-charge of Environmental Management | EPA and NWRA Branch offices | At least (25) staff per year, one from each agency<br>14 from basin committee – one from each basin<br>20 representative from WUA's | At District Level or WUA office with the help of EPA and NWRA branch offices |

# EXECUTIVE SUMMARY

| Institutional Capacity Program (Information, Education, and Communication) | | | | | |
|---|---|---|---|---|---|
| **Sl. #** | **Training Issues** | **Trainees** | **Trainer** | **Minimum number of staff trained per year** | **Time and Location** |
| | Dam Safety<br>☞ Importance of Data sharing<br>☞ Role of respective organization in conservation of Environment | | | | |
| 4. | Public Awareness Campaign on Groundwater conservation, Health and Hygiene, Water Borne Disease, Merits of controlling of Illegal Drilling, Modern Irrigation Technology, Demerits of Water theft or illegal connections | | Through EPA, NWRA, and WEC | In All governorates at | Lump sum per governorate |

# EXECUTIVE SUMMARY

## ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

**ES:46** Monitoring and evaluation is an important aspect for the success of the program. Proper implementation of the mitigation measures suggested in **Section 6** would require a monitoring mechanism for evaluating specified environmental parameters during the implementation and operational phases of the project. **Section 10** discusses the relevant issues briefly at National/Governorate/District Level. MWE will have overall responsibility for monitoring the environmental issues through the EPA, as envisaged in the Environment Protection Law #26 of 1995. The existing EPA branch offices will be responsible for evaluating the environmental and social screening processes as well as EIA reports prepared by the project activities of the WSSP interventions. EPA offices at the Governorate level may monitor closely implementation of management plans more frequently. Environmental Management officers located at the project level will submit quarterly environmental audit reports to the branch office. An Environmental Management Officer has been recommended to carry out various relevant activities related to monitoring and evaluation. An amount of USD 1,949,600 for a period of five years including salary of EMOs at sub-sector level. Break up of budgetary cost estimates is given in the following Table.

Budgetary Cost estimates

| Sl. No. | Activity | Unit | Amount per Annum | |
|---|---|---|---|---|
| 1. | Salary of EMO including all allowances | USD | 1512000 | |
| 2. | Assess adequacy of the subproject Approval and procedures | USD | 84000 | EPA |
| 3. | Assess adequacy of roles and responsibilities, procedures, forms, information resource materials | USD | 84000 | EPA |
| 4. | Monitoring and Site Visits by EPA officials | USD | 84000 | EPA |
| 5. | Identify key risks to the environmental and social sustainability of subprojects | USD | 110,000 | Lump sum for whole period |
| | | **Total** | 1,874,000 | |

## PUBLIC CONSULTATIONS

**ES:47** In the WSSP context, consultations have taken place at three different levels:

1. Focus Group Discussions (FGD)

Nine FGDs including three with women were conducted among the selected primary stakeholders e.g. women, poor farmers, land owners, village leaders and WUAs/WUGs to elicit their attitude towards the project, perceived problems and potential solutions as perceived at the local level. The FGDs were carried out in a number of governorates, including Sana'a, Ibb, Taiz, Lahej, Aden and Hadramawt.

2. Public Consultation Meetings

The first public consultation meeting was held on 26th May 2008 and 58 stakeholders working in different

field of water sector were invited. Participants expressed their views on a variety of issues, and the media was also invited to spread the message and purpose of the WSSP and SwESA Study.

The second consultation meeting was held on 3rd August 2008 and was attended by 80 stakeholders. Among other issues, the lessons learnt from the focus group discussions in the field were discussed and the different views have been documented.

3. Qualitative Interviews with Key Informants

As a part of the study, specific information was obtained from 'Key Informants'. Key informant interviews were conducted with different project proponents and concerned government officials working in the water sector projects. This was done through face-to-face qualitative interviews, and provided an up to date overview of the existing situation in the different project water projects on which the WSSD will be based.

**BUDGET SUMMARY**

**ES:48** The indicative budget is given below:

| SwESA Activity | Cost US$ |
|---|---|
| Environmental/Social Management Personnel | 600,000 |
| ESMF Environmental Mitigation Measures | 700,000 |
| Environmental/Social Monitoring Program | 962,000 |
| Institutional Capacity-Building Program | 3,010,800 |
| **TOTAL** | **5,272,800** |

**RECOMMENDATION**

**ES:49** The proposed Water Sector Support Program (WSSP) is more environmentally sustainable and has more beneficial impacts on the whole and deserves to be implemented.

# Table of Contents



**List of Figures**

# *SECTION-1.0: INTRODUCTION*

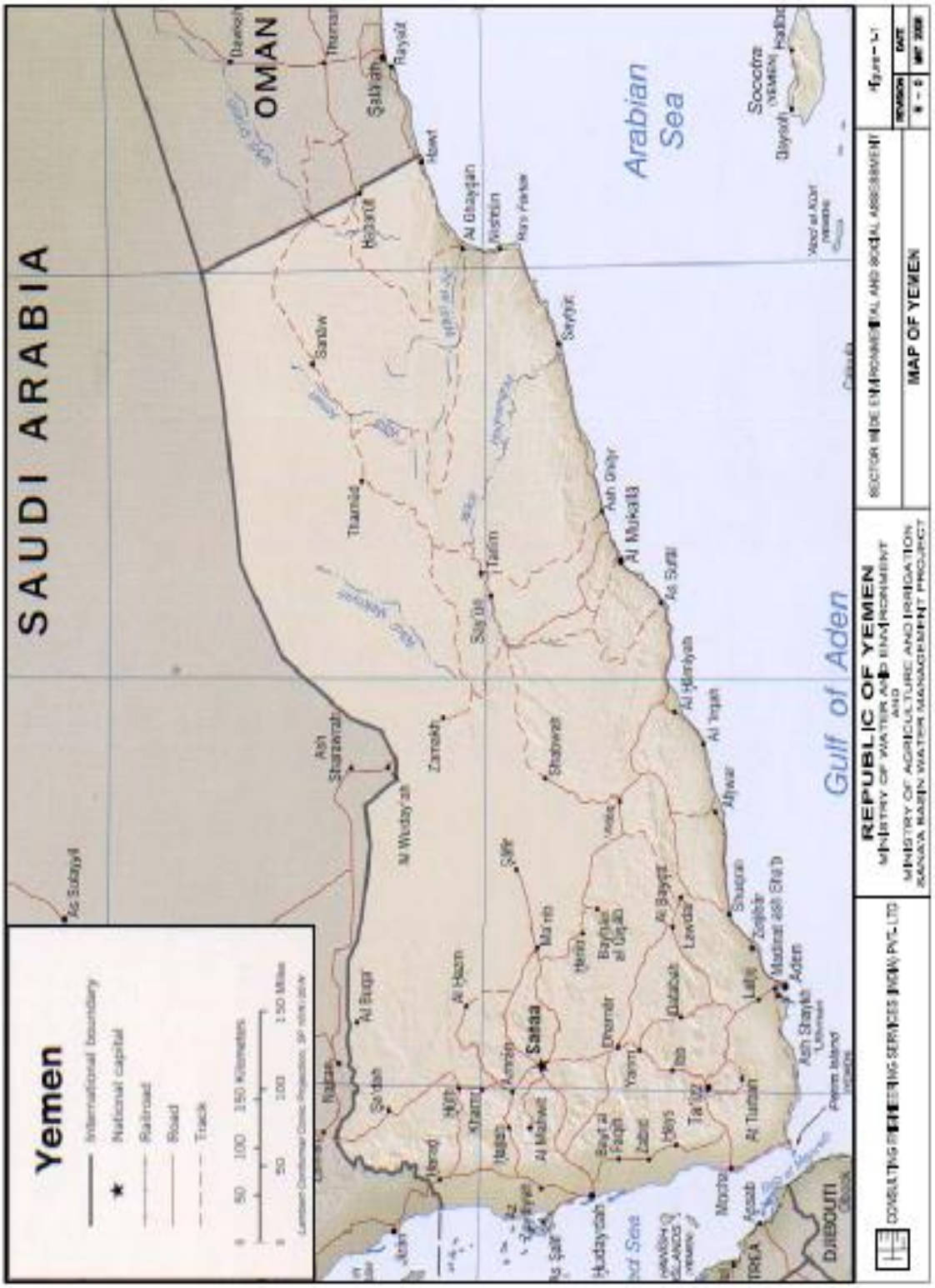

Republic of Yemen is situated in Arabian Peninsula, between 12$^{o}$ and 19$^{o}$N Latitude and 42$^{o}$ and 55$^{o}$E Longitude. Area of the country is 460,000Km$^{2}$. The country is bordered by Saudi Arabia in the North, Oman in the East, the Arabian Sea and the Gulf of Aden in the South and Red Sea in the West. The Republic of Yemen is administratively divided in twenty one Governorates, in addition to the Capital Secretariat. A map of Republic of Yemen is given in **Figure 1.1**.

Yemen is characterized by varied landscape, diversified terrain, and climate. The coastal plain ranges of low and high altitude mountains, many of which are terraced. There are mountains plateaus, hills, and plains. The mountain ranges from 1000m to 3600m. Green wadis are the riverbeds for the rainwater runoff during two rainy seasons. Desert extends eastward and northward.

Climate of the country is characterized by high temperatures and humidity during summer and moderate during winter. Moderate weather prevails in the western slopes, plateaus and flat lands. Temperatures reach 10-30$^{o}$C, falling to below 0$^{o}$C during the peak winter. The annual rainfall is between 300mm and 1000 mm. The climate in the eastern parts of Yemen differs considerably with temperature exceeding 40$^{o}$C during the summer and 10-15$^{o}$C during winter. Annual rainfall does not exceed from 50mm to 100mm. The entire area of Yemen is affected by monsoon winds blowing from the east with low air pressures from the west. The monsoons are usually accompanied by rain in summer and lesser rains in winter.

Population of Yemen is also growing fast with a growth rate of 3.02% and total population is around 19.7 million people as per census conducted in 2004. Out of this about 27% live in major cities and remaining 73% in rural areas. On account of the combined effect of growth of population, migration to urban areas, improvement in quality of life, the domestic water demand has also increased.

Land suitable for agriculture is widespread across many regions of Yemen including the plains, highlands, coastal areas and terraced mountain. Agriculture sector is one of the major consumers of water consuming around 90%.


SAUDI ARABIA
OMAN
Yemen
Arabian Sea
Gulf of Aden
Socotra
REPUBLIC OF YEMEN
MAP OF YEMEN

To meet the water demand for agricultural and domestic use, the groundwater is being used extensively in Yemen as there is no major surface water body. Over extraction of groundwater for meeting the irrigation demand is leading to rapid fall of aquifers level in many areas. Due to this, many towns are facing a serious water shortage for meeting their domestic water demand. Also, the uncontrolled abstraction of groundwater has caused seawater intrusion in some parts of coastal region especially in Abyan Delta, rendered the groundwater saline beyond recovery.

### 1.2 Project Background

In order to combat the water crisis in Yemen, the government has reorganized the water sector and established Ministry of Water and Environment (MWE) in the year 2003. A multi-stakeholder approach was initiated by MWE and the following documents were prepared to address various issues arising in the water sector.

- National Water Sector Strategy and Investment Program (NWSSIP) was prepared in the year 2004
- Poverty and Social Impact Assessment (PSIA) of water reforms in 2007

The NWSSIP, which is the key policy document of the GOY for the water sector, is currently being updated and a PSIA for the urban water sub-sector will soon be initiated. NWSSIP defines

- Objectives, policies, and approaches for the mid and long term.
- Action plans with short and mid-term horizons, and a mid-term (2005-2009) investment program.

NWSSIP has provided valuable inputs into Yemen's Development Plan for Poverty Reduction (DPPR) 2006-2010. This DPPR has also incorporated the objectives of the Agricultural Long-term Plan (AGSIP) 2006-2015, which has significant bearing on issues of rural livelihoods and sustainable water use.

The WB and its development partners such as gtz, the Netherlands, and the UK started to prepare Water Sector Support Program (WSSP) with an identification mission to Yemen in 2007. During this mission, donors collaborated with counterparts in the government such as MWE, Ministry of Agriculture and Irrigation (MAI), Ministry of Planning and International Cooperation (MOPIC), and Ministry of Finance (MoF) in identifying the program concept, development objectives, and components of the WSSP.

The policy, institutional and investment programs supported under the WSSP would be those agreed to in NWSSIP as revised**.** The WSSP is being formulated to achieve the following main development objectives by adopting a sector-wide approach (SWAp).

- improve access to water supply and sanitation services,
- increase returns to water use in agriculture,
- strengthen sector institutions for sustainable water resources management and environmental protection

### 1.3 Objectives of the Sector Wide Environmental and Social Assessment Study

Against the above project background, Sana'a Basin Water Management Project, Ministry of water and Environment, Government of Yemen has appointed M/s Consulting Engineering

Services (India) Pvt. Ltd. to conduct the Sector-wide Environmental and Social Assessment (SwESA) for the proposed Water Sector Support Program (WSSP). This study will analyze and review sector wide impacts of environmental and social issues arising from the proposed water sector policy reforms. Broadly speaking, the study will mainly focus on the following issues:

- ✓ Environmental Impacts Assessment of WSSP;
- ✓ Social Impacts of WSSP; and
- ✓ Economic Impacts of WSSP.

### 1.4 Scope of SwESA

The SwESA will include the following key outputs:

- An assessment of previous experience in the water sector, particularly based on implementation experience to date of the environmental (and social) management plans prepared for the existing water sub-sector projects.
- An analysis of the expected positive and negative impacts caused by the various components of the WSSP as it builds on NWSSIP's investments and policy reform program. Proposals for alternatives and/or mitigating measures as appropriate.
- A comparison of the situation and overall risks - both at the policy and project levels - in cases with and without the WSSP.
- An assessment of the effectiveness of the current Yemeni EIA procedures for water sector investments, including proposals to render the EIA more preventive and oriented to the sector level (rather than the narrow project) and to make the entire assessment process more transparent
- A well-documented consultation process, including the description of the representativeness of the consulted groups and how the comments received have been addressed in the SESA
- An ESMF for the SWAp based on the above outputs that will ensure environmentally and socially sustainable development approaches in the water sector.

In order to achieve the above, the consultants will carry out the following tasks.

**Background and preparatory work, public consultation program:**

- Review all background literature and consult closely with relevant donors active in the water sector, in particular the World Bank, Germany, the Netherlands and the UK;
- Assess/audit previous experience with sub-sector projects to determine: (i) what was implemented and what were the obstacles to implementation and (ii) what were the realistic mitigating, monitoring and institutional measures that were undertaken;
- Define the environmental and social objectives and areas of influence related to each of the WSSP components; ensure integration of the poor and vulnerable populations through community-based approaches;

- Gather available environmental and social data on existing conditions in potential areas of influence, with a focus on the wadi basin level, in order to establish a baseline on which the impacts of WSSP interventions can be evaluated;
- Collect relevant economic information (subsidies, tariffs, etc.) in order to include the economic dimension of the environmental and social aspects of the program (e.g. the economic incentives study currently underway by NWRA);
- Review the Yemeni policy, legal and institutional framework for environmental management and impact assessment of relevance to the WSSP, including land tenure and water rights (refer to RPF as appropriate). Identify potential conflicts in the policy, legal and institutional framework and propose appropriate mitigation measures at the policy and project levels;
- Prepare a public consultation program to include at least two public participation sessions: (i) during the scoping stage on the terms of reference (TOR) for this assignment; and (ii) following the preparation of a draft SESA, carefully documenting all the steps;

**Environmental Assessment:**

- Building on the previous baseline work described above, refine the environmental (physical and biological) and social baseline data and establish an information system for managing the data. Engage local expertise in the collection, analysis and management of the baseline data relevant to the WSSP;
- Identify potentially significant environmental and social impacts (taking into consideration the WB safeguard policies triggered or to be determined) and issues related to each component, and with respect to induced development, competition for scarce water resources and conflicts with other resource users, potential breaches of water standards and guidelines as well as their direct, indirect, cumulative and cross-sectoral impacts .Specific issues on water and waste water as well on irrigation and drainage that should be considered by the Consultant are found in Annex 2 of the Terms of Reference;
- Assess positive and negative environmental impacts at the policy, program and project levels;
- Specify appropriate preventive actions or mitigation measures at the different levels to effectively prevent, minimize or mitigate the types of environmental and social impacts identified above;
- Conduct an analysis of alternatives with regard to environmental and social issues of the different components;
- Based on the analysis and in coordination with the program design consultants, prepare a cost-benefit or cost-effectiveness analysis of the proposed program;
- Prepare an ESMF (based upon management plans prepared for existing sub-sector projects), including an environmental and social screening process for WSSP interventions (which will recommend the appropriate preventive actions or mitigation measures to be taken) in order to ensure compliance with Yemeni environmental laws and WB safeguard policies;

- Assess the institutional capacity within the EPA for conducting the environmental (EIA) and social screening process for WSSP interventions established in the ESMF and recommend appropriate capacity building measures to ensure effective management of these functions;
- Assess the institutional capacity of the EPA (as well as other water sector and public/private sector institutions) for performing water quality monitoring and enforcing environmental regulatory requirements and recommend appropriate institutional capacity building measures (or outsourcing measures) to ensure effective performance of the monitoring functions;
- Propose an appropriate environmental and social monitoring and evaluation program in order to: (i) ensure compliance with any preventive actions or mitigation measures recommended as a result of the screening process established by the ESMF; and (ii) assess the environmental and social impacts of WSSP interventions and take appropriate corrective actions where necessary;
- Liaise with the climate change initiatives of the GOY, World Bank and other development partners in order to ensure appropriate consideration of climatic impacts on water supply and demand in the future.

**Social Assessment:**

- Building upon the Bank's and other donors' previous project experience in the water sector, propose mechanisms to empower stakeholders through their participation in design and implementation;
- Explore practical options with regard to strengthening pro-poor selection criteria as highlighted in the PSIA, and outline the consequences of applying lower cost technologies and/or higher subsidies for the poorest sections of the community;
- Identify socio-economic characteristics and prioritization of vulnerable groups, including women, focusing on the cultural and economic features that differentiate social groups in the program area. Pay particular attention to the opportunities and constraints for women to participate in the local decision making process, skill building and income-generating activities. Analyze how traditional institutions, WUGs and WUAs function in the context of this program and identify which specific areas need attention in order to improve the performance of water user groups and associations. Collect information on local perspectives and the perceived constraints to community participation through key informant interviews and focus group discussions;
- Document economic and social differences among different groups within the program area, and how the needs and priorities of the different groups vary, with particular emphasis on the poor;
- Identify socio-economic characteristics and prioritization of vulnerable groups, including women. Emphasize the opportunities and constraints for women to participate in the local decision making process, skill building and income generating activities. Identify specific areas which need attention in order to improve the performance of water user groups and associations;

- Focus on social development outcomes to: (i) strengthen social cohesion by ensuring that poor and marginalized groups are included in the benefit stream; (ii) building upon the Bank's previous project experience in the water sector, empower stakeholders through their participation in design and implementation, and (iii) enhance security by minimizing and managing likely social risks, such the effects of the introduction of modern irrigation on the poorest farmers, women and landless farm workers;
- Prepare an analysis of positive and negative social impacts at the policy, program and project levels and specify preventive actions and mitigation measures at the different levels.

**Final document preparation, WSSP recommendations**:

- Based on the implications of SwESA findings, propose appropriate recommendations for the overall approach of the WSSP. Should components be added or reconsidered/modified, e.g. given the specific characteristics of water use in Yemen, is the proposed program likely to be considered fair and equitable by all socio-economic groups?
- Review the RPF (see specific TOR for RPF below) for its relevance to the SwESA, particularly with regard to land tenure and associated legal and institutional issues. Incorporate appropriate changes to the ESMF to reflect the requirements of the RPF;
- Finalize, after public consultation, the SwESA document, including the ESMF and the RPF.

### 1.4.1 Potential User of SwESA including ESMF and RPF

This report will be a reference material for use of key stakeholders involved in the WSSP. These stakeholders are as follows:

- Environmental Management officers at central level and governorate or local level of the concerned agencies such as:
  - Environmental Protection Authority (EPA) and its branch offices
  - National Water Resources Authority (NWRA)and its branch offices
  - Urban Water Supply and Sanitation Project (UWSSP)
  - Urban Local Corporations
  - General Authority Water supply and Sanitation Project (GAWRSP) and its branch offices
  - General Directorate of Irrigation (GDI) and its branches
  - Tihama Development Authority (TDA)
  - Improved Irrigation Project (IIP)
  - Groundwater and Soil Conservation Project (GSCP)
  - Non Governmental Organizations (NGOs)
  - Women Associations
- Funding agencies/donors for the proposed WSSP

## 1.5 Structure of the Report

Report has been structured that it should cover the all the related topics succinctly. Sections of this report are as follows:

Executive Summary

Section 1 – Introduction briefly presents the project background, objectives of the SwESA, Scope of work, and potential users of the SwESA, ESMF, and RPF.

Section 2 – An Overview of Water Sector Support Program gives briefly various components of the proposed WSSP, and justification for the proposed WSSP, and integrated safeguard polices which are applicable in WSSP interventions.

Section 3 - Baseline Water Sector Data: It outlines water sector upstream polices covering environmental and social features to establish the baseline data for assessing the impacts at polices, program, and project level impacts.

Section 4 - Policy, Legal and Regulatory Framework of the Water Sector: This section describes the existing policy, legal and regulatory framework related with the water sector.

Section 5 - Analysis of Environmental and Social Impacts at the Policy, Program and Project Levels: Various environmental and social impacts have been evaluated and presented in this section.

Section 6 - Recommended Preventive Actions and Mitigation Measures at the Different Levels: In order to reduce the degree of environmental and social impacts, mitigation measures and preventive action plan are suggested in this section.

Section 7 - Analysis of Program Alternatives: With WSSP scenario and without WSSP scenario have been analyzed in this section.

Section 8 - Environmental and Social Management Framework, operational procedures for environmental screening, environmental impact assessment for the WSSP interventions are discussed.

Section 9 - Institutional Capacity-building Program (Information, Education, Communication). This section presents institutional strengthening measures such as training needs and budgetary cost estimates for implementation of the proposed ESMF and EMP.

Section 10 - Environmental and Social Monitoring Program. A monitoring program for the proposed ESMF is suggested in this section. Budgetary cost estimates are also presented for effective monitoring of the environmental and social parameters suggested in the ESMF.

Section 11 - Description of Detailed Public Consultation Process and Summary: It summarizes proceeding of the public consultation, findings of the focus group discussions, and key informant interviews.

# Table of Contents



**List of Tables**

# *SECTION-2.0: AN OVERVIEW OF WATER SECTOR SUPPORT PROGRAM*[1]

Formulation and execution of the Water Sector Support Program (WSSP) seeks to improve significantly the water management situation in the country by adopting a Sector Wide Approach (SWAp). This program will be funded by the World Bank and the Donor Core Group comprising of the Netherlands, Germany and the UK (DFID).

## 2.1 Components of WSSP

It has five components comprising four water sub-sectors and one capacity building program. Each component has specific development objectives for sub-sector strengthening. Components of WSSP are briefly described in the following subsections.

### 2.1.1 Component 1–Urban Water and Sanitation (estimated at US$133 million)

This component is designed to support the decentralization of the urban water supply and sanitation service by strengthening the technical, administrative, commercial and financial capabilities of the Local Water Supply and Sanitation Corporations (LWSSCs) and Autonomous Water Utilities. The principal beneficiaries for this component would be the LWSSCs. The city residents will be the secondary beneficiaries because of:

Availability of better water quality and service reliability.

Affordability and sustainability of water supply and sanitation coverage.

Funding would be provided for: (a) increasing the managerial capacity of the LWSSCs to set up and administer effectively water and sanitation facilities in their respective jurisdiction, and (b) promoting extension well systems and efficient operation. LWSSCs would be assisted for:

- designing, and goods and services to serve existing customers better
- rehabilitation of current water supply and sanitation facilities

In particularly, LWSSCs which are working satisfactorily would be funded for expansion and facilitating operational efficiency

LWSSCs having a satisfactory level of service (indicators and targets to be defined), would get assistance for expansion and improving

This component will support the policy adjustment proposed in the updated NWSSIP. LWSSCs would gradually promote the role of the private sector in providing water supply in main cities as well as the role of private households, and the NGOs in facilitating decentralized sanitation systems (cesspits and small diameter gravity sewers being experimented by the SFD).

Support to LWSSCs would be carried out in three stages corresponding to three levels of funding: (a) *operational development*: technical assistance and training to all LWSSCs to carry an in-depth technical/ financial/ institutional assessment and prepare a comprehensive

[1] **Preparation Report of WSSP, Second Draft , July 07, 2008,**

rehabilitation program (network/ physical rehabilitation/ software) and a policy adjustment (tariff adjusted to recover investment cost); (b) *operational improvement and rehabilitation*: implementation of the rehabilitation program in eligible LWSSCs/Utilities; and (c) *expansion for water supply and sanitation systems*: investment for service expansion to new areas. Implementation arrangements would be coordinated with the on-going GTZ-KfW Provincial Towns Open Program (PTOP).

Four specific policy issues that will be addressed in WSSP are:

- The establishment of the Independent Regulator (the proposed National Jihaz for Regulation of Water and Sanitation Services NJRWSS) to oversee Governorate/ULC supervisory boards (General Assemblies)
- A long term sustainable UWWS based on provision of public water services through efficient LWSSC – The Regulator would receive and audit a suitable number of ULC business plans to choose one for a sound basis for operation. The policy matrix identifies the regulator as the recipient of business plans.
- Full cost recovery tariffs for LWSSCs – The average tariff needs to be set correctly to recover at least Operation and Maintenance costs individually, but progressively integrating capital investment costs as the utilities start taking advantage of on-lending credits through WSSP and (hopefully) other financing instruments negotiated with private sector investment partners. The block tariff would only provide a lifeline rate for the lowest end users, with the higher volume users paying the full rate for all their consumption needs.
- Commercially based financing for UWSS service extension. LWSSCs with acceptable business plans, operations, financial management and billing systems in place will be permitted to finance the expansion of their water supply and sanitation systems. They will be eligible for on-lending from the WB credit under commercial loan conditions and will be permitted to pursue financing instruments arranged through the private sector. The projects must be technically and economically sound. Further, such investment projects must be properly described and budgeted in the business plan.

## 2.2 Component 2 – Rural Water Supply and Sanitation (estimated US$164million, base cost)

This component will support the updated NWSSIP Policy adjustment for rural water supply and sanitation; based on the successful intervention of the new US$20 million Bank Supplemental Grant and the Netherlands support program for GARWSP, as well as the experience of SFD and PWP in the sub-sector. The program would support GARWSP decentralization and stakeholder cooperation and alignment at the Governorate level. It will strengthen the cooperation between GARWSP and other key partners such as the SFD and the PWP. All stakeholders would be invited to join a Partnership Agreement for Rural Water and Sanitation.

The salient features of this component are:

- Rapid expansion of water and sanitation services in rural communities,
- Enhancing the pro-poor focus and meeting the Millennium Development Goals (MDGs) in the rural sub-sector.

- Support to GARWSP and its local Governorate branches to design and implement rural water supply and sanitation schemes based on DRA throughout Yemen.
- Capacity building.

Key inputs would include:

capacity building grants to GARWSP Branches, Water User Associations, CBO/NGOs, and Local Authorities;

Equipment and logistical support for decentralized GARWSP Branches;

Training and support to Water User Associations;

Rehabilitation/ completion of mechanized schemes to optimize service delivery from existing infrastructure;

Providing new mechanized systems (wells, pump and generator, elevated tanks and pipe distribution networks), where affordable and sustainable;

Water harvesting systems and filtering systems where appropriate; and

Sanitation and hygiene

It is proposed that sub-components (i) through (v) would be carried out by GARWSP (through targeted budget support) and the PWP (under separate parallel financing). Sub-components (vi) and (vii) would be carried out by the SFD financed from "other donors" (outside the Donor Core Group) in areas well endowed with rainfall and with limited access to sustainable groundwater resources.

GARWSP would be supported through basket-funding, and/or a Policy Development Component, and its main partners SFD and PWP, through parallel financing. Output-Based Aid would be provided to support to communities and private schemes (including partnership agreements with the NGOs) for start-up and formal policies for NGOs to provide RWSS schemes in collaboration with GARWSP.

The component outputs would include:

Trained and equipped GARWSP Branch staff working in cooperation with stakeholders and the Local Authorities.

Preparation of District Water Master Plans supported by the local communities and approved by the Local Council.

Rehabilitated Water Supply facilities managed by efficient WUAs serving about 180,000 beneficiaries per year

Better integration of RWSS with the WRM framework through site selection by GARSWP and the NWRA.

Reservoirs tanks and networks to be constructed after securing water resource availability; wells to be licensed correctly, and GARWSP would inform NWRA's Monitoring & Annual Implementation Program on location and use of water resources of RWSS schemes (public and private).

Partnership agreements between GARWSP and key partners to develop water supply schemes in poorer areas, and to conduct GARWSP staff training on community mobilization and training for GARWSP schemes.

NGOs are empowered to access public/ donor funds under umbrella of WRM plans and Basin Committees.

Community start-ups would be supported.

The Government of Netherlands is already providing significant support to this sub-sector (through its 2007 – 2009 PAWS Agreement) through direct annual budget support to GAWRSP. There is an agreed program with identified outcomes.

GAWRSP and PWP are executing mechanized systems and are jointly involved in activities like:

- providing pumps and pipes by GAWRSP
- Installation of pipes and construction of Tanks and pump house by PWP.

A policy component with direct disbursement is under consideration for inclusion in the World Bank's (proposed) Specific Investment Lending (SIL). The Development Policy Component (DPC) within the Water Sector Support Program (WSSP) would provide incentive for improving implementation/ attainment of Yemen's NWSSIP targets through direct budget support. Broadly, these incentives will recognize progress towards bringing about more efficient and sustainable water management and service delivery. The attainment targets will reflect progress in the core areas of sector governance, institutional development and capacity improvement as well as improvements in financing and cost recovery. Specific sub-sectoral targets will address the most critical reforms required to expedite the performance for achieving declared outcomes in the NWSSIP.

It is suggested that the policy areas as water be included in the WSSP:

**Government approving a formal policy and strategy for delivery of RWSS** projects including policy on the level and modalities of beneficiary contributions. This would require all stakeholders (particularly the MWE, GARWSP together with Ministry of Local Affairs (MOLA) and Ministry of Planning and International Cooperation (MOPIC) to agree you a common approach for the decentralized RWSS operations to be ratified by the Cabinet.

**Promoting sector strategy and coordination** – (GARWSP at the central level, will be focused on Monitoring and Evaluation and training. Implementation will be done by its Branches and the Development Partners (including the private sector investors and local NGOs/CBOs) coordinated at the District and Governorate levels.

**Improved implementation/Broaden (diversify) range of partners** – GARWSP branches need to get away from simply implementing projects to becoming more deeply involved in generalizing coverage (GARWSP Branch Offices to become autonomous Governorate-based Rural Water Authorities)

**Improved Targeting and Sustainability** - Socio-economic audits with gender specific and pro-poor indicators will to strengthen the quality of delivery by tracking and responding to needs

**Sanitation** – It will be important to ensure that complementary investing in sanitation is accompanying water supply projects. The emphasis should be on increasing general hygiene awareness and good practices rather than simply focusing on sanitation infrastructure.

## 2.3 Component 3 – Irrigation Improvements (estimated at US$.72 million, base cost)

This component will improve farmers' livelihoods and ensure resource sustainability, both in quantity and quality, through the provision of modern on-farm irrigation technologies throughout Yemen, and by building on the experience gained from the IDA - supported projects which introduced concepts like "Participatory Irrigation Management" and "More Crop per Drop". It will support the proposed Irrigation National Program (INP) directly in designing and implementing a program of improvements including: transmission lines, on-farm modern irrigation technologies, irrigation user associations (at the canal level) and irrigation councils (at the wadi/basin level), and on-farm agronomic and water-saving practices leading to "more value per water drop". Capacity building will be a main element of the component.

The key inputs in this component are:

community-based water management activities

demonstration of on-farm modern irrigation technologies to the farmers/WUAs

farm investment on modern irrigation techniques, viz. transmission lines, localized systems, incl. pro-poor design and entry criteria for subsidized measures

volumetric monitoring of water available, applied/used, and saved

terrace rehabilitation and soil conservation and watershed management works

rehabilitation and development of spate diversion infrastructure and related flood control works in the major wadis of Tihama, Tuban/Abyan and Shabwa

improving conjunctive use, through selective introduction of recharge dams and subsurface dams

introduction of Irrigation Advisory Services (IAS) including water resource management advice at farm level, introduction of water-saving /short-maturing crop varieties, deficit irrigation, introduction of crop-calendar staggering, introduction of irrigation rescheduling across the various crop growth stages

Keeping in view NWSSIP policies, MAI has proposed to formulate an "Irrigation National Program".

- Consolidating existing GSCP, IIP, and Sana'a Basin Irrigation Projects.
- AFPPF activities would also align with the Program.
- WSSP Development Policy Component of 5 Million USD as direct budget support grant is under consideration of by DFID.

formation and empowerment of canal-level WUAs and wadi/aquifer levels Basin Committees or Irrigation Councils

Capacity development of the proposed National Irrigation Program and of MAI relevant irrigation policy department (incl. training for extension staff branches.

In addition the component would support rehabilitation of spate irrigation structure in critical wadis in Tihama, Abayan/ Tuban Delta, and Shabwa and watershed management (wadi training, flood protection, micro-spate)

The key outputs for the component include:

Community based water management in critical areas

on farm water saving on about 27,500 ha (groundwater irrigation)

reduction of groundwater abstraction

spate irrigation improvement for about 4,400 ha

increasing farmers' income

stabilizing area irrigated from groundwater

About 100,000 persons would benefit from shallow well recharge and land protection from floods.

### 2.4 Component 4 – Water Resources Management (estimated US$34 million, base cost)

This component aims to improve planning, conservation, and sustainable allocation of water and address water-related environmental issues and climate change impacts on water resources policy decisions. The component will provide support to (i) the planning and monitoring functions of the MWE; and (ii) NWRA in basin planning activities (design and implementation) in critical basins.

The WSSP will provide an opportunity for MWE/NWRA to collaborate with MAI on the supply-side management of water resources.

The key inputs would include:

Implementation support for existing Basin Water Management Action Plans (Taiz, Saada, Sana'a).

Support for speeding up the completion of Basin Water Management Action Plans under preparation (Tuban/Abyan, Hadramawt).

Water resources assessment studies.

Aquifer modeling.

Water monitoring networks.

Well inventory and monitoring.

Well drilling licensing and regulation.

Recharge studies.

> Three main axes are proposed in the WSSP paper for monitoring progress towards IWRM implementation would be:
>
> - Improvement of the water resources information/knowledge data base to ensure adequate platform for IWRM
> - Establishment and implementation at the District level of proper basin plans, and management plans, particularly for the important Wadis
> - Recruitment and retention of an adequately profiled executive and technical management along with an adequate technical and administrative workforce for the NWRA branches.

Support to NWRA in basin planning activities (design, implementation, and monitoring) in three additional critical basins (Amran, Rada, and South Tihama).

Studies for protected areas in Dhamar, Mokha, Abyan and Hadramawt.

Study on water rights in Sana'a, Taiz, Tuban, Abyan, and Hadramawt areas.

Capacity development and logistical support to Water Basin Committees.

Communication and public awareness programs particularly for Schools/ CBOs/ NGOs and Local Authorities.

NWRA Branch equipment and capacity improvement.

The key outputs would include:

- Groundwater abstraction monitoring and control in Sana'a, Taiz, Abyan Tuban and Hadramawt Basins.
- At least four operational Water Basin Committees.
- Three new Water Basin Management Plans.
- District Development Plans including water resource management activities based on the Basin Water Management Action Plan. In districts located in basins not yet covered by a Basin Water Management Action Plan, water resource mapping carried out under the RWSS component, would provide the basis for the water component of the District Development Plan.
- Implementation of the Water Law and its bylaws at district level in close cooperation with local councils and security
- Development of water markets based on recognized water rights
- Progress in NWRA's decentralization

### 2.5 Component 5 – Sector Institutional Strengthening and Capacity Building (estimated US$7 million, base cost)

Institutional capacity development and support to improved governance have been identified as a critical need for the water sector. The institutional development needs are pervasive across all sub-sectors. Hence, the NWSSIP Update addressed them in an integrated way. An overall goal for water sector institutional development has been set; water sector institutions are to be developed and their organizational performance enhanced to implement NWSSIP in an effective and efficient manner. This component will implement key aspects of the NWSSIP water sector institutional development program. In addition it would support improved governance and mitigate corruption risks through support to the higher Coordinating Group and the ACAP. It will address the need for improved institutional capacity of central institutions to develop policy, plans, budgets, and regulate the water sector, as well as the need for improved institutional capacity at Water Basin Committees, Governorate and District levels.

The key inputs for this component would include support to program management through:

a WSSP Support Unit and/or capacity development of key General Directorates such as Planning, Monitoring and Evaluation, Finance;

a WSSP Support Unit in MAI;

a capacity development facility managed by MWE to finance on demand:

- short term international consultancy;
- long-term and short-term national consultancy; and
- capacity development for MWE in planning, coordinating and evaluating NWSSIP implementation and overall management of the WSSP.

support to sub-sectoral planning and evaluation

a project preparation and evaluation facility to finance on a on demand basis:

- feasibility studies for water related projects expected to be financed from donors outside the Donor Core Group; and

- economic, social and environmental evaluation of projects initiated outside the WSSP framework.

support to the Anti Corruption Action Plan (ACAP) expected to focus on:

- procurement reform and capacity development;
- financial management reform and capacity development;
- enhanced information disclosure;
- community participation and consultation;
- education and awareness; and
- investigative capacity development;

support to a Communication Program;

Human resources development/training facility including short and medium and long-term training programs primarily for MWE and MAI and for the central and local branches of GDI, NWRA, GARWSP, and ULCs, designed to link with continuing civil service reforms.

The key outputs would include:

bi-annual sub-sectoral joint field supervision
bi-annual progress reports on NWSSIP Action Plan and WSSP implementation to be reviewed during the JAR
Contractual financial reports
improved coordination between MAI, MWE and MOLA
effective decentralization of GARWSP, NWRA
District Development Plans with pertinent water resource management components
Timely and cost efficient implementation of the WSSP.

## 2.6 Justification and Rationale for WSSP

An analysis of water sector issues in Country Water Resources Assistance Strategy (CWRAs), concluded that while the ongoing lending operations are helping GOY address the water challenges, their impact is getting diluted by implementation problems. Improving capacity and implementation performance are the critical short-term goals. In the longer term, priorities have been worked out as follows:[2]

- Getting the institutional structure right, with a correct balance between the management of the resource (NWRA) and the water and sanitation requirements and also users of particularly urban and rural water supply (irrigation).
- Getting the water resources planning and monitoring function operational with user participation and use of public disclosure mechanisms (especially basin planning by NWRA and water quality by EPA).
- Completing the rural and urban water supply reforms (NWSA and GARWSP), which would redefine the State's role as a facilitator and guarantor rather than as a service provider.
- Enhancing the role of the private sector and that of the community in service provisioning and oversight.
- Completing the reforms in the irrigation sector (MAI), and making operational community based models for management of groundwater/ surface water irrigation systems.

[2] CWRAS, March 2005, World Bank

These priorities are closely linked to the Bank's poverty reduction goal. The CWRAS and the PRSP clearly spell out that the poor water management creates poverty. The links between environmental degradation and poverty are also evident. Acting on Yemen's water problems is thus a pro-poor strategy. Overall, the reforms have made a contribution to reaching sector objectives, but broader, more sustained strategic actions are needed to make a difference. The objectives set for the water sector reform program have made a difference in past few years but the results are slow. For example:

- In water resources management - some instruments have been prepared and tested, but no significant difference to groundwater overdraft, inter-sectoral allocation or water use efficiency is evident.
- In water supply and sanitation, reforms have begun but only in urban areas with some limited impact on the consumer.
- In irrigation, in spite of efficiency gains in certain areas, resource depletion is continuing.
- In watershed management, resources and management effort have been tied up in a controversial dams program to the neglect of broader objectives of basin efficiency and poverty reduction.

It is apparent that water sector reforms are a major necessity for economic development of Yemen. The major donors and their focus areas in the Yemen Water Sector Support Program are presented in **Table 2.1**.

**Table 2.1: Major Donor Support to the Water Sector in Yemen**

| Donor | Major Focus Areas |
|---|---|
| Germany (GTZ and KfW) | Institutional development, urban water supply, hydrogeology |
| Netherlands | Rural water supply, water resources management, institutional development, urban water sector governance. |
| World Bank | Urban, rural, water resources, irrigation, institutional development. |

In November 2007, the Government of Yemen, the World Bank and the interested Development Partners agreed to move forward with a sector wide approach (SWAp) – a Water Sector Support Program (WSSP). This program will provide a solid transition link to the sector budget support during the lifetime of the program. The Bank also agrees that a SWAp framework is appropriate to promote a joint/integrated planning and monitoring of the water sector as it will help implement the commitments of the Paris Declaration.

The program will help GOY to achieve its main growth, development and poverty alleviation objectives as laid out in the governments' second PRSP and reflected in the 2006 Country Assistance Strategy (CAS).

The shit in the Yemen water sector from a project – based approach to a SWAp framework will allow the use of pooled funds from the IDA and other Donors to finance policy and infrastructure interventions within NWSSIP over the next five years. It will also allow the extended use of country systems and direct implementation by GOY agencies. The Bank and the Core Donors would provide the level of resources and both in-country and global experience essential to meet the government's objectives.

The WSSP would promote a sector wide approach at the district level through supporting Local Authorities in the preparation of District Water Master Plans. Pooling together information management systems already in use among the various stakeholders and in close collaboration with NWRA Branches, the district level plans will identify:

- geographical areas for development of water harvesting systems.
- areas with adequate groundwater resources suitable for mechanized water supply systems.
- areas where the use of groundwater for agriculture purpose would be prohibited. and
- areas where the irrigation improvement technology should be promoted as a priority, in consultation with farmers on water abstraction

## 2.7 Integrated Safeguard Policies

The World Bank classified projects in four categories depending on the type, location, sensitivity, scale of the project, nature and magnitude of the potential environmental impacts. These classifications are:

***Category A***

The category "A" project has significant environment impacts, viz.:

√ Sensitive

√ Diverse

√ Unprecedented

These impacts may affect areas other than sites/facilities subject to physical works. For category "A" projects, EA should cover potential negative and positive environmental impacts, analysis of feasible alternatives and mitigation measures.

***Category B***

The project has less adverse impact on human population or environmentally sensitive areas such as wetlands, forests and other natural inhabitants. These impacts can be mitigated by adopting mitigation measures more readily than category "A" projects. EA for category B project should cover potential negative and positive environmental impacts and mitigation measures.

***Category C***

It is likely that the project has minimal or no adverse impacts on the existing environment.

***Category FI***

The project involves investment of Bank funds, through financial intermediary in sub-projects that may result in environmental impacts.

The applicable environmental and social policies, directives, and good practices guidelines of the World Bank are given in **Table 2.2**.

Safeguards Policy Issues: The WSSP triggers the following World Bank safeguard policies: (a) Environmental Assessment (OP/BP/GP 4.01), because WSSP interventions will involve infrastructure investments in urban and rural water supply and sanitation and irrigation improvement activities in the agriculture sector; (b) involuntary Resettlement (OP/BP 4.12), because WSSP interventions may result in limited resettlement of local populations and/or

acquisition of land; and (c) Pest Management (OP/BP 4.09), because WSSP interventions will involve irrigation improvement activities that may affect the use of agricultural chemical inputs in the agriculture sector.

**Table 2.2 Applicable Banks Integrated Safeguard Policies**

| 6. Safeguard Policies Triggered | Yes | No |
|---|---|---|
| Environmental Assessment (OP/BP 4.01) | X | |
| Natural Habitats (OP/BP 4.04) | | X |
| Forests (OP/BP 4.36) | | X |
| Pest Management (OP 4.09) | X | |
| Physical Cultural Resources (OP/BP 4.11) | | X |
| Indigenous Peoples (OP/BP 4.10) | | X |
| Involuntary Resettlement (OP/BP 4.12) | X | |
| Safety of Dams (OP/BP 4.37) | | X |
| Projects on International Waterways (OP/BP 7.50) | | X |
| Projects in Disputed Areas (OP/BP 7.60) | | X |

Since, water sector-wide approach is adopted in the proposed WSSP and the critical nature of water resources management in Yemen, the WSSP has been classified an Environmental Category "A" project (requiring a full environmental assessment) under the Bank's Environmental Assessment safeguard policy (OP/BP/GP 4.01).

TABLE OF CONTENTS

LIST OF TABLES



LIST OF FIGURES



LIST OF ANNEXES

# *SECTION-3.0: BASELINE WATER SECTOR DATA*

## 3.1 Introduction

Yemen is an extremely water scarce country and urgent attention to improved water resources management is a pre-requisite for achieving sustainable economic growth, reaching the Millennium Development goals and maintaining social cohesion. The Government of Yemen has in recent times undertaken several projects/ reforms/ initiatives in the water sector to meet the future requirements. This section presents briefly the current socio-economic scenario along with the baseline data for the water sector.

## 3.2 Physical Environment

### 3.2.1 Topography

The Republic of Yemen (ROY) is situated in the Arabian Peninsula, between 12$^{o}$ and 19$^{o}$N Latitude and 42$^{o}$ and 55$^{o}$E Longitude.

Yemen is characterized by varied landscape, diversified terrain, and climate. The coastal plain shows ranges of low and high altitude mountains, many of which are terraced. There are mountains, plateaus, hills, and plains. The mountains range from 1000m to 3600m in height. Deserts extend eastward and northward. Green wadis are the riverbeds for rainwater runoff during the two rainy seasons.

### 3.2.2 Geology

The Arabian Peninsula is a part of the Afro-Arabian massif. Their current segmented dispositions are the products of extensive rift faulting, leading to the formation of Red Sea and the Arabian Sea. These two rift faults are nearly perpendicular to one another and have contributed in each instance to the formation of a series of cross faults on the territory. These cross faults have given rise to blocks of horsts and grabbens, provided passage for extrusion of lava, differential subsidence and upliftment of blocks of land, and lateral sliding of these blocks in many parts of Yemen. The inland basin was not spared by these mega-tectonic forces, much of their manifestations having remained buried under recent and sub-recent lithofacies. The lithostratigraphy of the inland basin of Yemen is given in **Table 3.1**.

The Afro-Arabian massif was subjected to erosion for a long time. This led to the formation of peneplains, upon which the sediments of the Proterozoic and Mesozoic periods were deposited. These sediments are mostly terrestrial derivatives (sandstones) and occasionally marine in the origin (limestone). These do not represent any uninterrupted sequence of sedimentation but reveal many unconformities. In the late Cretaceous and the early Eocene period, this massif was affected by epirogenic movement leading to up-warping around the Sana'a Mountain and pitching down at the Hadramawt end. This led to block faulting, basaltic lava flows, dykes, etc which was followed by sedimentation through the Tertiary era. During the Pliocene period, a change in sea level took place, causing a rise of about 150 m above the present level. Volcanic activity continued leading to reactivated tectonic activity in the late Tertiary era. Volcanic activity was continued into the early Quarternary era but not inducing any tectonic activity. Classic and argillaceous sediments were deposited during the Quarternary period in the shape of wadi deposits, alluvial fans, alluvial flats, etc. During the pluvial stage of the Pleistocene period, mass wasting and sheet wash brought down gravels of earlier origin into the inland basin leading to the formation of mixed layers of gravel and sand, lacustrine sediments and often marine deposits in the coastal areas. In the Holocene period, due to climatic change, the sedimentary litho-logy contributed towards the formation of Aeolian deposits of sandy plains and various types of sand dunes.

The plate tectonic model of Red Sea and Gulf of Aden is presented in **Figure 3.1**. The

formation of the Red Sea valley was accompanied by widespread volcanism. This covers large areas in the east of Dhamar, Yarim, and Damt, between Sana'a and Amran, as well as in the region of Sirwab with numerous cones and young lava effusions. The central part of the country, extending from Sana'a southwards to the area of Taiz, consists mainly of the Yemen Volcanics.

Yemen is moderately seismically active due to its proximity to the Red Sea Rift Fault system. The UBC loads has characterized the country in the high risk seismic zone and classified it in zone 3.

**Table 3.1: Lithostartigraphy of Inland Basin of the Republic of Yemen**

| Geological Periods | | Lithofacies | | Igneous Formation | | Tectonic Effects | |
|---|---|---|---|---|---|---|---|
| CENOZOIC | Quarternary | Q11 | Active Alluvium: Sand & Gravels in the main water courses | 6 | Basaltic Lava | | |
| | | Q10 | Older Alluvium: Conglomerates & coarse Gravels in lower reaches of major wadis | 5 | Trachytic flow & Domea | | |
| | | Q9 | Gravel in areas of low relief on stony surface | 4 | Basaltic Pyroclastic Deposits | | |
| | | Q8 | Aeolian Deposits: Barchan Dunes | | | | |
| | | Q7 | Aeolian Deposits: Liner sand dunes | | | | |
| | | Q6 | Loess & Ancient Dunes | | | | |
| | | Q2 | Colluvium: Scree over dissolution of salt diapers | | | | |
| | | Q1 | Lacustrine deposits in areas of inland drainage | | | | |
| | Tertiary | Ts | Shihr Group: Undifferentiated | | | | |
| | | Tr | Rus Formation: Thin bedded dolomites, limestones, Marls, Gypsum and Anhydrite | | | | |
| | | Tj2 | Nodular & Flinty Limestones with thin beds of brown & gray shales | | | | |
| | | Tj1 | Inter-bedded light grey shales & marly Limestones | | | | |
| | | Tu2 | Thinly bedded dolomitic limestones | | | | |
| | | Tu1 | Scarp Forming limestones & Dolomite with Marls & Shales | | | | |
| Mesozoic | Cretaceous | K | Undifferentiated | | | K-C4 | Alkaline to Ultramafic Diaremes |
| | Jurassic | Jn | Bituminous limestones, dolomitic marls | | | | |
| | | Je & Jm | Bituminous marls & Limestones with some gypsum/marl & Limestone with intermittent Basalt conglomerates | | | | |
| | | Js | Limestones & Marls with some sandstones | | | | |
| | | Jk | Sandstones calcareous sandstones & conglomerates | | | | |
| | | | | | | d3 | Late Syntectnonic to Post Tectonic Diorite |
| | | q | Quartzite | 3 | Acid Metavolcanics | y2 | Syntectonic Granite |
| | | gf | Graphic Schist | 2 | Intermediate Metavolcanics | y3 x d2 | Syntectonic Syenogranite Ultramafic Rock Syntectonic Diorite |
| | | c | Marble & Metadolomite | 1 | Basic Metavolcanics | | |
| | | m | Schist | | | v2 | Syntectonic Gabbro |
| | | g | Para-gneiss | | | g | Orthogneiss |
| | | A | Amphibolites | | | | |
| | | M | Migmatite | | | | |

**Source**: Adopted from EIA report for Safir – Hadramout Road Project, Volume 1, March 1994

### 3.2.3 Climate

The Republic of Yemen lies within the northern stretches of the tropical climatic bordering the sub-tropical climatic zone. Various elevations are largely responsible for variations in temperature and climate in Yemen. The mean annual temperature ranges from less than 15°C in the highland region to 30°C in the coastal plain region. The temperature rises to 40°C during summer in the coastal plains and to more than 40°C in the desert plateau region. However, the winter temperature falls down to 0°C in the highland region. Relative humidity ranges between the extremely dry (4%) to very high (90 to100%). The country has been divided into three climatic zones as under:

**Arid Tropical Climate**: Lower Mountain slopes in the west and the south and the coastal fall in this zone. Such regions have high temperatures and less rainfall ranging between 0 and 400 mm.

**Arid Sub-tropical Climate**: it is a transitional climate between the tropical climate of the coastal plain region and the temperate climate of the highland region. The lower and the upper mountain slopes and the eastern plateau enjoy this climate. The mean monthly temperature ranges between 16°C and 28°C and rainfall, between less than 100 mm and 600 mm.

**Temperate Climate**: the mountains ranging in altitude from 1,800 to 3,700 meters lie in this zone. The mean temperature between 10°C and 18°C and precipitation, from 200 mm to more than 1200 mm.

### 3.2.4 Rainfall

Isohyets showing the regional variation of the estimated mean annual rainfall in ROY, depicted in **Figure 3.2,** indicate that rainfall is higher in the west and the south than in the east or the north. The inland basin falls in the rain shadow zone of the western and the southern mountains. Three meteorological phenomena noticed below, generally cause rainfall in Yemen.

The Mediterranean Effect*:* In the winter months, (especially in December and January) the influx of polar air that follows the passage of a depression may trigger light rainfall. However, such events are infrequent occurring on an average once in 3-5 winter seasons.

*The Red Sea Convergence Zone (RSCZ):* The RSCZ is caused by the rapid heating up of land surfaces (relative to sea warming) that gives rise to the generation of onshore winds. These are then affected by the convection effects of the Western Highlands. As a consequence humid air masses are lifted and carried eastward to give rise to heavy, but short and highly localized, rainstorms. The RSCZ is most influential from March to May, and with reduced effects in the autumn season.

*Monsoonal Inter-Tropical Convergence Zone (ITCZ):* The Monsoonal ITCZ influences Yemen from July to September when warm dry air from the Arabian (and the African) land masses to the North mixes with moist southerlies from the Indian Ocean. The rain producing effects of the ITCZ are most keenly felt on the Western and the Southern Escarpments where the triggering orographic effects are most significant. The Eastern Escarpment receives relatively little in the way of rain from the influence of the ITCZ. However, as the ITCZ moves north (before retreating south again) areas as Far East and North as the Sana'a plain may receive rainfall.

### 3.2.5 Climate Change

The Consultant has reviewed the available data to address the probable impacts of climate change on water supply and demand in the future. Some of the findings are as under:

- The Republic of Yemen has ratified the international treaties as under:
  - United Nations Framework Convention on Climate Change (New York, 1992)
  - Kyoto Protocol on Climate Change (September 2004)
  - Agreement on Banning the use of Technologies that change the Environment for Military purpose and for any other aggression (Geneva, 1977)
  - Protocol on Substance that Deplete the Ozone Layer (Montreal, 1987)
- Data indicators pertaining to $CO_2$ emissions:
  - Increase in Index Value from 100 in the Year 1960 to 400 in the Year 1998[3].
  - Sector wise contribution of $CO_2$ emission is as follows

| Sector | 1998[3] | 2004[4] | Percentage increase/decrease |
|---|---|---|---|
| Transportation, | 48% | 31% | -35.42% |
| Electricity and Heat Productions | 20% | 29% | 45.00% |
| Residences/other Fuel Combustions | 20% | 27% | 35.00% |
| Manufacturing and Construction | 7% | 9% | 28.57% |
| Other energy industries | 4% | 5% | 25.00% |

- An increase between 25% and 45% may be noticed from all sectors except transportation where it declined by 35%.

Climate change indicators pertaining to Yemen reveal the following[5]

- Temperature
  - December, January, and February Temperature Mean Change (°C), value is 1.51 in the period 2030 – 2050 compared to the period 1980 – 1999. This is based on A1B Scenario[6] and 8 GCMs[7].
- Precipitation
  - Value of Mean Change – December, January, and February – is 14.56 % in the period 2030 – 2050 compared to the period 1980 – 1999. This is based on A1B Scenario and 11GCMs.
  - Minimum across country value is 8.26%.
  - Maximum across country value is 35.86%.
  - Mean Model Concordance value (% models that agree with sign of change) is 64

[3] Climate and Atmosphere—Yemen, Earth Trends, Country Profiles, 2003

[4] Yemen CO2 Emissions (mtCO2, %) by Sector in 2004 (excludes land use change)
Original Source: Climate Analysis Indicators Tool (CAIT) Version 5.0. (Washington, DC: World Resources Institute, 2008)

**[5] Source: From the World Bank web site with the following notes –**
**Data from the World Climate Research Programme's Coupled Model Inter comparison**
**Project: Phase 3 (https://esg.llnl.gov:8443/) are extracted and reanalyzed by the World Bank.**
**** The runoff dataset was obtained by the U.S. Geological Survey (USGS), c/o National Oceanic and Atmospheric Administration (NOAA) Geophysical Fluid Dynamics Laboratory (Milly et al. 2006) and reanalyzed by the World Bank.**

**[6] A1B Scenario: The A1 storyline and scenario family describe a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies and "B" a balance across all sources (Baseline Scenario) Source: *The Scientific base, 2001 (Intergovernmental Panel on Climate Change – IPCC)***

**[7] GCM: General Circulation Models, Source: *The Scientific base, 2001 (IPCC)***

- Drought indicators
  - Value of change in (Maximum) Consecutive Dry Days (2030 - 2050, compared to 1980 - 1999, 8 GCMs; A1B scenario) is -4.
  - Mean Model Concordance (percentage models that agree with sign of change) value is 61.
  - Change in r5d (maximum rain over 5 day period) (2030 - 2050, compared to1980 - 1999, 8 GCMs; A1B scenario) value is 23.86%.
  - Value of Mean Model Concordance (% models that agree with sign of change) is 97.
- Runoff change
  - Value of Mean Runoff Change (%) (2041 - 2060 compared to 1900 - 1970; A1B scenario) is 10 to 20.
  - Number of pairs of model runs (out of 24) in agreement with sign of change is 3 to 9.

From the above discussions, it is apparent that the country will get impacted in future because of climate change scenario.

### 3.2.6 Hydrology

After heavy rainfall, run-off flows through wadis like a flashflood or spate and becomes surface flow for a short time. It also starts infiltrating rapidly into wadi beds and recharges the groundwater.

Rainfall absorbing zones and Runoff producing zones of Yemen as defined in previous studies are as follows[8]:

- Areas with limited rainfall, limited relief and a relatively low energy environment tend to be rainfall-absorbing areas.
- Areas with higher rainfall, greater changes in relief, and higher energy environments tend to produce runoff.

The GOY has undertaken extensive terracing of hillsides in the upper wadi catchments to:

- Harvest the limited annual rainfall more effectively.
- Stabilize the soils.

In addition, spate irrigation systems and other available water harvesting techniques have also been utilized / enhanced by the Ministry of Agriculture and Irrigation (MAI) and the Ministry of Water and Environment (MWE). Some of these projects are:

- Spate Irrigation Improvement Project
- Groundwater and Soil Conservation project.
- Sana'a Basin Water Management Project

Findings of previous studies indicate that the quantity of underground water is approximately 10 billion cubic meters annually. Of this, one billion cubic meters is in Al-Masila basin, 2.5 billion cubic meters in Tihama basin, and the remaining underground water reaches to 1.5 billion cubic meters annually through wells. Water drawn from the reservoirs is 3400 million cubic meters, of which 90% to 93% is used for agricultural purpose, 8% for municipal water supply services, and

[8] Yominco-TNO/DGV, 1983

2% for industrial sector.

As the quantity of groundwater exploitation exceeds the average recharge of around 900 million cubic meters, it has resulted in lowering the water tables. In some basins, this decrease in the water level is between 2 and 6 meters annually. Overdraft of groundwater is a major factor contributing to the depletion of water resources.

- On an average, the depletion rate in Yemen is about 138% of the replenishment rate; however in some critical aquifers, it varies between 250% and 400%.
- The number of wells in the country is estimated at around 45,000 together with about 200 drilling platforms.
- If such overdraft continues, it is most likely that the majority of aquifers would run dry in a period of 15 to 50 years. Such a critical situation calls for immediate remedial measures for treating water as a scarce and strategic commodity.

## 3.3 Surface Water Hydrology

There is no major surface water body in the country. Only flashfloods during heavy rainfall in hills generate surface water in the wadis. A total of Seventy Eighty (78) wadi catchment basins exist in Yemen. These catchment basins are grouped in four (4) major basins as under:

- Red Sea Basin
- Arabian Sea Basin
- Gulf of Aden Basin
- Ar Rub' Al khali Basin

### 3.3.1 Flow Characteristics

Available data for Wadi catchments and surface flows are summarized in **Table 3.2.**

**Table: 3.2 Average Surface Flows of Wadi Catchments in Yemen** [9]

| Wadi Basins | Catchment Area (km2) | Average Annual Surface Flow (Mm3) |
|---|---|---|
| Sana'a Basin | 3,200 | 11 |
| Harad | 1,700 | 35 |
| Rasian | 1,990 | 12 |
| Mawza | 1,600 | 29 |
| Bana | 6,200 | 170 |
| Hassan | 3,000 | 41 |
| Ahwar | 6,410 | 71 |
| Mawr | 8,100 | 129 |

[9] (Rypkove, V., 1999, "Water Resources Management Regions of Yemen")

| | | |
|---|---|---|
| Zabid | 4,632 | 125 |
| Surdud | 2,700 | 82 |
| Rima'a | 2,750 | 99 |
| Siham | 4,900 | 73 |
| Tuban | 5,060 | 109.4 |
| Al-Jawf | 14,000 | 150 |
| Jaza'a | 15,000 | 60 |
| Hadramout | 46,075 | 161 |
| Adhanah | 12,600 | 100 |
| Beyhan | 3,000 | 21 |
| Markhah | 4,000 | 24 |
| Mayfa'ah | 9,900 | 54 |
| Najran | 4,400 | 30 |

## 3.4 Groundwater Availability

Renewable resources, estimated at about 2,100 million cubic meters a year, are being supplemented by groundwater mining at a rate of about 1,300 million cubic meters a year from deep aquifers (with desalination and reclaimed wastewater accounting for a negligible percentage). This is creating problems of equity between users, and an unsustainable "bubble" of agricultural use. The concentration of population in the relatively water-scarce highland basins - especially in Sana'a and Taiz - is leading to extreme water constraints in towns and to aggravated competition for water between urban and rural. In the Sana'a Basin, for example, there are over 8,000 operational wells – but only 70 for public water supply.

Review of past data on the wadi data indicate that there is a need to improve the spate water irrigation system in order to reduce the dependability of groundwater for irrigating the agricultural fields. The wells which are being used for irrigation purpose, are abstracting water from upper alluvium layer. Due to non availability of spate water in valley areas and with increased population in the command area is forcing farmers to abstract groundwater from deeper layers. This is deteriorating the situation and is a source of environmental concern such as sea water intrusion.

## 3.5 Groundwater Hydrology

### 3.5.1 Groundwater Recharge

Groundwater is in a dynamic state as a result of replenishment (groundwater recharge) on one hand, and the discharge process on the other. Direct recharge of groundwater is generally very low in Yemen. This is a logical consequence of the prevailing rainfall regimes and the soils are dry during most of the time. Any rainfall that does not run-off immediately in the form of overland flow tends to be easily accommodated in the upper soil zone, from where it is lost almost entirely by evaporation and evapo-transpiration during subsequent days. Heavy and continuous precipitation for a few days helps recharge the groundwater. It is clear that given a certain rainfall regime, the direct recharge in runoff absorbing zones is likely to be greater than in the run-off producing zones. The main forms of natural groundwater recharge in Yemen are by infiltration of surface water from wadis. Indirect recharge by wadis and the direct charge by

rainfall are also recharge processes active during the overland flow phase. Water moving as overland flow toward the nearest branches of the wadi channel network passes over different types of land surface. On its way down, it may flow into fissures and cracks of solid rocks and it may accumulate in ponds or get trapped (for convenience, classified under 'direct recharge'). It helps recharge extensive aquifer rocks of the rugged mountain massifs and plateau. Another factor, which contributes to induced groundwater recharge in Yemen, is the infiltration losses. Intensely irrigated zones such as the Highland plains may exceed the natural recharge of the groundwater reservoirs. Induced recharge through discharge of domestic and industrial wastewater is comparatively unimportant in Yemen, at least from the quantitative point of view. Artificial recharge is not practiced at all.

The overall effect of irrigation on groundwater recharge depends mainly on the source of irrigation water, whether it is surface water or groundwater. Applying groundwater for irrigation tends to increase the demand on groundwater recharge. This process tends to activate the hydrological cycle and by diverting surface water for irrigation or 'harvesting' overland flow (which is widely practiced in Yemen), has a direct effect on reducing groundwater recharge.

### 3.5.2 Groundwater Discharge

Groundwater discharge can be divided into 'natural' and 'induced' or 'man-made' components. In Yemen the latter category entails groundwater abstraction only; the former one includes discharge by springs, by outflow into streams (base-flow), by evaporation and evapo-transpiration, and by submarine outflow.

Springs occur in many zones of Yemen, in particular in the mountain and plateau areas. Many of them are in Amran Limestone, in the rocks of Hadramout Group or in the volcanic areas. These are also found in rocks, in the upper part of Wadi Surdud Catchment (Wadi Ahjar zone), where hundreds of small springs are located along the contact between Tawilah Sandstones and the rocks of the underlying Amran Group (Dufour, 1989).

The Mukalla sandstone outcrops in the rifted zone east of Wadi Ahwar are also scattered with springs (Robertson, 1991d; TC-HWC, 1992d). They generate a steady base flow to Wadi Hajar, the only permanent stream in southern Yemen. Some of the springs in the catchment of Wadi Hajar are obviously thermal springs (van der Meulen and Von Wissmann, 1932).

Discharge of groundwater by outflow into streams, where it constitutes base-flow, often occurs in association with springs. It is typical for the upper and intermediate parts of the wadis in the water zones, e.g. in the area of Western Slops. The lower part of the streams, however, near the sea and at the edge of the desert does not collect base-flows.

Evaporation and evapo-transpiration are important mechanisms of natural groundwater discharge, in arid zones. Typical features are sebkhas (wet lands) along the cost and white-crusted evaporation zones in wadi beds, especially at narrow outlets of groundwater basins, such as at the Sadah Plain, Radah Plain and in the eastern part of Wadi Hadramout.

Submarine outflow is a common mechanism of coastal aquifers. It is estimated that it accounts for about half of the natural discharge of the Tihama and the Tuban, Abyan aquifers. Groundwater abstraction has gained enormous importance over the last 20-30 years. Less than one

generation ago it was a minor component of the total discharge of the groundwater systems; nowadays it is the dominant form of groundwater discharge of most of Yemen's groundwater systems.

## 3.6 Water Resources Management

**NWRA is the Agency responsible for water resources management and would undertake measures to check uncontrolled abstraction of groundwater as under:**

- **Adopt Basin Management approach**
- **Form Basin Committees.**
- **Basin plan to be by the Basin committees, priority to be given to domestic water use.**
- **Well Inventories are to be taken up by the Basin authority in each basin.**
- **Licenses for drilling would be issued after making enquires such as purpose of drilling etc.**
- **Quantity of water used is fixed at the time of issuing licenses.**
- **Drilling machines are to be fitted with Global Positioning System (GPS)**
- **Patrol cars are to be deployed**

**Consultants' Remarks**:

- **Professional staff are lacking**
- **Enforcement of water law is weak**
- **NWRA checks water quality of wells but there is no check of water quality of private suppliers.**
- **Dearth of hydro-geological data on groundwater.**
- **Data sharing among MAI, EPA, NWRA, LC, and GAWRSP is must before undertaking any project.**

It is apparent that water resources are scanty in Yemen. The per capita availability of water in Yemen is the lowest in the world 150$m^3$/cap/year compared to 1250 $m^3$/capita/year in the MENA region and 7500 $m^3$/capita/year world wide. This amounts, approximately, to 10% of the regional and 2% of the world average per capita availability. The problem is more acute in the western part of the country (Highlands, Tihama, and Arabian Sea area) where 90% of the population lives and per capita availability of water is 90$m^3$. Moreover, the relative water scarcity is exacerbated by physical and temporal variations as well as serious water allocation problems. With rapid population growth, it is expected that water availability per capita will decrease by about 35% in 2025, well below levels generally reckoned to indicate severe water stress. To tackle the water crisis in the country, the GOY proposed the water resources management objectives as under in National Water Sector Strategy and Investment Program (NWSSIP):

- Ensuring greater degree of sustainability and giving priority to domestic needs of rural and urban populations.
- Improving water allocation keeping in view equity, social norms, domestic needs, and economic benefits.
- Creating a realistic and holistic water vision among the general population.
- Alleviating poverty by promoting efficient water use and equity in water allocation.

The proposed water resources management policies involve consolidating the basin management in partnership with local communities. For its part, the Government assumes the responsibilities of:

- Creating an enabling institutional framework, providing information, raising awareness and creating a water management vision
- Providing water related public infrastructure
- Protecting water rights by implementing the water law
- Creating conducive macroeconomic environment.

The NWSSIP also endorsed implementation of integrated water management plans for water basins on co-management approach with local communities for them in solving their water management problems.

The strategy outlined in NWSSIP is as follows:

### 3.6.1 Sustainability through Water Resources Protection

The biggest challenge threatening Yemen's water resources is overdraft of groundwater. The introduction of motor pumps and tube-well technology enabled farmers to tap deeply into groundwater aquifers as traditional water rights allow unlimited access to such aquifers on farmer's private land. Literature review indicates each farmer tries to capture as much of this common pool resource as possible.

In order to make it sustainable, the MAI has piloted a range of irrigation efficiency and watershed management innovations and is currently adopting participatory management approach by formation of water user organizations and facilitating technical advisory services.

The National Water Resources Authority (NWRA) is carrying out water-well inventories in a number of basins, and amended Water Law has introduced some regulatory instruments.

The overdraft problem will have to be dealt with by a comprehensive "package" of measures, including:

- Economic incentives, including trade and agricultural policy measures;
- Regulatory measures, including self-regulation by the community;
- Clear assignment of water use rights (linking them to specific uses);
- Irrigation technology packages that help farmers earn more income using less water.

MAI will continue and expand its activities in this field through promotion of water use efficiency, and will work with the MWE/NWRA to launch pilot projects to help local communities (that have demonstrated water use adaptive capacity) to regain control of groundwater.

### 3.6.2 Increasing Farmers' Income through Increasing the Efficiency of Water Use in Irrigation

Government policy is to increase water productivity with in the agriculture sector (more crops per drop). The goal is to use water efficiently and in a sustainable manner for irrigating the lands. In this regard, MAI would develop water efficient technology projects through Agriculture Research and Extension Authority (AREA). Measures to improve the existing water use system will include:

**NWSSIP suggests the following approach:**

1. **Refocus research and extension:**
   - **Research on use participatory techniques and integrate socio-economic factors.**
   - **Extension work to focus on water use efficiency at farm level, with national coordination provided by the MAI/AREA.**
2. **Cost recovery on public irrigation schemes and developing water user associations (Under A21A reform program)**

- Institutional capacity building.
- Increased participation and strengthening of farmer's institutions

- Optimization of use of non-conventional water sources (e.g. treated wastewater).

### 3.6.3 Enhancing Sustainability and Quality through Improved Watershed Management

**Discussions during field visits with various government agencies revealed:**

- **GARSP, LWSSC, EPA, and MAI are trying to coordinate among themselves.**
- **Meetings are being organized to review the status of the implementation of water plan at governorate level.**
- **NWRA, Governorate level council (GLC), and District Level Council (DLC) cooperate well.**
- **Workshops normally organized at district level to discuss the basin plans.**
- **Irrigation improvement schemes are being implemented to improve the irrigation efficiency.**
- **Participatory management approach being promoted by forming WUAs' and WUGs'.**

MAI proposes a comprehensive approach to water resource management integrating rainfall and run-off management, rangeland, forestry, recharge and dams. This approach to watershed management follows the national strategy of integrated water resources management and basin management plans.

The MAI will reinforce its decentralized approach under A21A, working in close cooperation with NWRA. The agricultural research agenda will be broadened to cover soil-water interactions and rainfed/ water resource management issues. Investments on facilities like terrace rehabilitation, check-flow structures, dams and spate improvement will become a priority for AFPPF financing and will be coordinated by the MAI and the NWRA within the basin framework.

On the question of dams, a review and evaluation of past experience will be undertaken. A Basin-wide Master Plan will develop guidelines for site selection, economic, social and water resources management assessments, and EIAs. A participatory approach will be adopted, involving both the beneficiaries and the Local Councils.

## 3.7 National Water Sector Strategy and Investment Program

A National water sector strategy and investment program (NWSSIP) for 2005 -2009, prepared by the MWE, deals comprehensively with the water sector related issues and proposes a set of institutional, financial, and policy measures. It also addresses discrepancies in the sub-sectors (water resources, urban WSS, rural WSS and irrigation) in order to harmonize and promote the interests of all the stakeholders.

NWSSIP is a comprehensive strategy, action plan and investment program. Integrated management is explicitly dealt with, and measures to improve institutions and governance issues are set out. Proposals are made on economic policy issues, particularly to revise the incentive framework. There is a strong program of support for NWRA in water resources management. There are proposal to reinforce the ongoing sector reform program for urban water supply and sanitation, with increased investment to attain the MDGs. Proposals for the rural water supply and sanitation sector are "tentative" as the sector strategy have also been considered in this document. Action plans on irrigation and watershed management include an overhaul of the dams program, and reallocation of resources to broader water conservation measures. Objectives, policies, and approach of NWSSIP are listed in the following box.

**1. OBJECTIVES OF NWSSIP**

- **Ensure coordination among all partners working in urban and rural water supply and sanitation sub-sectors, within and outside the MWE**
- **Ascertain that policies in each of these two sub-sectors are unified and that investments are equitably allocated among governorates according to unified rules and that no projects are duplicated, especially in rural areas, so as to ensure that investments complement each other.**
- **Ascertain integration of water policies and national policies of sustainable growth and poverty reduction.**
- **Ensure that sector financing effectively supports sector goals.**
- **Monitor and evaluate performance.**

**2. POLICES TO ACHIEVE THE OBJECTIVES OF NWSSIP**

- **giving immediate priority to defining and implementing the strategy, investment program and action plan;**
- **organize the institutional and administrative setup of sector institutions and to ensure that they are properly functioning and managed;**
- **Ensure that multi-dimensional issues between different stakeholders in the water sector are being dealt with in an integrated manner (funding, community contribution, tariffs, training, etc).**

**3. APPROACH**

- **Consolidating MWE institutional structure**
- **Improving the quality of sector investment and of AFPPF financing**
- **Formulation of a clear policy on institutional responsibility of each concerned body regarding water quality and its suitability for various uses, and regarding the assessment and control measures of such quality.**
- **Follow-up of implementation of the necessary measures to establish control over groundwater abstraction through an integrated package that includes economic incentives, regulatory measures, clear definition of water use rights and assisting farmers to enhance the economic and financial returns from water use (getting more income with less water).**

### 3.7.1 Urban Water and Sanitation Development Strategy

Modern potable water supply in urban areas has been developed by both public and private sectors. Public schemes operate in most large towns but have low efficiencies and poor coverage. Private and community piped schemes exist in some places, usually on a small scale. In most cities, private supply by tanker or bottled drinking water is a vital supplement to erratic and inadequate public supply. Urban sanitation is largely by cesspits. Where a sewered system exists, wastewater treatment is limited and reuse is minimal.

In this regard, NWSSIP adopted the same objectives as those of the WSS Sector Reform Program set out in Cabinet resolution (237/ 1999) to increase coverage by WSS services. Millennium Development Goals (MDGs) set for the program are presented in **Table 3.3**.

**Table 3.3: Millennium Development Goals for Urban Water Supply**

| | 2002 | 2009 | 2015 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Percent of urban population covered with water supply services | 47 | 71 | 75 |
| Urban population covered with water supply services(million) | 2.4 | 4.9 | 6.7 |
| Total urban population(million) | 5.2 | 6.9 | 8.9 |
| Urban water demand(million cubic meters) | 129 | 175 | 225 |

**Source**: NWSSIP, 2005-2009

### 3.7.1.1 Urban Water Supply

The city of Aden was the first urban centre of Yemen to have a piped water supply system which was operational in the 1930s. The system was fed by a well field at Sheikh Othman and served a limited part of Aden population. Only since the beginning of the seventies, significant efforts have been made to organize adequate municipal water supply systems in all urban centers. Water supply in the urban centers has expanded considerably in recent years as the cities are growing. But the pace of meeting urban water demand does not match the requirements in many cases. Efforts are being made by the GOY to improve the coverage of water supply and sanitation services in urban areas. **Table 3.3** presents the millennium development goals set by the Government for urban water supply and sanitation services. In the urban water sub-sector, reform programs are currently being implemented to enhance decentralization and transfer responsibility to autonomous local corporations, designed to be self-financed ultimately. For meeting the MDG's, additional quantities of water would be required. It is expected that water demand would reach 100 MCM by 2015. An annual investment rate of the order of 150 million USD is required to achieve the MDG's set for the UWSS.

**The current UWSS scenario is as follows:**

- **Groundwater is the source for meeting urban water demand.**
- **Total groundwater abstraction for urban use through public utilities is about 75MCM excluding abstractions by private suppliers.**
- **All known water sources have been harnessed; hence, possibility of water supply augmentation by reducing distribution system losses is modest.**

**Thus, new options for meeting urban water supply requirements have to be explored.**

NWSSIP indicates some of the new sources which might be used in future for urban water demand:

- Through transfer of additional quantities of water from agricultural use in the rural areas to domestic use in urban areas.
- Saving of water by improving the irrigation facilities shall be given priority so as to reduce over draft of groundwater from the wells already strained.

It is noted that the volume of water supplied annually to the southern part is more than that in the northern part, in spite of a smaller urban population. The level of services in the southern part is higher than that in the northern towns and cities, with a greater percentage of people connected and a higher per capita consumption. Several urban cities in the north such as Sana'a and Taiz have serious water supply problems. Many people have to rely partly or completely on the private water supply systems.

**Major activities undertaken by the UWSSP to improve the water supply conditions include:**

- **Well rehabilitation to enable continuous and adequate water supplies.**
- **Augmentation of the carrying capacity of the transmission mains.**
- **Rehabilitation of the existing water supply network for increasing the carrying capacity of pipes and reducing losses.**
- **Developing a zoning system to facilitate an efficient and equitable distribution of available water supplies, by constructing new clear water reservoir etc.**
- **Introducing bulk and consumer water metering to regulate water supplied/ consumed.**
- **Controlling unaccounted for water within feasible limits.**

### 3.7.1.2 Un-served Areas of the Country

People living in the un-served areas as well as served areas, where water supply is intermittent, are purchasing water from the private sources/ vendors. Drinking water is sold in private shops in 5l and 10l cans costing 40YR and 80YR. Besides, citizens depend on costly water tankers to fulfill domestic needs. Private vendors sell water tankers at the rate of YR 1000 to 1200. Many poor families are currently relying on expensive tanker-delivered water. There is no proper arrangement for checking the quality. Urgent actions are needed to enforce laws to prevent uncontrolled abstraction of groundwater as well as check water quality of private tankers/ vendors.

**Source: NWSSIP**

The current policy is to encourage gradual phase-in of public-private-partnerships, through management contracts and "utility support programs", and by developing outsourcing. Some private networks are supplying water to meet the requirement of the newly expanded areas and un-served areas.

### 3.7.1.3 Urban Sanitation Services

As the number of people connected to the water network is increasing, there is higher water demand in the urban areas. Fresh increase in water demand and consumption requires improved methods of discharging and reusing to protect health and sanitation**.** The MDGs fixed for

**During the field visit, the study team visited one of the private suppliers. The salient points are presented below:**

- **Local Corporation (LC) services do not exist in the area.**
- **LC gives permission to the operator to provide water.**
- **NWRA has given permission to dig the well for domestic water supply only, on the following conditions:**
  - **No extension of the network unless approved by Local Corporation (LC)**
  - **No increase in tariff unless approved by LC**
  - **No supply of water to private tankers.**
- **Tariff structure is set by LC. Lifeline tariff block is 0 to 10m$^3$ and Tariff is 150 YR/m$^3$.**
- **Water samples are sent to the Environmental Health and Public Administration.**

**Recommendations:**

- **As water supply is the responsibility of the LC, they should check the water quality of the private suppliers.**

sanitation services are given **in Table3.4.**

**Table 3.4 Millennium Development Goals for Sanitation Services in Urban Centers**

| | 2002 | 2009 | 2015 |
|---|---|---|---|
| Percentage of urban population covered by sanitation services | 25.0 | 52.0 | 63.0 |
| Urban population covered by sanitation services(million) | 1.3 | 3.6 | 5.6 |
| Total urban population(million) | 5.2 | 6.9 | 8.9 |

**Source:** NWSSIP

It is seen from the table above that 25% (1.3 million urban populations) was covered in 2002 which will be increased to 52% (3.6 million) by 2009. This will improve the quality of life and help in managing groundwater use. Highest coverage of population with sewerage system is reported in Aden 95% followed by 75% in Mukalla, and 65% each in Taiz and Hodeidah. Data pertaining to the existing sewerage system indicate that major activities to improve the existing sanitation services include:

- Rehabilitation/up-gradation of existing sewer system to meet existing and future demand of the cities
- Provision of new sewer system to the newly developed areas of the cities.
- Collection and disposal of waste from the non-connected households of the cities.

**During the field visit, the study team visited one of the private suppliers. The salient points are presented below:**

- **Local Corporation (LC) services do not exist in the area.**
- **LC gives permission to the operator to provide water.**
- **NWRA has given permission to dig the well for domestic water supply only, on the following conditions:**
  - **No extension of the network unless approved by Local Corporation (LC)**
  - **No increase in tariff unless approved by LC**
  - **No supply of water to private tankers.**
- **Tariff structure is set by LC. Lifeline tariff block is 0 to 10m$^3$ and Tariff is 150 YR/m$^3$.**
- **Water samples are sent to the Environmental Health and Public Administration.**

**Recommendations:**

- **As water supply is the responsibility of the LC, they should check the water quality of the private suppliers.**

### 3.7.1.4 Environmental Concerns

In some cities, the existing sewerage system for collection of wastewater and treatment plant has become inadequate because of rapid growth of population.

The photograph shows the situation in un-served areas of one city where the households are discharging such wastewater into the wadis or open spaces. Flow of untreated sewage in wadis is a source of groundwater contamination. It also has negative impacts on environment as well as health and hygiene.

**For example in the city of Ibb, the existing wastewater treatment unit is running overloaded and obnoxious smells are noticed in areas near the plant. Further, untreated wastewater is flowing to the wadi and farmers are using it for irrigating their fields.**
**Well fields are located in the wadi. Such situations would cause environmental health problems and become a source of groundwater contamination in the long run, if left unattended.**

In some cities, existing wastewater treatment systems are overloaded due to rapid population expansion and are a source of pollution. Urgent attention is required to upgrade the existing systems/ provide new wastewater treatment systems in newly developed towns/ cities.

### 3.7.2 Rural Water and Sanitation Development Strategy

Rural water supply and sanitation (RWSS) is a very powerful poverty alleviation tool, considering the positive impact of access to drinking water on health, girls' education, and unemployment. Hence, expanding rural water supply and sanitation coverage is a national priority. General Authority for Rural Water and Sanitation Project (GARWSP) is the main organization responsible for covering rural areas. Other organizations such as Social Fund for Development (SFD) and the Public Works Projects (PWP) are also working to improve access of the rural people to safe drinking water and sanitation services. In order to meet the MDGs and achieve the program objectives, GOY is encouraging decentralization and cost sharing with the beneficiaries. The beneficiaries would be made responsible for operation and maintenance of the schemes implemented in the rural areas. The Millennium Development Goals set for improving rural water supply and sanitation are given in **Table 3.5**.

**Table: 3.5 Millennium Development Goals for Rural Water Supply and Sanitation**

| | 2000-2003 | 2009 | 2015 |
|---|---|---|---|
| Percentage of rural population with access to safe water supply | 25% | 47% | 65% |
| Percentage of rural population with access to safe Sanitation | 20% | 37% | 52% |
| Rural Population with access to safe water supply (million) | 3.4% | 8.2% | 13.6% |
| Rural population with access to safe sanitation (million) | 2.8 | 6.5 | 10.5 |
| Total Rural Population (million) | 13.8 | 17.5 | 20.9 |
| Total investment required (million USD/year) | 50 | 130 | 130 |

**Source: NWSSIP, MWE**

#### 3.7.3.1 Existing Rural Water Supply

The rural population in Yemen in 2006 was 15.5 million of which 42%, i.e. 6.5 million had access to safe water. The population is projected to rise to 20 million in 2015. Another 7 million (approx) people would need to get access to safe water to achieve the target of 65% coverage in 2015. About 800,000 people are required to be served annually between the period 2007 and 2015.[10]The main objective of the on-going project is to expand sustainable rural water supply and sanitation coverage in six governorates by:

- Introducing to Yemen a demand responsive approach, proven worldwide.
- Decentralized community-managed RWSS development approach assisting the Government in building and strengthening local RWSS capacity.

[10] Report No. AB3362, Rural Water Supply Additional Financing, 2008, the World Bank

- Helping the Government to translate the agreed demand responsive approach (DRA) principles into a coherent RWS strategy.
- Preparing a long-term (10-15 years) national RWSS investment program that could be supported by the Bank and other donors.
- Mainstreaming the tested and successful implementation approach into governorate water activities aligning project activities with the NWSSIP and strengthening capacity for sanitation and hygiene promotion activities.
- Supporting preparation of studies and development of capacities for transition to SWAP. Under the water supply component, coverage is to be extended to 270,000 new consumers through construction of about 80 water supply systems in the six governorates.
- Governorate water branch offices will be more closely involved to ensure alignment to the branch office water program and prepare for future use of country systems. [10] Normally, in rural areas buckets and ropes are used to fetch water from open wells. The GAWRSP is providing water using the most common method which is a mechanical system consisting of a well and a pump. The SFD is another organization which is also involved in rural water supply program. Rain Water Harvesting structures such as small dams etc are being constructed under the program. SFD is now planning to provide individual roof top harvesting tank (for Wadi Qadi Area in Taiz) for meeting the domestic tank. It is also providing silver coated filter which is producing water up to WHO standards.

#### 3.7.3.2 Existing Rural Sanitation System[11]

There is no proper sanitation in the rural areas. Various wastewater discharging methods are used, e.g. covered and uncovered cesspits systems in varying proportions in urban and rural areas. Also, 40% (approx) of wastewater is discharged on the lands especially in rural areas.

**a) Rural Areas**

Only a small percentage of households have some form of latrine. Latrines are either located inside the premises or in a separate building outside the house. These latrines have:

- Pour-flush system.
- Ceramic squatting pan connected to an external soak-pit.

Buckets are used to flush out the pan. In hilly areas, households use pipes for discharging the wastewater to the valley below. Generally the latrines or cesspits are not emptied when full, these are covered with sand, and the villagers dig a new pit.

**b) Rural Schools and Clinics**

[11] Summary of the Environmental Review for Rural Water Supply and Sanitation Project, Attachment V, Document # 349, 2000

Many rural schools and clinics have no proper sanitation facilities. Some schools have sanitation facilities, e.g. pit latrines, soak pits, and septic tanks which are maintained individually by the administrative personnel. However, little attention is given to this issue. The situation may be improved by making annual contracts with private individuals to maintain the facilities.

**SANITATION IN RURAL AREAS:**
**Consultants' had conducted field household survey of villages in the year 2006 during the Rapid Assessment Study of different wadis. Some of the findings of that study on the prevailing sanitation services are summarized below:**

**a) Siham**
- **Only 7% of the houses have permanent flush toilets and around 51% have temporary sanitary toilets.**
- **The balance 42% of the households use open places as they could not afford to build even temporary toilets in their houses.**
- **Only 10.5% of the families felt that sanitation around their surroundings is fairly good, while another 35.1% appear to be satisfied with their sanitary environment.**

**b) Bana**
- **The majority (98.08%) of the houses in Wadi Bana enjoy sanitary toilet facility, and the balance 1.92% of the families use open space.**
- **About 26.92% of the families felt that the sanitary condition of their surroundings is good; 63.46% reported that it is some what satisfactory and the rest 9.62% felt that it is not good.**

### c) Large Villages and Small Towns

The more densely populated areas of large villages and small towns (3,000 to 10,000 population), rely on "on-site" disposal through latrines and cesspits. Sanitation coverage is higher in these areas, up to 60% causing potential surface and groundwater contamination problems. The emptying of pit latrines and cesspits in these more densely populated areas can be improved, if the concerned authority provides an emptying service using a vacuum tanker. The costs could be covered by user charges. However a major issue that should be addressed is to how to provide facilities where septic wastes can be emptied and treated.

### d) Gray Water Disposal

The majority of village households have no proper means of gray water or sullage disposal. It is usually piped away from the sink to the outside where it is allowed to soak into the ground, or if no sink exists, the waste is thrown onto the ground. Also, in general, the spillage from public stand posts or water points is allowed to remain on the ground, forming a stagnant pool where animals come to drink, churning the area into a mud bath. Increasing water supply service levels in villages can aggravate this problem unless it is addressed properly.

## 3.7.3 Agriculture and Irrigation Water Sector Strategy

For improving the rural livelihoods and adding sectoral value in a sustainable manner, NWSSIP outlines the following the specific objectives for irrigation and watershed management:

| Main agricultural products in Yemen | | |
|---|---|---|
| **Item** | **Hectares** | **Production** |
| **Sorghum** | **453011** | **401843** |

| | | |
|---|---|---|
| **Khat (qat)** | **136138** | **147444** |
| **Millet** | **112955** | **82276** |
| **Wheat** | **110709** | **149173** |
| **Maize** | **43301** | **65890** |
| **Barley** | **36985** | **27745** |
| **Mango** | **23436** | **345265** |
| **Dates** | **13774** | **50090** |
| **Grapes** | **12544** | **117580** |
| **Almond** | **4746** | **8547** |
| **Pomegranate** | **2499** | **23270** |
| **Peach** | **2366** | **11277** |
| **Apple** | **2129** | **18728** |
| **Apricot** | **733** | **1509** |
| **Guava** | **581** | **3714** |
| **Fig** | **445** | **4569** |
| **Quince** | **231** | **1263** |
| **Original Source : Agricultural Statistics Report 2007, Adopted from: YEMEN: Changing weather patterns pose challenges for agriculture, humanitarian news and analysis, UN Office for the Coordination of Humanitarian Affairs, IRIN News, DUBAI, 8 May 2008 (IRIN)** | | |

- Enhancing sustainability through water resources protection.
- Improving farmers' income through increasing water use efficiency.
- Enhancing supply d) Improving institutional performance in support of farmers. The MAI is currently responsible for irrigation, dams, reservoirs, and water harvesting. At the field level, the MAI's programs have demonstrated the technical and economic feasibility of investing to better agricultural water management in groundwater-irrigated lands, in watershed management and in spate irrigation improvement.

### 3.7.3.1 *Agriculture*

Agriculture is the main source of livelihood in rural areas. In Yemen agriculture is not only an economic sector but also a way of life with different economic functions.

### 3.7.3.2 *Cultivated Areas and Production*

Land suitable for agriculture is widespread across many regions of Yemen including the plains, highlands, coastal areas and terraced mountains. The cultivated area has increased to a total of 1.4 million ha. The crops cultivated are mainly cereals, vegetables, fruits, cash crops, and animal feeds.

The salient features, inter alia, are:

- Cultivated area for cereals increased from 639,806 ha in 1991 to 685,439 ha in 2004 and production, from 447,470 tons to 487,944 tons during the same period.
- Cultivated area for fruit doubled and the production increased from 316,000 tons to 736,000 tons.
- Cultivated area for vegetables also increased to 71,200 ha and production increased by 30% (i.e. 833,000 tons).
- Cultivated area for coffee reached to 33.7 million ha with production at 11,600 tons. Production of cotton increased to 29,000 tons.

### 3.7.3.3 Use of Pesticides

In Yemen, use of pesticides started in the mid thirties (1935). Pesticides were used at low levels from the fifties onwards; mostly chlorinated hydrocarbon compounds were used for control of desert locust, cotton, and date palm pests, and public health pests. In the sixties, the use of pesticides increased, caused by the start of bilateral co-operation projects in agriculture and public health sectors. Organophosphate and carbonate compounds were used in development, research and service projects by regional development authorities and continued up to seventies along with the chlorinated hydrocarbon compounds.

In this context, the private sector started to import, distribute and sell agricultural pesticides. During the early eighties, synthetic pyre-throids compounds were used to control pests in agriculture and public health. Also, the Government started paying more attention to solve problems created by the expanding use of pesticides. The initial measures by Government against the misuse of pesticides, was to prohibit the sale and use of chlorinated hydrocarbon compounds.

Decree (68) of the Ministers' council (1989) dealt within commercial procedures in agricultural pesticides. At the same time, and extending into the nineties, surveys were carried out on the presence of economic pests and their natural enemies.

The Pesticides Management approach, including biological pest control, became the main alternative to control by chemical means. In order to control the quality of imported pesticides, Government established the" Pesticides Formulation Laboratory ". In the 1990s, the Ministry of Agriculture and Irrigation organized the disposal of obsolete and unwanted pesticides (300 tons), which had accumulated in Yemen during the last 40 years, mainly for use in locust control.

In 1999, Parliament approved the Agricultural Pesticides Act. Fertilizer abuse creates several health and environmental problems.

### 3.7.3.4 Pest Management

Although the WSSP's interventions in improving techniques in the agriculture sector will not directly finance or promote the purchase or use of pesticides, these interventions will continue and build on many of the irrigation improvement activities started by the World Bank's Sana'a Basin Management Project and thus may result in increased use of agricultural chemicals at WSSP sites. This triggers the safeguard policy on **Pest Management (OP/BO 4.09)**. In recent years, the GOY has gained increasing experience with integrated pest management (IPM) techniques, preparing pest management plans for grapes and qat, building capacity in the MAI's Department of Plant Protection, and providing outreach and advice to farmers. Many of these activities were, in fact, financed by the Sana'a Basin Water Management Project. The WSSP will reinforce and build on these experiences as necessary to ensure proper pest management. The ESMF will screen proposed interventions in irrigation improvements and identify appropriate measures to address any potential adverse impacts from agricultural chemicals.

### 3.7.3.5 Water Requirement of different Crops

| MAIN IRRIGATION SOURCES | |
|---|---|
| **Irrigation sources** | **Hectares** |

| | |
|---|---|
| **Rain** | **661,152** |
| **Wells** | **429,182** |
| **Floods** | **148,172** |
| **Streams** | **35,347** |
| **Dams** | **19,142** |
| **Tank on car** | **15,650** |
| **Other** | **634** |
| **Total** | **1,309,279** |

**Original Source : Agricultural Statistics Report 2007, Adopted from: YEMEN: Changing weather patterns pose challenges for agriculture, humanitarian news and analysis UN Office for the Coordination of Humanitarian Affairs, IRIN News, DUBAI, 8 May 2008 (IRIN)**

In order to meet the farmers' demand, MAI has undertaken various projects to improve irrigation efficiency. NWSSIP also indicates that MAI will continue and expand its activities in this field through promotion of water use efficiency in close association with the MWE/NWRA. The MAI piloted a range of technical efficiency and watershed management innovations, and is currently using Water User Organizations (WUA) and Technical Advisory Services (TAS) in its activities. Some of the projects undertaken by the MAI are presented briefly in the following sub-sections.

Determination of crop water requirement for various crops is an important aspect for estimating the water demand for agriculture sector. Based on earlier studies conducted by the Consultant, data have been compiled in **Table 3.6** for water requirement of different crops:

**Table 3.6: Crop water requirement for various crops in Tihama Region[12]**

| Sl. No. | Method of irrigation | Crops | Crop water requirement ($M^3$/ha.) |
|---|---|---|---|
| **1.** | **Spate Irrigation** | Sorghum | 4300-6500 |
| | | Sesame | 4000-6500 |
| | | Cotton | 7000-13000 |
| **2.** | **Ground Water Irrigation** | Tomato | 5500-6500 |
| | | Onion | 5500-6500 |
| | | Water Melon | 4000-6000 |
| | | Sweet Melon | 4500-6500 |
| | | Chilli | 6000-8000 |
| | | Banana | 12000-22000 |
| | | Mango | Not Available |

### 3.7.3.6 Improved Irrigation Project

Irrigated agriculture is estimated to use more than 90 percent of Yemen's water. Irrigation has grown rapidly, both from groundwater and surface water. Later, in the 1970s, the introduction of the tube-wells and motor pump revolutionized irrigation. Now, full or supplemental groundwater irrigation accounts for over two thirds of the value of crop production. Irrigation efficiencies are low (nationwide average about 40%). Water consumption in the irrigation sector is continuously increasing with an average rate of 30 MCM/year or 5% per year. By 1990, irrigated agriculture alone was consuming 130% of Yemen's renewable water resources which increased to 150% in 2005. If expansion were to continue, the overdraft would reach 200% by 2025 – although many aquifers would be pumped dry before then.[13] Irrigated agriculture in Yemen is facing a number of challenges such as:

- Sustainability of spate irrigation
- Sustainability of groundwater irrigation
- Low productivity of irrigated agriculture

[12] Source: Study on Machinery Selection and Management for farms in Tihama
[13] Country Water Resources Assistance Strategy, 2005, The World Bank

In order to improve the existing system, Spate Irrigation Improvement Project (SIIP) was undertaken by the Ministry of Agricultural and Irrigation.

Participatory irrigation management (PIM) system was also introduced in this project. Under this system farmers would gradually take more responsibility in operating and maintaining the spate scheme. This project includes the following activities:

- Rehabilitation of existing structures
- Dredging of silt from the upstream of the diversion structures Regular maintenance of gates such as painting, greasing etc.
- Removal of sediment and trees from bed and side slope of the canal to restore canal capacity.
- Construction of a new diversion structure with proper intake facility.
- Rehabilitation/ improvement of diversion structures (divide walls, skimming weir, sluice weir, weir crest, toe).
- Rehabilitation of turnout structures, protection work in downstream portion of drop structures, box culverts, silt ejectors, and cross regulators etc.
- Bank protection works.
- Replacement of gates in primary and secondary canals etc.
- Improvement of canals to increase the ability to carry larger spate flows.

### 3.7.3.7 Groundwater and Soil Conservation Project

Another project under implementation, viz. the Groundwater and Soil Conservation Project (GSCP) seeks to improve water management and increase irrigation efficiency in Yemen. The main objective of the GSCP is to conserve water, especially groundwater, and soils by:

- Improving water management and encouraging the widespread adoption of water saving technologies that improve irrigation efficiency,
- Improving and rehabilitating small and medium spate irrigation to ensure better and longer spate supplies for spate irrigation and improved groundwater recharge;
- Encouraging the rehabilitation of terraces and related measures that conserve and improve soils;
- Capacity building of Government institutions and community groups to manage, and conserve water.

Under the project, groundwater conservation through participatory water management will be introduced initially in two selected, pilot sub-basins, namely Sa'dah Plain and Tuban Delta that have critical groundwater situations. These selected pilot areas are designated as Enhanced Groundwater Management Areas (EGMAs). Components of GSCP are listed in **Table 3.7.**

**Table 3.7: Components of the GSCP** (Source Environmental Management Plan for GSCP)

| GSCP component | Project Sub-component |
|---|---|
| Groundwater Irrigation and Management Improvement | Improved conveyance of groundwater for irrigation |
| | Localized on-farm irrigation systems |
| Groundwater recharge and soil conservation improvement | Small and medium spate irrigation improvement and rehabilitation |
| | Water harvesting structures and soil conservation in uplands |
| | Institutional strengthening of PCU |

| | |
|---|---|
| Institutional strengthening of the water institutions | Institutional strengthening of FUs |
| | Institutional strengthening of MAI offices, including GDI, CWMU |
| | Irrigation advisory service (IAS) for water management |
| | Institutional strengthening of NWRA and water user/conservation |
| | community groups |

The activities under the subprojects of the project include:

- Use of PVC buried pipes and GI pipes to improve water distribution and save conveyance losses
- Installation of localized on-farm irrigation systems such as drip irrigation system, bubbler irrigation, small holders drip systems and micro-sprinkler systems, etc.
- spate irrigation improvement works
- wadi bank protection walls, and spurs made of gabions and/or traditional systems using dry stones.
- **Water harvesting structures and soil conservation in the uplands would provide for:**
  - Rehabilitation of abandoned terraces.
  - Wadi bank protection works in uplands.
  - Spate breakers, check dykes, vegetative measures for wadi soil conservation and erosion control.
  - Small on-farm water storage tanks New tanks Rehabilitation of existing tanks.
  - Traditional water harvesting structures to collect rainwater for human, animal and crop consumption and for groundwater recharge and open pits in wadis bed for groundwater recharge.

#### 3.7.3.8 Watershed Management

Watershed management upstream and Basin management in the wadis would address the problems of flooding and silt deposition. Watershed management works include identification of problems and construction of upstream protection works needed such as erosion control structures, spate breakers, terrace rehabilitation, mechanical, and biological watershed protection works, small dams, hill lakes, earth embankments and dikes.

### 3.8 Socio-Economic Profile and Socio-economic Survey Results

The Yemeni economy is predominantly rural and agricultural. The Human Development Report (2007-2008) ranks According to 2007/2008 report, Human Development Report ranks Yemen at 153 out of 177 with a GDP of $930 per capita. Population growth, water shortage, lack of economic diversification and weak institutional and administrative coordination mechanisms are some of the main challenges.

### 3.8.1 Demographic Characteristic

#### 3.8.1.1 Population and Housing Census

The country has one Capital City Council and 21 Governorates consisting of 333 districts with a population of about 20 million, growing at a rate of 3% (approx) as shown in the **Table 3.8.** The male population (10,036,953) constitutes 50.99% of the total population, and the female

population (9.628.616), 49.01% of the total population. Although the vast majority of the population is rural (71.4%), the rate of urbanization has been steadily increasing over the last decade. It is also observed that 51.5% of the residents are in the age group of 15-64, while 45.0% are less than 15 years old.

**Table 3.8: Main Demographic Indicators**

| Item | Estimated 2006 | Estimated 2005 | 2004 Census | 1994 Census |
|---|---|---|---|---|
| Total of residents population | 20900532 | 20282944 | 19685161 | 14587807 |
| Annual growth rate of population | - | - | 3% | 3.70% |
| **Resident population by sex** | | | | |
| Males | 10661838 | 10344249 | 10036953 | 7473540 |
| Females | 10238694 | 9938695 | 9648208 | 7114267 |
| **Resident Population by Urban Status** | | | | |
| Urban | 6070613 | 5894749 | 5637756 | 3423518 |
| | | | 28.6% | 23.5% |
| Rural | 14829919 | 14433195 | 14047405 | 11164289 |
| | | | 71.4% | 76.5% |
| **Resident Population by age group *** | | | | |
| Less than 15 years | 9414513 | 9136291 | 8866993 | 7554236 |
| | | | 45.0% | 50.3% |
| (15-64) years | 10769567 | 10451377 | 10143388 | 6736573 |
| | | | 51.5% | 46.2% |
| 65 years and over | 716452 | 695275 | 674780 | 516998 |

***Source:*** **2004 Census and 2005 and 2006 estimates**

(* The unspecified age is distributed on wide age groups)

### 3.8.1.2 Population and the Literacy Rate

The 2004 Census Report shows literacy rate of the adult population as 23.4%. Gender wise, the adult male literacy rate is 34.2%, and the adult female literacy rate 12.2%. The enrollment rate for boys in the age group of 5-15, is 44.8% and that of the girls, 22.1%. However, enrollment rate of both boys and girls of the age group of 5-15, is 33.2%. **Table 3.9** shows gender wise adult literacy rates and enrollment rates of school going children.

**Table 3.9: Adult Literacy Rates and Enrollment of School Going Children (Age 5-15 Yrs)**

| Adult literacy rate | | | Enrollment of school going children (Age 5 -15 yrs) | | |
|---|---|---|---|---|---|
| **Male** | **Female** | **Both Sex** | **Boys** | **Girls** | **Both Sex** |
| 34.2 | 12.2 | 23.4 | 44.8 | 22.1 | 33.9 |

***Source:*** Census Report – 2004

### 3.8.1.3 Health Status

The development strategy in Yemen pays particular attention to the provision of necessary health services to the population. In 2004, the number of hospitals, including rural hospitals is 172. There were 5282 physicians and 8882 nurses; giving a ration of one Doctor per 3734 person and 1.7 nurses per Doctor **Table 3.10** shows a few relevant details.

**Table 3.10: Health Status**

| **Life expectancy** | |
|---|---|
| Total | 62.5 years (2007 estimate) |
| Female | 64.5 years (2007 estimate) |
| Male | 60.6 years (2007 estimate) |
| **Infant mortality rate** | 58 deaths per 1,000 live births (2007 estimate) |
| **Population per physician** | 4,573 people (Census 2004) |
| **Population per hospital bed** | 1,662 people (2003) |

***Source:*** Census Report – 2004

### 3.8.1.4 Health and Health Conditions

The current Government health system consists of health units, centers and hospitals. The total no. of reported cases in 2004 were 227824 in which Diarrhea and Malaria are the two major diseases, numbering 154571 cases and 51992 cases respectively. Availability of physician/ nurses/ beds is low compared to the neighboring countries and the developing economies.

**Table 3.11: Main Indicators for the Health Sector**

| | |
|---|---|
| Total Population count (resident population) | 19721643 |
| Total reported cases | 227824 |
| No. of Beds | 12734 |
| No. of Physician | 5282 |
| No. of Disabled resident population | 1882 |
| No. of AIDS Cases | 123 |
| Hepatitis B | 3130 |
| Hepatitis A | 4332 |
| Measles | 8079 |
| Whooping cough | 3476 |
| Diphtheria | 11 |
| Malaria | 51992 |
| %(Malaria infections) | 23% |
| Diarrhea | 154571 |
| Other cases/Total cases | 21261 |
| % (other cases) Total cases | 9% |

***Source:*** *Census Report - 2004*

Illness and death rates due to endemic diseases are higher particularly because of the lack of access to safe drinking water and low coverage of the sewerage network. This creates an environment favorable for spreading the endemic ailments.

### 3.8.2 Gender Issues

In Yemen, social differentiation by gender starts early. In childhood, the male child's needs (e.g. education, care, and nutrition) take precedence over that of the girl child. The female child, from an early age, is trained to become a good, obedient wife and mother. This involves early training in domestic activities and agricultural work, including transportation of water in rural areas.

**Table 3.12: Gender Profile for Yemen**

| | |
|---|---|
| **Population** | |
| Sex ratio(number of males per 100 females | 103.2 |
| Percentage of female population | 49.2 |
| **Health Indicators** | |
| Life expectance at birth in full years(females) | *63.8 |
| Total fertility rate per woman (TFR) | 6.10 |
| Average age at marriage (female) | 22.3 |
| Total fertility rate | 6.2 |
| Infant mortality Rate( 000) Females | 75.4 |
| Total registered Birth rate(females) | 66474 |
| Total registered Date rate (females) | 5372 |
| **Education indicators** | |
| Percentage of illiteracy for females | 61.6 |
| Percentage of females who can read and write | 25.4 |
| Female Illiteracy among the population 10 years and above | 69.1 |
| Female school enrollment rate(6-14years) | 54.9 |
| Percentage of females to total students | 39.9% |
| Percentage of females to total students (primary schools – public) | 38.7% |
| Percentage of females whose education level university and above | 1.0 |
| Percentage of females to total students (secondary schools –public) | 30.3% |
| No. of students in vocational training(female) | 917 |
| **Employment** | |
| Employment ratio(women) | 60.5 |
| Unemployment ratio(women | 39.6 |
| Women works as labor force | 12.13 |

**Source: CSO-2004**
* Projected estimates for 2001-2006

Yemen, with 6.2 births per woman, is among the countries with the highest total fertility rates (TFR) in the world e.g. 6.10 in 2004. Although the growth rate decreased from 3.7 per cent in 1994 to just over 3.0 per cent in 2004, rapid population growth continues to be an underlying cause of many of the problems the country faces. As the population of Yemen is expected to double in 23 years at the present growth rate, the poverty situation in the country is expected to aggravate further, hindering prospects for sustainable development and threatening prospects for equitable access to and expansion of education and primary health care. As stated in the 2005 Common Country Assessment (CCA), “less than full attention to population dynamics of the country, and in particular efforts to increase birth spacing will undermine socio-economic development efforts.

Variations in the fertility rate exist between women of different demographic and socio-economic groups. For example, there is an association with early marriage as the fertility rate among women married before the age of 15 is 6.2, (**Table 3.13)** compared to 3.5 for women who married at the age of 20 or 21 years.

### 3.8.2.1 Main Gender Concerns

- Impact of prevalent social customs and cultural values on the status of women.

- Poor application of laws and legislation which are essentially based on equality of both sexes.
- The Widespread illiteracy, poor quality of educational attainment of women hampers the participation of women in the society in general, and hinders equitable benefit from the fruits of development.
- Girls have much less free time than boys, are much less mobile, are much less likely to participate in paid work, and have heavier domestic responsibilities regardless of whether or not they are in school.
- Adolescent girls' movements are restricted and their participation in public activities is severely limited. About 69 percent of all girls who are economically active are not involved in paid work. Instead, many work as unpaid workers for relatives.
- Young women, out of school, tend to spend their adolescence in relative seclusion within the family bounds. Female Illiteracy among the population, 10 years and above, is 69.1 percent (Census -2004)
- The status of women is low, with the gender gap especially large in education, which confines women's ability to benefit from their economic, social and cultural rights.
- Gender inequities in households/ markets/ and society are the causal factors that prevent women from realizing their current income potential and improving future income potential
- The Health services are particularly inadequate in the rural areas. Women suffer the most in taking care of themselves and their children.

### 3.8.3 The Agriculture Sector

Agriculture accounts for nearly 15 percent of GDP and employs 75 percent of the rural workforce, constituting about 75 percent of Yemen's population. **Table 3.13** shows that agriculture accounted for 29.8% of employment in the country in 2004 vis-a-vis 42.8% in 1999. Out of a total 3.5 million, around 1.06 million households are engaged in agriculture. Working women make up 13.3% of the labor force; 30.9% are mainly skilled workers in agriculture, pasturing and fishery activities.

**Table 3.13: Main Indicators in Agriculture Sector**

| | |
|---|---|
| Total no. agricultural tenure | 1180105 |
| Total area(acre) | 1609484 |
| Cultivable area(acre) | 1609484 |
| Cultivated area (acre) | 1452437 |
| Percentage of employed persons out of the total labor force (%) | 83.8 |
| Agriculture, hunting and pasturing | 29.8 |
| No of person in agriculture, hunting and pasturing | 1060000 |
| Skilled workers in agriculture, pasturing and fishery (women) | 30.9 |

**Source: CSO-2004**

#### 3.8.3.1 Demand for Water in Agriculture

The major issues for consideration are:

- As noticed in the earlier section, agriculture is the mainstay of the Yemeni economy.
- The agricultural sector consumes about 90% of the available water resources for irrigation.

- Water use efficiency is still low though efforts are being made for improvement
- Increasing population growth coupled with rapid urbanization, requiring larger allocation of water for the urban sector (including sanitation) as well as the continuing water scarcity will definitely affect water availability for irrigation and/or lead to price increase.
- Small farmers with dispersed land holdings and reliant on traditional water resources will be unable to use costly water and continue production.
- As their livelihood will come under increasing strain leading to migration urban areas, weakening the rural economy.
- The entry of rural labor into the urban market without necessary skill/ training would in all likelihood, deprives wages and spread poverty amongst the new entrants.

### 3.8.4 Labor and Unemployment

Economic growth, imbalances *in* the GDP structure, and restrictive financial and monetary policies were reflected *in* the labor market. **Table 3.14** shows that the rate of contribution to economic activity increased from 38.1% in 1994 to 39.2%) in 2004. The percentage of the economically inactive out of the total manpower (15 years and over) was slightly reduced to 60.8% from 61.8%. At the same time unemployment rate increased sharply from 10.6% in 1994 to 39.4% in 2004.

**Table 3.14: Main Indicators of Labor Force**

| Item | 2004 | 1999 | 1994 |
|---|---|---|---|
| Percentage of employed persons out of the total manpower (15 years and over) (%) | 32.9 | 33.2 | 34.4 |
| Percentage of employed persons out of the total labor force (%) | 83.8 | 86.3 | 90.2 |
| Percentage of the unemployed persons out of the total manpower (%) | 6.4 | 5.3 | 3.7 |
| Percentage of the unemployed persons out of the total labor force (%) | 16.2 | 13.7 | 9.8 |
| Percentage of the economically inactive out of the total manpower (15 years and over) (%) | 60.8 | 61.5 | 61.9 |
| Rate of contribution to the economic activity | 39.2 | 38.5 | 38.1 |
| **Unemployment ratio** | | | |
| Males % | 13.0 | 12.5 | 9.7 |
| Females% | 39.6 | 25.4 | 10.6 |
| Total % | 39.6 | 25.4 | 10.6 |
| **Rate of contribution to the economic activity** | | | |
| Males % | 68.4 | 69.9 | 71.3 |
| Females% | 9.6 | 7.0 | 4.2 |
| Real ratio of economic dependency (%) | 39.2 | 38.5 | 38.1 |

| Item | 2004 | 1999 | 1994 |
|---|---|---|---|
| Total ratio of economic dependency (%) | 454 | 485 | 484 |

**Source:** CSO-2004

Providing employment opportunities is one of the major challenges facing the government. The industrial sector would not, in the near future, replace the agriculture sector, which engages about 52% of the total workforce and 89% of female workers. For enhances employment opportunities outside agriculture, the Government will have to promote investment, develop the productive sectors, and adopt financial and monetary policies that accelerate *growth.* Economic policies should be appropriately framed to utilize/ upgrade available skills, improve productivity and provide a climate inductive to growth.

### 3.8.5 Poverty Assessment

The 2005 Household Budget Survey (HBS) estimate that the new national averages for poverty lines in nominal terms were 70 to 80 percent higher for urban and rural regions respectively than those in 1998. The average consumption for Yemen as a whole is only 60 percent above the average poverty line, indicating low income levels in the country as shown in **Table 3.15.**

**Table 3.15: Comparison of New and Old Poverty Lines in Current Prices**
***(Yemeni Riyals per-capita per month)***

| | All Yemen | | Urban | | Rural | |
|---|---|---|---|---|---|---|
| | 1998 | 2005 | 1998 | 2005 | 1998 | 2005 |
| **Total Poverty Line** | **3210** | **5456** | **3195** | **5667** | **3215** | **5377** |
| **Ratio of mean consumption to poverty line** | **1.3317** | **1.5679** | **1.6056** | **2.151** | **1.2498** | **1.3360** |
| **Food Poverty Line** | **2101** | **3765** | **2093** | **3581** | **2103** | **3694** |

**Note:** There appears to be an error in the food poverty line of All Yemen – the figure should be in between the corresponding values of food poverty line for Urban and Rural Strategy
**Source: Yemen Poverty Assessment, 2007**

### 3.8.6 Social Determinants of Poverty

Poverty is not the outcome of economic process alone, rather it is the result of the interaction of economic, social and cultural factors which either alleviate or deepen the severity of the phenomenon. Human poverty assessment is been made by studying various social indicators, viz. population (i.e. fertility, infant and maternal mortality), illiteracy rates, enrollment in basic and secondary education, access of people to primary health care and potable water, access to electricity etc . As noticed earlier, UNDP (2007/2008) Report indicate HDI value of 0.508 for Yemen ranking it at 153 out of 177 countries. This indicates that there is an urgent need to upgrade basic social services in urban and rural areas for males and females belonging to either poor or non-poor sections.

An assessment of statistical data indicates that causes of poverty are as follows:

- Large family size which raises the chances of coming under poverty line.
- Families with a large number of children have a higher probability of being poor whether located in rural or urban areas.
- The probability of falling into poverty reduces with an older head of the household increases in families headed by widower/ widow.
- The employment situation has an important impact.
- The probability of falling into poverty is reduced largely in families headed by a businessman/ a self-employed person.

### 3.8.7 Water and Poverty

Water problems are an important component of poverty. There is a clear disparity between the better off and the poorer sections of the Yemenis in terms of both access to and price paid for safe water and sanitation. The Scarcity of water makes significant impact on the lives of the poor. The correlation between water and poverty is as below:

- Poorer people are more vulnerable and spend a larger share of their income for adequate water.
- Ownership of a water source is correlated with higher income in agriculture. Development of groundwater resources in recent years has increased income disparities as the better off sections have taken a larger share of the resources.
- Water problems had severe adverse health consequences for the Yemeni population – for instance, mortality rate of children under the age of 5 years is twice that of other countries in the MENA region; half of these deaths of children are due to diarrhea.
- In rural areas, ground and surface water are the main sources of potable water; each providing about 50% of the total supply with associated health risks.
- Women and girls spend a large part of each day in fetching water.
- Sanitation services are poor in rural areas and many districts as a whole.
- Expansion of water and sanitation services is particularly urgent in rural areas. In addition, existing public networks suffer from decay and poor maintenance.

### *3.8.8* Socio-economic Survey

Sample socio-economic survey of participants' was carried out to identify existing socio-economic characteristics and prioritization of vulnerable group in five Governorates namely Sana'a, Ibb, Taiz, Lahej for Aden and Hadramawt Governorate. A simple questionnaire (**Annex-3.1**) was distributed among the 82 participants in the Focus Group Discussions**.**

The social survey was carried out using the following tools:

- Questionnaire survey with the help of a structured questionnaire in the Arabic language.
- Questionnaire survey was conducted during Focus Group Discussion with participants.

#### 3.8.8.1 Results of Socio-Economic Survey

The survey results revealed that 68.29 percent are living in joint families and the average size of the family is 13.5 members. The male population constitutes 54.15 and the female, 45.85 percent of total sample survey. 82.93 percent of the participants are literate. The main occupation is agriculture e.g. 56.10 percent, followed by 37.80 in service and 6.10 in other occupations as indicated in **Table 3.16**.

**Table 3.16: Socio-economic Characteristics**

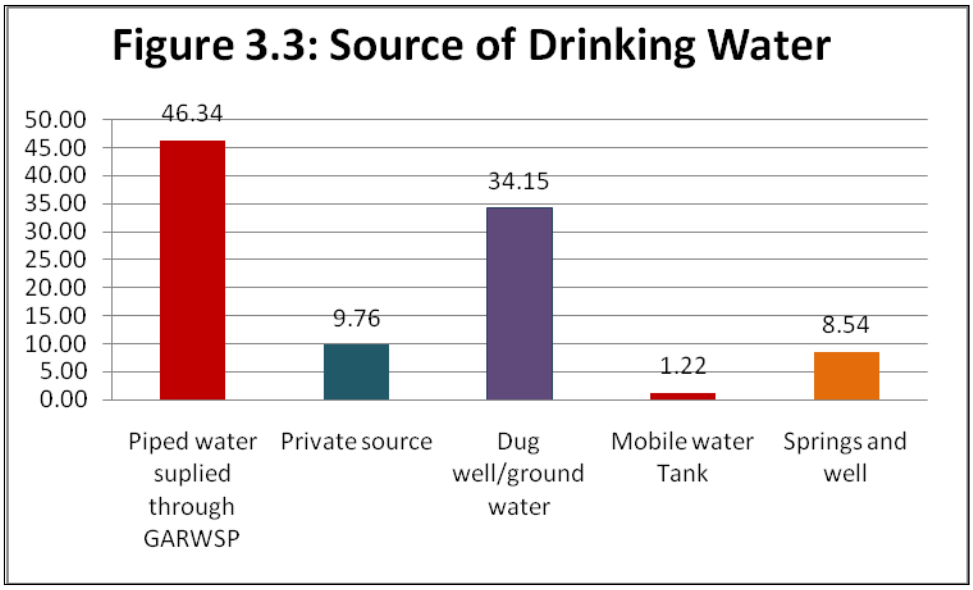
| Particulars | No | % |
|---|---|---|
| **Total no. Participants(sample survey)** | **82** | **100** |

| Particulars | No | % |
|---|---|---|
| Average of Family Size | 13.3 | |
| Household Type | | |
| Joint | 56 | 68.29 |
| Nuclear | 15 | 18.29 |
| Extended | 11 | 13.41 |
| **Sex** | | |
| Male | 581 | 54.15 |
| Female | 492 | 45.85 |
| **Education status** | | |
| Illiterate | 10 | 17.07 |
| Literate | 68 | 82.93 |
| **Main Occupation** | | |
| Agriculture | 46 | 56.10 |
| Service | 31 | 37.80 |
| Others | 5 | 6.10 |

***Source:*** *Participants questionnaire survey- 2008*

### 3.8.8.2 Source of Drinking Water

The survey indicates that the major source of drinking water supply is through piped water through GARWSP (46.34 percent) and dug well/ground water (17.52 percent). Private springs, and wells and mobile tanks are other sources of drinking water supply with a share of 9.76 percent, 8.54 percent & 1.22 percent respectively **(Figure 3.3)**.




***Source: Participants' questionnaire survey- 2008***

### 3.8.8.3 Quality of Drinking Water

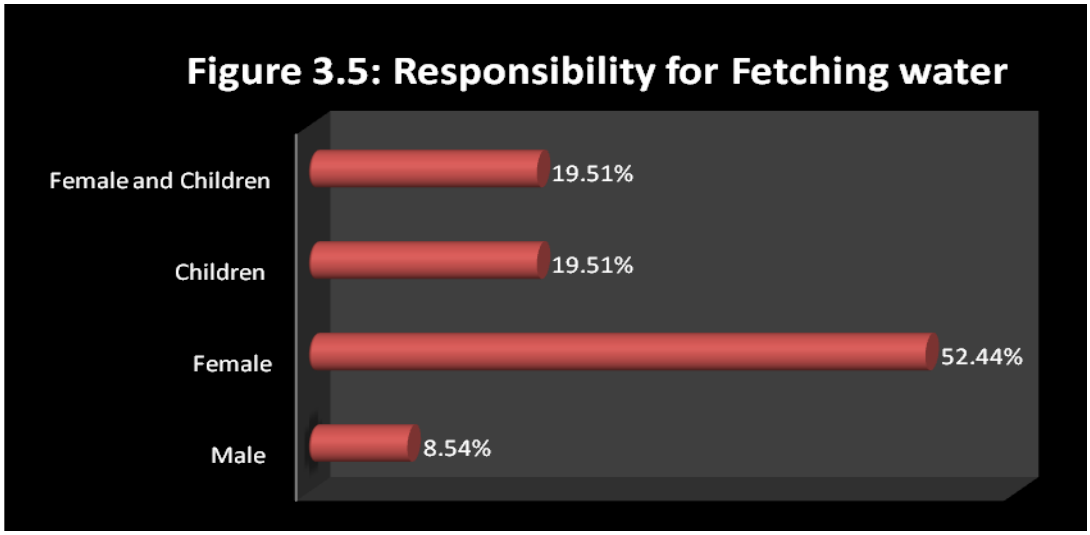
As per survey results, 49 percent of the households feel that the quality of drinking water is good, another 15 percent feel that it is excellent while 36 percent stated that quality of water

they consume is salty and bitter in taste **(Figure 3.4)**.


***Source:*** *Participants' questionnaire survey- 2008*

### 3.8.8.4 Responsibility for Fetching Water

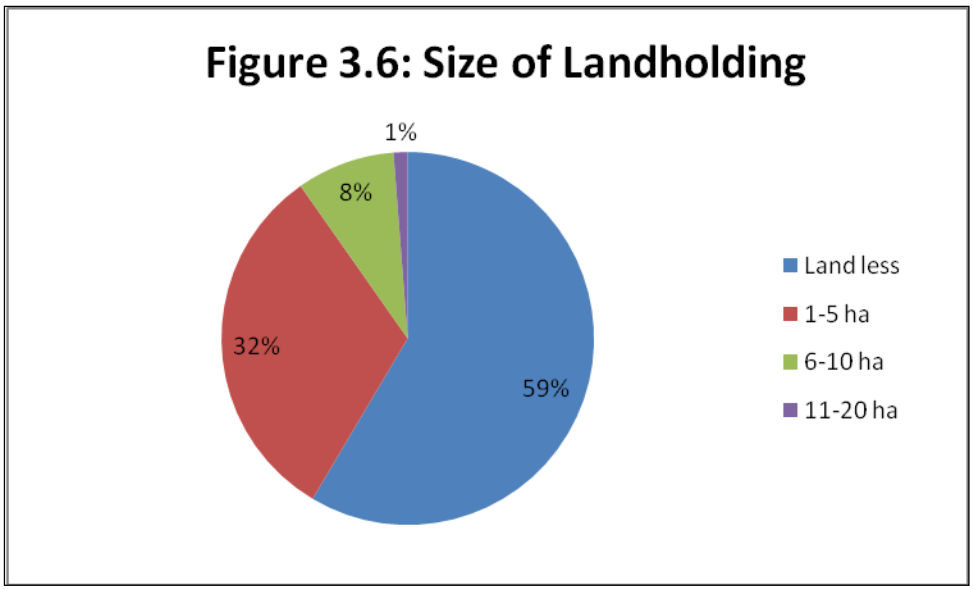
The survey revealed that women are largely responsible for bringing water from different places. **Figure 3.5** indicates that 52.44 percent women and 39.02 percent female and children especially girl child have the responsibility to fetch water while only 8.54 percent male contribute in fulfilling this responsibility. This domino effect increase no. of dropouts of female child from the schools.




***Source:*** *Participants' questionnaire survey- 2008*

### 3.8.8.5 Size of Landholding

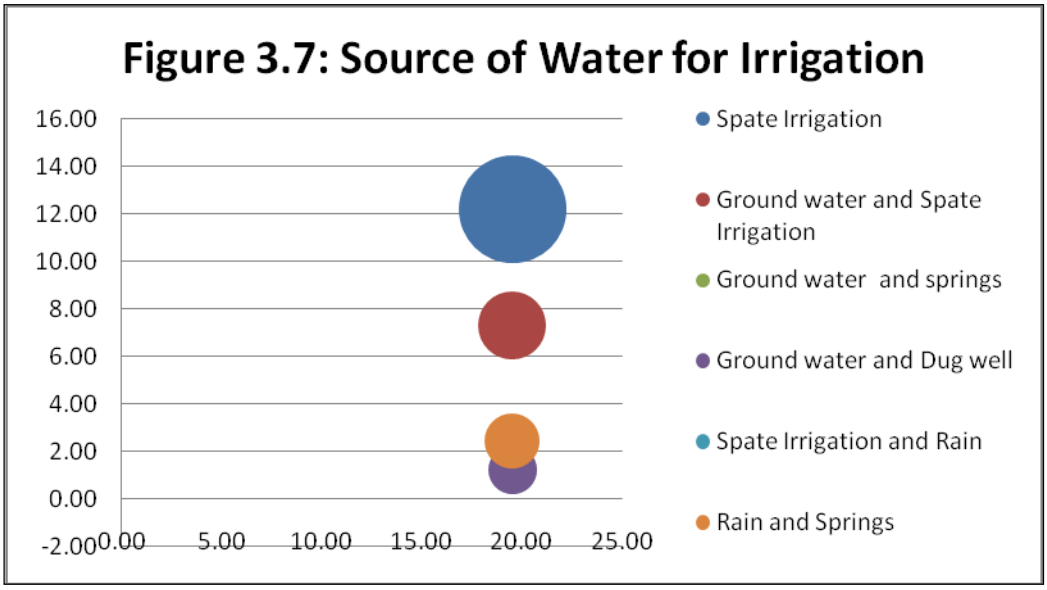
The survey indicates that out of 82 households, 59 percent are landless, 32 percent have 1-5 ha landholding, 8 percent has 6-10 ha and only 1 percent has 11-20 ha landholding **(Figure 3.6)**.




***Source:*** *Participants' questionnaire survey- 2008*

### 3.8.8.6 Source of Water for Irrigation

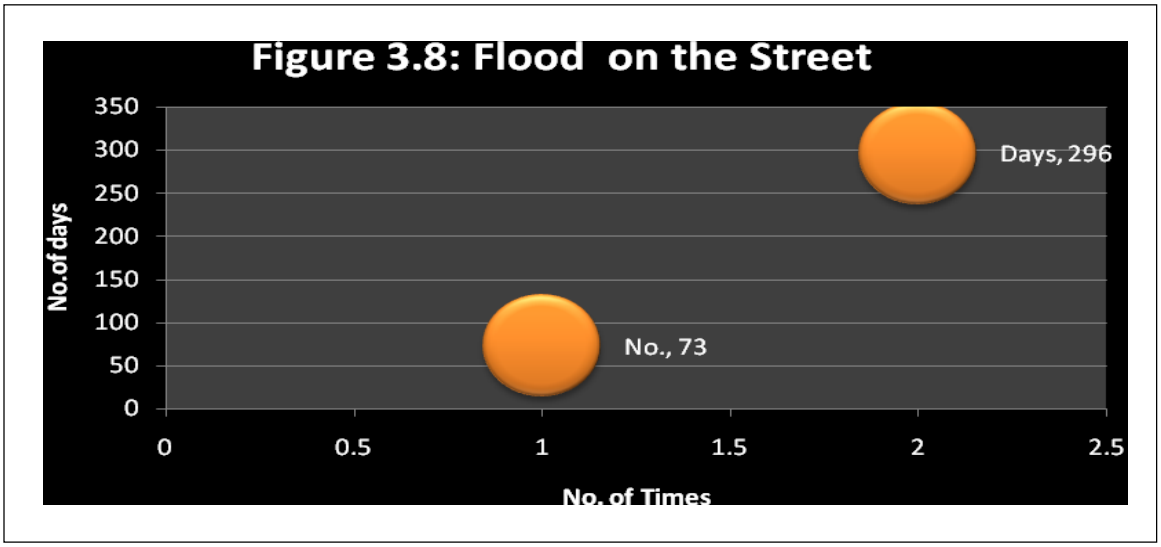
Data analysis shows spate irrigation and groundwater are the major sources of irrigation followed by ground water and springs, ground water and dug well ; spate irrigation & rain water and rain and springs respectively .( **(Figure 3.7)**.




***Source:*** Participants' questionnaire survey- 2008

### 3.8.8.7 Sanitation

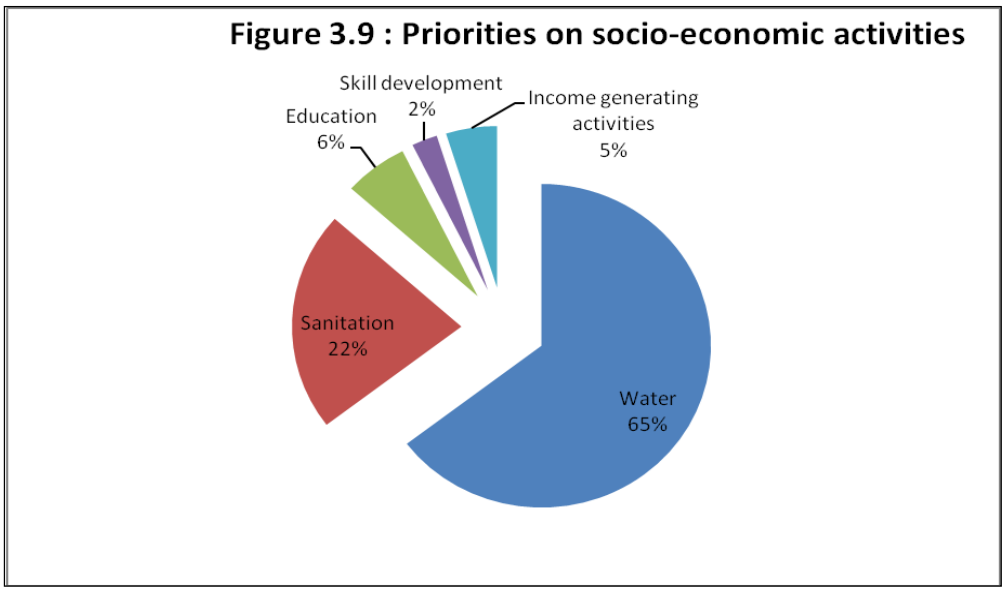
The survey results show that the streets in the vicinity of the households are flooded most the time. The streets got flooded 73 times during the last year and last for 296 days. **(Figure3.8).** It indicates that once the streets get flooded with drain water, it lasts for many days almost throughout the year.




***Source:*** *Participants questionnaire survey- 2008*

### 3.8.8.8 Demand for Water

65 percent of the respondents demanded water projects; 22 percent emphasized sanitation issues; 6 percent paid attention on education, 5 percent demanded income generating activities and 2 percent on skill development activities. (**Figure 3.9)**.

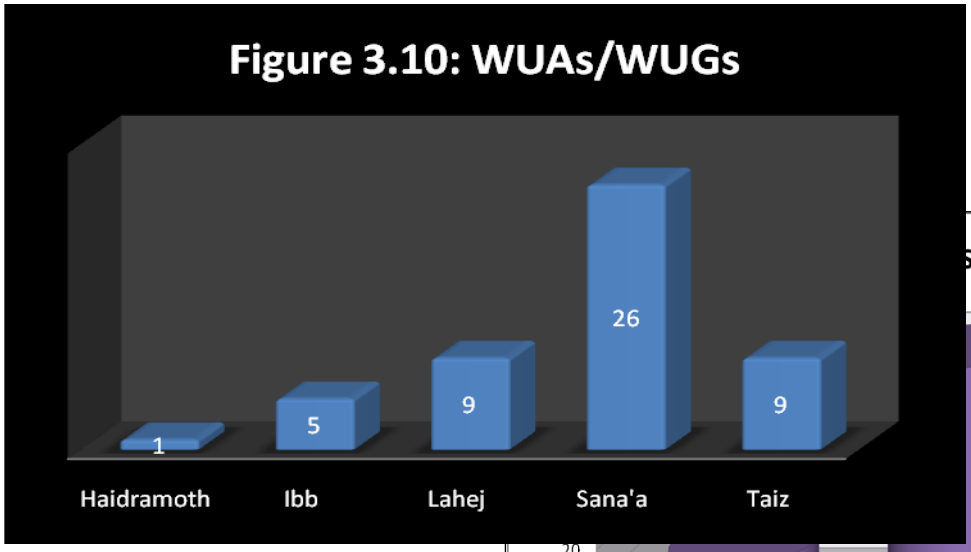


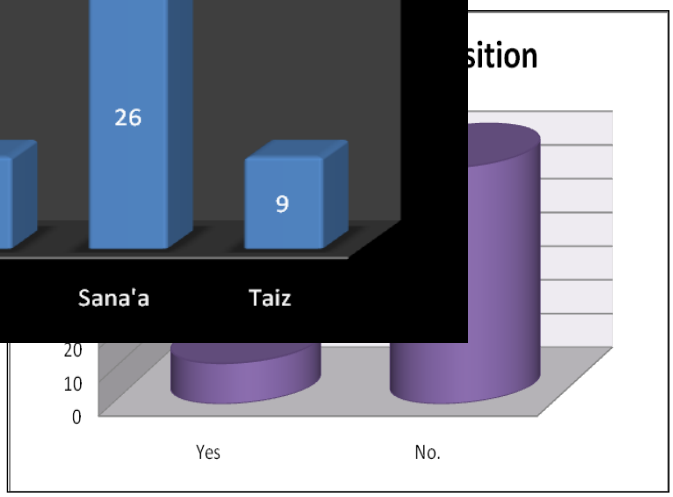

***Source:***

Participants' questionnaire survey- 2008

### 3.8.8.9 Role of the WUAs/WUGs

A total number of 50 WUAs/WUGs are working in five Governorates e.g. 26 in Sana'a, 9 in Lahej, 9 in Taiz, 5 in Ibb and 1 in Warmouth. (**Figure 3.10)** Water Users Associations (WUAs) are formed at district level while Water Users Groups (WUGs) are originally formed at the villages with a number of farmers sharing a well. The WUGs frame rules to manage the water use of the wells. Other forms of the WUGs exist according to the needs of the farmers.



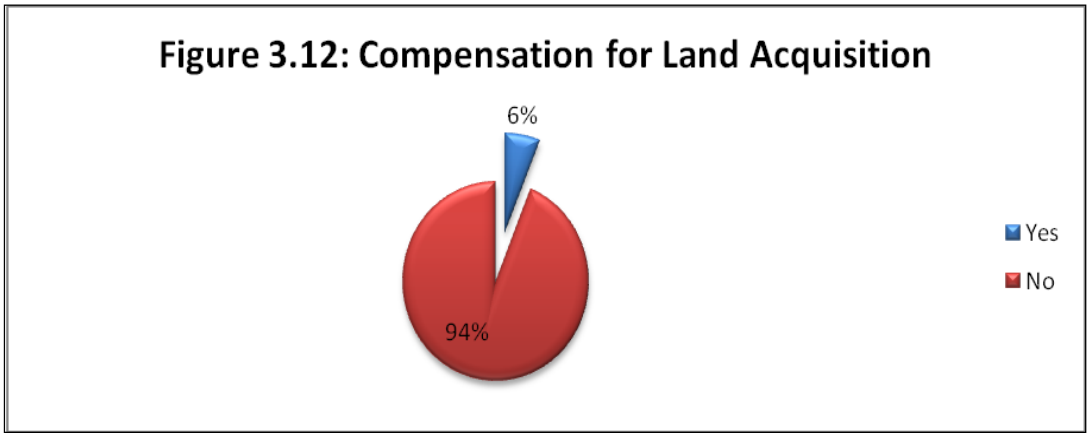

**Source:** Participants' questionnaire survey-2008

Broadly the WUAs/ WUGs perform the following functions: survey

1. Manage available water resources
2. Monitor well abstraction
3. Reduce water use
4. Install new water savings technology
5. Market agricultural products
6. Increase water use efficiency

### 3.8.8.10 Land Acquisition and Compensation

14.63 percent (**Figure 3.11**) of the respondents stated that private land had been acquired, 94 percent (**Figure 3.12**) said that they had not been given any compensation or assistance for the land acquired. This finding indicates that for any future land acquisition in context of WSSP, close supervision of any subsequent RAP will be required.




## 3.10 Economic Characteristics

### 3.10.1 Economic Indicator

- GDP (Purchasing Power Parity) USD 20.46 Billion
- Real GDP growth 2.6%
- GDP – Per Capita (PPP) USD 1000
- Crude Oil Production USD 387,500 b/d (2006)
- Consumer Price Inflation 20.8% (2006 estimate)
- External Debt USD 5.494 billion (2006 estimate)

### 3.10.2 GNP per Capita

USD 760 (2006 estimate)

### 3.10.3 Balance of Trade

- Export: USD 6614.06 million (including Re-export of USD 227.80million)
- Imports: USD 5241.81 million
- Balance of Trade:1372.25million (+)

### 3.10.4 Main Items of Import to Yemen

Gas oil, wheat, fuel oil, sugar, drugs, automobiles, rice, poultry, dried milk, heavy and light engineering goods, edible oil, cement, lubricants, machinery and its parts, electrical and electronic goods, maize, tobacco, tires, wood, textiles and garments, paper etc.

**3.10.5 Main Destination of Exports ( as a % of Total) – Excluding Re-exports**

| Year 2005 | | Year 2006 | |
|---|---|---|---|
| China | 36.33 | India | 24.79 |
| India | 16.71 | China | 23.32 |
| Thailand | 12.26 | Thailand | 14.96 |
| Japan | 6.51 | UK | 6.04 |
| South Korea | 6.49 | USA | 5.83 |

**3.10.6 Main Origins of Imports by Yemen ( as a % of Total)**

| Year 2005 | | Year 2006 | |
|---|---|---|---|
| UAE | 18.63 | UAE | 22.03 |
| Saudi Arabia | 08.79 | Saudi Arabia | 9.70 |
| China | 8.44 | Switzerland | 9.10 |
| Kuwait | 6.56 | China | 7.33 |
| USA | 6.07 | Kuwait | 6.70 |

**3.10.7 Reserves of Foreign Exchange and Gold:**

USD 7.545 billion (2006 estimated)

**3.10.8 Budget**

| **Budget (YR bn)** | **2002** | **2003** | **2004** | **2005** |
|---|---|---|---|---|
| Revenue | 482.2 | 604.0 | 681.0 | 1155.63 |
| Expenditure | 531.80 | 668.4 | 745.00 | 1194.43 |

| | | | | |
|---|---|---|---|---|
| Deficit | -49.60 | -64.40 | -64.00 | -61.20 |

### 3.11 Biological Environment

Since location, type, and other details of the WSSP interventions are not known, existing biological environment features are given in **Annex 3.2** for reference.

**ANNEX 3.1 : Participants Questionnaire Survey**

**Sector wide Environmental and Social Assessment (SwESA) Sana'a Basin Water Management Project, Ministry of Water and Environment Republic of Yamen**

**Questionnaire No. …… Venue of PCM…… Date ……**

**A. General Information**

1. Name of Participant: 1.1 Sex ……..
1a. Name of Village/Governorate …… 1b. Name of Sheikh/ Aqil……..

| 2.No. of family members | Male | Female | Total |
|---|---|---|---|
| Adult (above 18 years) | | | |
| Children (2-17 years) | | | |
| Infant (0-1 years) | | | |

| 3. Household Type | Joint 3.1 | Nuclear 3. 2 | Extended 3.3 |
|---|---|---|---|

| 4. Size of landholding ( in ha or | 4.2 | 4. 3 | 4.4 |
|---|---|---|---|

| | | | |
|---|---|---|---|
| labnah or fadan or ghasabh | | | |

5. Education level of the participant.

| | | | |
|---|---|---|---|
| 5.1. Illiterate | 5.2 . read only | 5.3. read & write | 5.4 . Up to Class 7 |
| 5.5 . Up to Class 12 | 5.6 . Graduate and above | 5.7 . Other professional | |

6. **HOUSEHOLD BUDGET**

| Source of Income | Average Income in (YR.) | | |
|---|---|---|---|
| | Daily | Monthly | Yearly |
| 6.1.Agriculture | | | |
| 6.2.Wage Labor | | | |
| 6.2.Business/Trading | | | |
| 6.3.Service (Govt. /private) | | | |
| 6.3.Livestock & Animal Husbandry | | | |
| 6.4.Fishing & Aquaculture | | | |
| 6.5. Forestry | | | |
| 6.6.Other (specify----------) | | | |
| **Total Income** | | | |

**7. Health Status (Both rural and urban people)**

Was any member of your family affected from any disease during the last year?

| S. No. | No. of cases | Type of illness/disease* | Amount spent in treatment | Type of treatment** |
|---|---|---|---|---|
| | | | | |
| | | | | |

**7.1 Allopathic 7.2 Unani 7.3 Homeopathic 7.4 Traditional 7.5 No Treatment 7.6 Other

* 7.7 water borne diseases(Typhoid ,Dysentery, Infectious hepatitis, Malaria , water logging, Dental problems due to excess of fluoride in water) 7.8 Other disease( specify)

**B. Water Supply and Drinking Water (Rural/Urban Area)**

8. What are the projects going on in your area? If so , Kindly name it

.....

.....

9 A. Source of Drinking water

| | | |
|---|---|---|
| 9.1 Piped water supplied through GARWSP | 9.2 Private sources | 9.3 Dug well. /Groundwater |

9 B How much do you pay monthly for water? Riyal……..

10. Domestic water consumption per month

| | | | |
|---|---|---|---|
| 10.1 ) 20 | 10.2 30 | 10.3) 40 | 10.4) more than 40 (specify)…… |

11. Quality of water

| | | | |
|---|---|---|---|
| 11.1 Excellent | 11.2 Good | 11.3Salty | 11.4 Bitter |

12. Distance to travel for getting the potable water……..

13. Who normally goes for fetching the water from distant sources?

| | | |
|---|---|---|
| 13.1 Males | 13.2 Female | 13.3 Children |

14. How many times in a day they have to go to fetch potable water

| | | |
|---|---|---|
| 14.1 Once | 14.2 two-three times | 14.3 More than three times |

15. How much time it takes in each trip?

| | | |
|---|---|---|
| 15.1 less than one hour | 15.2 two – three hours | 15.3 More than three hours |

16. Do you satisfied with the present water situation

| | |
|---|---|
| 16.1 Yes | 16.2 No |

17. If no, would you be willing to pay for better water supply for drinking purpose

| | |
|---|---|
| 17.1Yes | 14.2 No |

18. How many Rials per month can you afford for clean drinking water

| | | |
|---|---|---|
| 18.1 Rial 0-100 | 18.2 Rial 100-500 | 18.3 Rial more than 500 |

## C. Water and Sanitation

| 19. How many times the street in the vicinity of your house got flooded during last one year and generally how long? | 19.1 No …… | 19.2 days …….. |
|---|---|---|

.

| 20. What is the drainage system : | 20.1 Open | 20.2 Underground |
|---|---|---|

21. Problems of existing drainage system

| 21.1 Block occasionally | 21.2 Doesn't clear quickly | 21.3 Others(specify) |
|---|---|---|

22. Who is responsible for maintaining the drainage system?

23. Who would you like to depend on most for maintaining the drainage system (answer in the grid below?

| **Type of organization** | **Q.22** | **Q. 23** |
|---|---|---|
| Government | 1 | 1 |
| NGO | 2 | 2 |
| WUA/WUG | 3 | 3 |
| Autonomous Body | 4 | 4 |
| Local Authority | 5 | 5 |
| Any other (specify) | 6 | 6 |

24. What would be your priorities among the following?

| Type of Socio-economic features | Order Preference (1, 2, 3,4 , 5 ) |
|---|---|
| Water | |
| Sanitation | |
| Education | |
| Skill development (type of skill) | |
| Income generating activities (type of activity | |

| 25. Do you think/like to introduce low cost technologies and/or higher subsidies to be given poorest section of the community | 25.1 Yes | 25.2 No |
|---|---|---|

**D. Water and Irrigation system**

26. Is there any irrigation project going on in your area? If so , Kindly name it

……
……

27. What is your source of water for irrigation

| | | | | |
|---|---|---|---|---|
| 27.1 Groundwater | 27.2 Spate Irrigation | 27.3 Dug Well | 27.4 Shallow wells | 27.4Other (specify) |

28. Is there any improvement in water availability in your area

| | |
|---|---|
| 28.1 Yes | 28.2 No |

29. If yes, how much

| | | |
|---|---|---|
| 29.1 Less than 10% | 29.2 10-25% | 29.3 More than 30% |

30. Is there any benefit /improvement in water availability

| | |
|---|---|
| 30.1 Water available timely | 30.2 Sufficient quantities are available |

31. Do you feel that the present irrigation system has got low efficiency

| | |
|---|---|
| 31.1 Yes | 31.2 No |

32. If yes, why do you think so? Give reasons……

33. Is there any WUA/WUG in your area?

| | |
|---|---|
| 33.1 Yes | 33.2 No |

34. Is there any representation from women /marginalised/poor people

| | |
|---|---|
| 34.1 Women | 34.2 Marginalised/Poor |

(Tick either or both)

35. Is there any problem with WUA/WUG?

……
……
……

36. WUAs/WUGs are working efficiently in management of water?

| | |
|---|---|
| 36.1 Yes | 36.2 No |

| 37.WUA/ WUG charge for providing water for irrigation? | 37.1 Yes | 37.2 No |
|---|---|---|

38. If yes, how much do you pay for it monthly? ……

| 39. Is there any improvement in yield | 39.1 Yes | 39.2 No |
|---|---|---|

40. Is, if yes, how much do you do satisfied?

| 40.1 under 10% | 40.2 10-25% | 40.3 More than 25% |
|---|---|---|

41. Is there any negative impact due to the project, if yes , kindly elaborate your problems
……

……

42. What are your expectations from government in proper management of water system?
……

……

**E. Resettlement and Rehabilitation**

| 43.Is there any land been acquired for any water project | 43.1 Yes | 43.2 No |
|---|---|---|

| 44.If yes , which project land has been acquired | 44.1 Dam Construction | 44.2 Any other(specify) |
|---|---|---|

| 45.What type of land has been acquired | 45.1 private land | 45.3 Communal land |
|---|---|---|
| | 45.2 state owned land | 45.4 Waqf land |

| 46. In case of private land acquisition, was any compensation given? | 46.1 Yes | 46.2 No |
|---|---|---|

| | | | | |
|---|---|---|---|---|
| 47. What is the nature of compensation | 47.1 Cash | 47.2 Land for land | 47.3 Assistance | 47.4 any other(specify) |

| | | |
|---|---|---|
| 48. Was compensation satisfactory | 48.1 Yes | 46.2 No |

## ANNEX 3.2 : Biological Environment of the Country

## 3.2 Biological Environment

The biological environment of Yemen is presented below.

### 3.2.1 Terrestrial Ecology

The World Conservation Monitoring center has estimated approximately 566 known species of amphibians, birds, mammals, and reptiles. Of these 7.2 percent are endemic and 4.1 percent are threatened. The terrestrial flora and fauna found in the country is as follows:

#### 3.2.1.1 Terrestrial Flora

Yemen has wide rage of faunal species which are a mixture of species from east Africa, the Sahara Arabia, and the Mediterranean. The vegetation covers ranging between 9 percent and 43 percent. The vegetation is dominated by grasses and dwarf shrubs. Occurrence of different species of plants as per major type of land forms in Yemen is given in the following **Table**.

**Occurrence of Plants as per Major Type of Land Forms in Yemen**

| Sl. No. | Name of Plants | Types of Landforms | | | | | |
|---|---|---|---|---|---|---|---|
| | | Hills and Foothills | Gravel Plain | Sandy Plain | Sandy Dunes | Flood Plain | Inter-dune Playas |
| 1. | Baleria acanthoides | ● | | | | | |
| 2. | Cynvigab hawarcabuys | ● | | | | | |
| 3. | Canvigab oarjeru | ● | | | | ● | |
| 4. | Cymbogan scheonanthus | ● | | | | ● | |
| 5. | Cynadon dectylon | ● | | ● | ● | | |
| 6. | Digitaria spp. | | | | | ● | |
| 7. | Eragotis aegyptiaca | | | ● | ● | | |
| 8. | Eragotis termula | ● | | | | | |
| 9. | Erypos spp. | ● | | | | | |
| 10. | Eagonia cretica | | ● | | | ● | |
| 11. | Haloxydon salicormicum | | | | | | ● |
| 12. | Helotropium bacciferum | ● | | | | | |
| 13. | Heliotropium rariflorum | ● | | | | | |
| 14. | Indigofora cordifolia | | ● | | | ● | |
| 15. | Indigofora linifolia | | ● | | | ● | |
| 16. | Jutiopha spp. | ● | | | | | |
| 17. | Odyssea mueronata | | | | ● | | |
| 18. | Pulicaria wightiana | | ● | | | | |
| 19. | Rhazia stricta | | | | | ● | |
| 20. | Salosola baryosma | | | ● | | ● | ● |
| 21. | Suaeda fruticosa | | | ● | | ● | ● |
| 22. | Tephorsia purpurea | | ● | | | ● | |
| 23. | Tephorsia petrosa | | ● | | | ● | |
| Variety of Plants | | 10 | 6 | 4 | 3 | 11 | 3 |

***Source:*** *EIA Study for Safir-Hadramout Road Project by CES*

High altitude slopes ranging between 1900 and 2200 masl have grasses and shrubs of species such as, *Acanthus arboreus, Barleria proxima, Scabiosa columbaria, and Pennisetum setacem.* These are mainly found in the Jabal Saber (South Taiz), Jabal Sumaira. *Acacia origena* are found on the slopes of the Jabal Sumaira, Jabal Saber, and Ibb. High altitude region produces good quality of forage for livestock. The specie of Acacia origena woodland areas provide fuel

wood and fodder for livestock especially in dry season.

The medium elevation mountains are rich in vegetation especially succulent species in the areas around Taiz and east of Hammam Ali. The medium altitude mountains (1350m – 1450m) are covered by mainly by Acacia Spp. especially Acacia mellifera. The tree species found are *Fucus vasta, F. sycomorus, F. palmata, F. cordata, Salicifolia, Trichilia emetica, Tamarindus indica* etc.

Except lower slopes and wadis, these plains almost do not have trees. These trees are found scattered or as small groups and mainly covered by *Accacia origena*. Occurrence of different species of the plants/trees has been summarized in following **Table**.

**Occurrence of Plants Classified by Major Types of Land forms : Trees**

| Sl. No. | Name of Plants | Types of Landforms | | | | | |
|---|---|---|---|---|---|---|---|
| | | Hills & Foothills | Gravel Plain | Sandy Plain | Sandy Dunes | Flood Plain | Inter-dune Playas |
| 1. | Acacia aibida | | | ● | | | |
| 2. | Acacia arabica | ● | | | | | |
| 3. | Acacia commiphora | ● | | | | | |
| 4. | Acacia ethrenbergina | | | | | ● | |
| 5. | Acacia hamulosa | ● | ● | | | ● | |
| 6. | Acacia mellifera | | ● | | | | |
| 7 | Acacia monilifer | ● | | | | | |
| 8. | Acacia oerfota | ● | | | | | |
| 9. | Acacia seyal | ● | | | | | |
| 10. | Acacia tortolis | ● | ● | ● | | ● | |
| 11. | Aerva persica | | | | | ● | |
| 12. | Anogessius pendula | | ● | | | | |
| 13. | Aristada funiculata | | | | | | |
| 14. | Aristada adscensionis | | | | | | |
| 15. | Azadirichta indica | | | | ● | | |
| 16. | Calatropis procera | | ● | | | ● | |
| 17. | Calligonum polygonides | | | ● | | | |
| 18. | Calligonum commosum | | | ● | | | |
| 19. | Capparis decidua | | | | | ● | |
| 20. | Cassia auriculata | | | | | ● | |
| 21. | Chenopodium album | | | | ● | | |
| 22. | Dipterygium glaucum | | | | | ● | |
| 23. | Euphorbia balsamifera | ● | | | | | |
| 24. | Eucalyptus spp. | ● | | | ● | | |
| 25. | Haloxydon ammodendron | ● | | | | | |
| 26. | Leptademia pyrotechnica | | ● | ● | | ● | |
| 27. | Lycium shawaii | ● | | | | | |
| 28. | Oleas africa | ● | | | | | |
| 29. | Panicum turgidum | | | | | | |
| 30. | Parkinsonia aculata | ● | | ● | | | |
| 31. | Pistacia atlantica | ● | | | | | |
| 32. | Prosopis cineraria | | | ● | | | |
| 33. | Prosopis juliaflora | | | | ● | | |
| 34. | Prosopis spicigera | ● | | | | | |
| 35. | Salvadora persica | | | ● | ● | ● | |
| 36. | Tamarix articulata | | | ● | | ● | |
| 37. | Tamarix indica | | | ● | | ● | |
| 38. | Ziyphus jujuba | | | | | ● | |
| 39. | Zizyphus nummeleria | | | | | ● | |
| 40. | Ziztohus spina christi | ● | | | | ● | |
| 41. | Zygophyllum simplex | | | | ● | | |
| Variety of Trees | | 16 | 6 | 10 | 6 | 15 | 0 |

***Source:*** *EIA Study for Safir-Hadramout Road Project by CES*

### 3.2.1.2 Terrestrial Fauna

Terrestrial faunal species of mammals and birds found in Yemen are given the following sections.

### a) Mammals

The recorded faunal species in Yemen is 71 types. Of this one (1) is endemic and six (6) species are threatened. Some of the mammal species found in Yemen is given in the following **Table along** with their English and Scientific names.

**Mammal Species of Yemen**

| English Name | Scientific Name | Remarks |
|---|---|---|
| Idmi or Arabian Mountain Gazelle | *Gazelle gazelle* | Endangered |
| Rhim or Goitered Gazelle (desert gazelle) | *Gazelle subguturosa* | Endangered |
| Queen of sheba's Gazelle | *Gazelle Arabica bilksi* | Extinct |
| Dorcas Gazelle | *Gazelle saudiya* | Endangered |
| Honey Badger or Ratel | *Mellivora capensis* | |
| Arabian Red Fox | *Vulpes vulpes arabicus* | |
| Strped Hyaena | *Hyaena hyaena* | |
| Wolf | *Canis lupus* | |
| Caracal Lynx | *Caracal caracal* | |
| Arabian Leopard | *Panthera pardus* | Endangerd |
| Asiatic Jackal | *Canis aureus* | Endangered |
| Cheetah | *Acinonyx jubatus* | extinct |

Source: *Yemen Update* 34 (1994):20-22, wildlife and conservation in eastern Yemen, by Michael. C. Jennings

### b) Birds

About 385 species of birds representing eighteen classes and sixty one families are found in the country. The richness in the avifaunal species in Yemen is due to the following reasons:

- Topographical features of the country such as mountains, Tihama plains, wetlands and marshes, coastal areas, Gulf of Aden and Red Sea, and agricultural landscapes.
- Position of Yemen at transition zones of three bio-geographic regions such as Afro tropical oriental and aphaeretic has given mixture of species from all three regions.
- Yemen, being located at the foot of Arabian Peninsula, acts as an important stop over in the flying path of migratory birds
- Geographic isolation by sea and deserts resulting in endemic and near endemic species.

Out of the 385 species, ten (10) species are endemic and fourteen (14) are threatened species. Otma protected area is located at a distance of 55 km from Dhamar. The endemic and globally threatened birds recorded in Otma are as follows:

**Endemic Species**

Arabian Red legged Patridge (*Electoris melanocephala*)
Arabian woodpecker (*Dendrocopos dorae*)
Yemen warbler (*Parisoma buri*)

Yemen Thrush (*Turdus menachensis*)

**Globally threatened**

Yemen Serin (*Serinus menachensis*)

Yemen linnet (*Carduelis yemenensis*)
Arabian Serin (*Serinus rothshildi*)
Arabian Accentor (*Prunella fagani*)
Arabian Waxbill (*Estrilda rufibarba*)
South Arabian Whiter (*oenanthe lugentoides)*

Protected areas as declared by EPA are listed in the following **Table**.

**List of Protected Areas[14]**

| S. # | Name of the protected area | Governorates |
|---|---|---|
| 1. | Belhaf area | Hadramut |
| 2. | Hawf area | Al-Mahrra |
| 3. | Jabel Iraf area | Taiz |
| 4. | Jabel Al-Lawz | Sana'a |
| 5. | Jabel Bura'a | Al-Hodida |
| 6. | Soqatra island | Hadramut |
| 7. | Otma | Dhamar |
| 8. | Beer Ali | Shabuah |
| 9. | Ras-Sharma | Hdramut |
| 10. | Al-Luhaia | Al-Hodida |
| 11. | Kamaran Island | Al-Hodida |
| 12. | Al-Zobair, Zoqar and Honaish | Al-Hodida |
| 13. | Waddea'a | Amran |
| 14. | Bani Omar | Taiz |
| 15. | Hlamlam | Haja |
| 16. | Bani Gaber and Bani Seham | Sana'a |
| 17. | Chain of Koor mountains | Abyan |
| 18. | Wetland | Aden |
| 19. | Gashan beach | Al-Muhrra |
| 20. | Wadi Thaher | Sana'a |
| 21. | Al-Ahger | Sana'a |
| 22. | Waraf | Ibb |
| 23. | Tarim | Hadramut |
| 24. | Al-Areg | Al-Hodida |
| 25. | Hamel, Bit Boos | Sana'a |
| 26. | Al-Ryadi | Al-Mahwit |
| 27. | Kashma | Al-Hodida |
| 28. | Rima | Al-Hodida |
| 29. | Al-Aer | (Al-Hima) Sana'a |
| 30. | Kataba | Tihama |
| 31. | Al-Wahija | Tihama |
| 32. | Al-Ghorira | Tihama |
| 33. | Bab al-Mandab | Taiz |

[14] Source: Directive on EIA of Water Management and Waste Water Projects, 2nd Draft September 2006, EPA, by Dr. Lia Carol Sieghart – MWE

# Table of Contents

LIST OF ANNEXES



# *SECTION-4.0: POLICY, LEGAL, ADMINISTRATIVE AND INSTITUTIONAL FRAMEWORK FOR THE WATER SECTOR*

## 4.1 Introduction - The Socio Economic Background

Yemen's economy is undergoing profound changes over the last two decades. The key factors, inter-alia, are a gradual shift from a (largely) subsistence economy to an emerging market economy, creation of an Unified State in 1990, and the evolution of a new system of governance facilitating an expanding role of the State, coupled with greater access to public facilities like health, education and information. Such changes have had significant impacts (both positive and negative) on the traditional principles of equity and fairness guiding local institutions / practices for resource management, including land and water. At the same time, new opportunities for socio-economic inclusion, concerted attempts towards de-centralization and reiteration of age-old mechanisms for solidarity, conflict resolution, and management reinforce the vision of an emerging, vibrant economy. The current water sector problems, along with their multi-dimensional impacts and the mitigation measures being undertaken / proposed, need to be appreciated and evaluated in this context.

### 4.1.1 The Current Water Sector Scenario

Yemen is passing through a period of acute water stress with adverse impacts all over the economy. In the absence of perennial rivers/streams, prime farm land in Yemen is only 2.9% with another 3.7% as marginal farmland. As noticed earlier in Section 3, the per capita water availability[115] is one of the lowest in the world - 150$m^3$ / person /year compared to 1250 $m^3$ / person / year in MENA region and 7500 $m^3$ / person / year world-wide. This amounts, approximately, to 10% of the regional and 2% of the world average per capita availability. The problem is more acute in the western part of the country (Highlands, Tihana, Arabian Sea area) where 90% of the population lives and per capita availability is only 90 $m^3$.

Weakening of age old agricultural practices (e.g. terrace cultivation), dilution of water rights and water sharing customs and practices, erosion of authority/assumption of new, more powerful roles by many of the community leaders as well as rapid expansion of tubewell irrigation projects in the late seventies have aggravated issues like coverage, adequacy and quality of service of water supply and sanitation projects both in rural and

[15] Country Social Analysis, World Bank, 2005 Chapter 2, P 16.

urban areas. Access to water is becoming more difficult for the poor because the big landowners feel no obligation to share it with others.

In the context of weak growth of GDP per capita income growth, rising inequality of incomes and increasing difficulties in having access to water for various uses, achievement of Millennium Development Goals (MDGs) appears to be difficult.

### 4.1.2 Structure of the Section

In this broad background, the subsequent sub-sections, would review briefly the environmental and social aspects of some of the important issues in the water sector, adopting an integrated sector - wide approach as under:

Section 4.2 - The Legal, Administrative and Institutional framework in the Water Sector.

Section 4.3 - A few important Issues for consideration

Section 4.4 - Key elements of a National Water Policy -- the emerging scenario.

Section 4.5 - Conclusion

## 4.2 The Legal, Administrative and Institutional Framework in the Water Sector

### 4.2.1 The Legal Set-up

A few important laws, rules, regulations, decrees pertaining to the Water Sector are as under:

- The Constitution of the Republic of Yemen.
- Water law No. (33) of August 2002.
- Water law (Amendment) No. 41 of December 2006.
- Environmental Protection Law No. (26) of 1995.
- Cabinet Resolution NO. (237) of 1997 on Water and Sanitation Reforms Policy Agenda.
- Decree No. (101) of 2005 regarding establishment of the Public Environmental Protection Authority.
- Republican Decree No. (154) of 1995 establishing the National Water Resource Authority (NWRA) – amended by Republican Decree No. (22) of 2005.
- Prime Minister's resolution No. (968) of 2002 regarding the Institutional Framework of NWRA.
- Law No. (20) of 1999 setting up the National Cleanliness Fund for improvement of Cities.
- Law No. (4) of 2000 and Executive Decree No. (269) of 2000 concerning the Local Authority Law.
- Republican Decree No. 60 of 2002 setting up the GARWSP.
- Law No. (22) of 2002 regulating Investment in the Republic of Yemen.
- Republican Decree No. (218) of 2004 about the Bylaws pertaining to the Ministry of Water and Environment (MWE).

- Republican Decree No. 77 of 2004 transferring control of GARWSP to the Ministry of Water and Environment (MWE).

Some of the important provisions of the Water Laws, the Environment Laws and those relating to setting up of various institutions/agencies are elucidated briefly in the subsequent sections.

### 4.2.2 The Administrative Set-up

The Ministry of Water and Environment (MWE) and the Ministry of Agriculture and Irrigation (MAI) play a very important role in this sector.

One significant development was bringing together in May 2003 various Water Sector organizations and activities under the purview of the Ministry of Water and Environment (MWE) and the Ministry of Agriculture and Irrigation (MAI). Most of the Water Agencies and Institutions were transferred to the MWE, namely, National Water Resources Authority (NWRA), National Water and Sanitation Authority (NWSA), Environment Protection Authority (EPA) the General Authority for Rural Water Supply and Sanitation Projects (GARWSP) as well as the Local Water Supply and Sanitation Corporations. However, the MAI remains responsible for Irrigation, which uses about 90% of the available water. Its decentralized units manage the major spate irrigation schemes in the West and the South of the country, and a Central Department, the General Directorate for Irrigation (GDI), is responsible for dams and support to ground water irrigation. MAI's Forestry Department is entrusted with Water-shed management (**Annexes 4.1 and 4.2** show the organization structure of the MWE and the MAI respectively).

Four other Ministries have an important involvement in the water sector:

- The Ministry of Planning and International Cooperation (MOPIC) is responsible for sustainable development, poverty reduction as well as investment planning and programming;
- The Ministry of Finance (MoF) deals with budgeting, resource allocation for schemes, investment subsidies and trade policy, regulations of diesel price and the like;
- The Ministry of Local Administration (MoLA) oversees decentralization programs and activities of the Local Authorities, as well as implementation of the Water Policy and laws at the local level and finally,
- The Ministry of Interior is responsible for enforcement of laws, rules and regulations, including the Water Law.

### 4.2.3 The Institutional Set up

#### 4.2.3.1 The National Water Resources Authority (NWRA)

The National Water Resources Authority (NWRA), set up in 1995, is emerging as the key agency for promoting conservation, efficient use, as well as management and development of the water resources. The water Act of August 2002, the amendments to the Water Law in December 2006 and various Government Resolutions have, over time,

strengthened its institutional role. Its organizational structure is at **Annex 4.3** Currently, it discharges various functions as under:

- framing and coordinating appropriate policy measures, with relevant water sector institutions and donors.
- exploring / analyzing technical options available for more efficient use and conservation of water resources throughout the country with emphasis on local community participation.
- implementing the water laws and facilitating water usage through license/registration and enforcement measures.
- mobilizing / building up public support and awareness for a sustainable water management regime.

#### 4.2.3.2 Programs Initiated Successfully by NWRA

In recent times, NWRA has initiated successfully a few important programs and activities as under :

- setting up National Standards - Four (4) national water quality standards were approved for drinking water, irrigation water, bottled water and industrial water.
- identifying water management regions - Fourteen (14) regions were identified, based mainly on natural hydro-geological boundaries and wadi catchments but also taking account, in some cases, administrative convenience.
- as a follow-up, action plans are being finalized for regions which are particularly water-stressed namely, Taiz, Taban-Abyan, Hadramaut and Sa'adah
- monitoring network - routine monitoring observations, through a set of local monitoring networks, are being carried out to evaluate and predict possible changes in ground water level and quality including, sea water erosion. Also useful data on other water sources are being exchanged with meteorological and rainfall stations all over the country.
- information dissemination and exchange - a National Water Resources Information Centre has been established at the headquarters.
- promoting sector efficiency and co-ordination - An Integrated Water Resources Management Working Group, comprising an independent group of professionals, has been set up to share knowledge/experience and provide fresh policy inputs. Chairman, NWRA presides over the Group which includes national, international, governmental and non-governmental experts in the water sector.

#### 4.2.3.3 Executing/ enforcing "the Control and regulatory provisions" of the Water Laws

The relevant provisions in the Water Laws no. (33) of 2002 and no. (41) of 2006 are briefly noticed below:

- Article (6) of the water law, 2006 prohibits exploitation of groundwater resources without a valid prior permit.
- Articles (35), (36) and (42) of the Water Law, 2002 do not, generally, permit digging or drilling near water wells without a valid permit/license from NWRA specifying the purpose and location of the well.
- Article (49) of the Water Law (2006) allows NWRA to prohibit, in specific zones, certain industrial/agricultural/other activities, affecting adversely, groundwater resources after getting approval from the Council of Ministers.
- Article no (11a) of Prime Minister's Resolution no. (227) of October 2004 nominates NWRA as the sole licensing authority for water wells
- Article (12) of the Prime Minster's Resolution cited above also lays down that any drilling company/rig owner would have to be registered with NWRA and obtain, from the Governorate concerned, a Traffic Access License to a drilling site along with a valid license from NWRA for drilling/deepening/rehabilitating a water well.
- Article no. (54) of the Water Law, 2002 empowers NWRA to take steps to protect water resources from pollution and maintain water quality.

#### 4.2.3.4 Follow up Action by NWRA

- Applications for drilling a new well as well as deepening/rehabilitating an existing well are being processed.
- NWRA verifies the information provided in the application form, in coordination with local authorities and the registration date of well drilling companies, to rule out potential conflicts with other local beneficiaries, before issuing necessary clearance.
- An integrated system of licensing and registration is being implemented by the NWRA headquarters as well as the branch offices.
- Strict enforcement of the relevant provisions is possible only with the co-operation of the public agencies and the local security set up.
- A new Operations Unit equipped with GIS tracking systems and a free Telephone Helpline is expected to improve matters in the long run.
- Technical studies and professional services are being conducted/provided to Government agencies/Local Corporations/Local Councils on measures for protecting water quality, but a lot more remains to be done.

### 4.2.4 The General Directorate of Irrigation (GDI)

The GDI, (under the MAI) envisaged as a policy making and regulatory department, oversees the preparation and execution of long-term strategies, intermediate plans, bidding documents etc. pertaining, inter-alia, to:

1. on-farm irrigation modernization and advisory services,
2. rehabilitation / development and O&M of irrigation on farm infrastructure,
3 land reclamation,

4. relevant training and capacity building activities,
5. groundwater exploration
6. Setting up Data Base and Management Information System (in coordination with MWE/NWRA), and
7. early flood warning and hydro-meteorological monitoring (in coordination with MWE/NWRA).

The GDI, is proposed to be strengthened by adding 4 General Directorates for, inter-alia supervision of agricultural wadis, particularly for rain-fed and spate irrigation, like,

- reclamation and on-farm mechanization,
- on-farm irrigation modernization and advisory services, as well as off-farm irrigation infrastructure.

### 4.2.5 The General Authority for Rural Water Supply and Sanitation Projects (GARWSP)

GARWSP was established by the Republican Decree No. (60) of 2002 and subsequently under Republican Decree No. 77 of 2004, it came under the Ministry of Water and Environment (MWE). GARWSP provides technical guidance for planning, executing and the operation and maintenance of rural water supply and sanitation projects. Apart from the Chairman and the Deputy Chairman, the organization works through seven (7) General Directorates and Executive units for projects. The General Directorates look after various aspects viz. planning, statistics and follow-up studies, Control Supervision and Inspection, Financial Affaires, Legal Affairs, Branch Affairs etc. Its branches cover all the Governorates. Branch performance is assessed annually and the branches are ranked accordingly. The Organization chart is at **Annex 4.4**.

The broad objectives and functions of the Authority are, inter-alia, to:

- provide clean water in sufficient quantities to rural communities
- promote local initiatives and community participation in planning/ implementing operating and maintaining the projects completed.
- explore safe water resources and prepare plans/program for extraction/ utilization of such sources in consultation with other agencies involve.
- prepare technical regulations/guidelines to assist the beneficiaries to operate and maintain completed drinking water and sanitation projects by Local Committees and Local Councils.
- protect the environment from pollution and dispose of waste water without endangering public health in coordination with the parties involved.
- establish/operate and update a Management Information System (MIS) along with a Data Base for better functioning.

### 4.2.6 Environment Protection Authority

Environmental Protection Law No. (26) of 1995 and the Republican Decree No. (101) of 2005 deal with the establishment of the Public Environmental Protection Authority which seeks to promote broadly :

- conservation of environmental elements from negative effects of pollution
- safety and balance of the natural environment by implementing appropriate policies and plans
- carrying out environmental surveys, monitoring, evaluating and reporting on relevant programs and activities

Articles 6 to 8 of the Republican Decree cited above deal with setting up the Public Environment Protection Authority (EPA) (earlier known as the Environmental Protection Council under the 1995 law) and lay down the objectives, tasks and management set up of the Authority. The Chairman presides over the Management Council consisting of 9 members. It has now six (6) departments including a new Department of Chemical Safety and an unit for each of the International Conventions to which the Republic of Yemen (ROY) is a party. It functions through 16 branches, covering all the 22 Governorates, conducting inspections and analysis of water quality. In 2007, it had an overall budget of YR 300m (approx.) with an investment component of about YR 300 m. It has a staff component of about 200 people (professionals 70% and support staff 30%). The Authority has, up-to-date, declared five (5) areas as Protected areas in the country, namely Sana'a, Hawf, Aden Wet Lands, Hodeidah Bura'a and Dhamar. The Organization chart of EPA is at **Annex 4.5**.

The Functions assigned to the EPA include :

- preparation and execution of appropriate policies/strategies/plans to protect the environment
- conducting environmental surveys
- assessing areas/resources/species to be protected through necessary measures
- conserving the ecosystem including flora and fauna, wild and marine life as per existing laws and monitoring their application
- developing legislative proposals for environment protection in coordination with other agencies involved
- developing a National Emergency Plan to combat natural disaster and environmental pollution in consultation with the agencies concerned
- implementing environmental protection law and other relevant laws/regulations
- reviewing EIA studies for public /private sector projects for giving clearance and monitoring their execution
- coordinating relevant programs/activities with national, regional and international agencies and organizations
- recommending necessary laws, regulations and systems to protect the environment, in accordance with regional and international agreements on environmental protection.

- collecting data, assessing and evaluating the status of the environment, and setting up suitable monitoring systems
- Laying down appropriate standards for protecting the environment from pollution and formulating policy guidelines to combat industrial pollution and protect animal, plant and marine ecology.

### 4.2.7 National Water and Sanitation Authority (NWSA), and Local Water Supply and Sanitation Corporations (LWSSCs)

NWSA was setup by the Cabinet Resolution No. (237) of 1997 on Water and Sanitation Reform Policy Agenda, as an autonomous body under the erstwhile Ministry of Electricity and Water for development, operation and maintenance of water supply and sanitation facilities in the country in a planned manner. It had branches covering all the Governorates. Subsequently, 15 of its branches were converted overtime into Local Water Supply and Sanitation Corporations under the Water Sector Reforms initiated in 1997. These units work in close coordination with the elected District Local Councils / Governorate Local Councils set-up under the Local Authority Law no. (4) of 2000.

NWSA is now mainly engaged in urban water supply and sanitation projects in secondary towns where LCs do not exist, developing new water resources (test drilling, planning), monitoring/evaluating activities (taking water samples. analyzing water quality /pollution levels) and improving the business set up and commercial performance of the Local Corporations.

Decentralization of service provision and corporatization through sitting up autonomous Water Supply and Sanitation Corporations was one of the important objectives of water sector reforms. It as envisages that these corporations would gradually start functioning as autonomous commercial entities with a tariff structure that would fully cover its capital, operational and maintenance costs. Currently, 15 Local WSSCs and 13 Autonomous Public Utilities are going through a transitory phase towards full autonomy and commercial operation. Tariff structures have been rationalized and limited to three blocks – the lowest (0-10cbm/day) being the 'lifeline' block for the poor. Business plans are being formulated/ implemented, professional staff, recruited and trained. However, full cost recovery does not appear to be possible. Almost all the Corporations are running at a loss.

Operational efficiency is low and the proportion of Non-Revenue Water (system loss, illegal connections, etc.) is quite high – around 35% to 40% in most of the utilities. These are also facing problems, among others, of declining water levels, deterioration of water quality, old pumping equipment, and networks, etc. which need major repairs/ replacement urgently. The MWE has, in this context, initiated steps separately to provide technical assistance to a few LCs for technical assistance in support of decentralization.

One significant development is the introduction of Performance Indicator Information System (PIIS) in the second quarter of 2005 for evaluating the performance of the LCs. In spite of data weakness, there are some interesting findings. This is discussed further in Section 4.5.4 to 4.5.4.4 (below).

### 4.2.8 The Social Fund for Development (SFD)

Established in 1997, SFD is an autonomous governed by a Board of Directors under the Chairmanship of the Prime Ministers with wide and varied representation from Government, Private Sector, NGOs and Financial Sectors. It functions through six implementation units, sum support units and light regional Branch offices covering the country. SFD's goal is to expand the range of services available to the poorer sections of the people through an effective, efficient and transparent institutional mechanism by:

- Developing social services delivery approaches
- Empowering local communities to improve themselves

SFD's programs/ activities have three components – Community development, Micro-enterprise development and Capacity Building and Institutional support.

Under the community development component, SFD has undertaken a wide range of projects in the Water and Environment sector, through its Water and Environment Unit (WEU). The objective is to improve access to potable water supply schemes, particularly in areas highly dependent on rain water encourage rain water harvesting, sewerage and promote environmental protection with a view to addressing water depletion problems in the country. The interventions suggested include:

- Rural Water Supply and Sanitation
- Small and Medium Scale Dam construction and small scale irrigation, piped water, training and awareness
- Environmental protection, waste water and solid waste management, soil conservation, flood control, training and awareness.

In all these projects, the Beneficiary groups are involved in all aspects of subproject management and emphasis is on improved access to and improved quality of drinking water. Sustainability is a key focus for all water subprojects. Apart from sector specific projects, integrated interventions with a mix of, e.g. health, education and water projects with emphasis on strong community involvement have had significant impacts.

### 4.2.9 Water Users Groups (WUGs)

Article 10 of the Water Law No. 33 of 2002 encourages the establishment of user community organizations in water resource management as well as in operation and maintenance of the facilities and installations. Such organizations namely, the WUGs and the WUAs (discussed in sec. 4.2.9 below) play an important role in project components like demand management and irrigation improvement.

Many existing WUGs were originally formed around irrigation wells already in operation with 5 to 10 co-owners. Such conventional WUGS function on an informal basis, relying on customary usage and practice, to operate/maintain the wells, and distribute water equitably to their members. However, many of these WUGs failed to regulate/control ground water discharge of their wells as well as of those in the neighborhood

Improvement and formal recognition of such WUGs are being under taken currently with a view to making them :

- beneficiaries of project investment
- the primary contributors to the community's share of investment costs in a demand responsive approach
- serve as demonstration /pilot units for project activities.

The WUG members are expected, inter-alia, to :

- participate in project discussions/negotiations at village level
- assist in setting up village based WUA and appointment of WUG representative to it
- attend/participate in demonstration of improved irrigation system and practices at pilot schemes/farms.

Selected WUGs enter into formal agreements with WUA's and the project authorities covering :

- types of investments to be made in their system
- amount and modes of payments of their financial contributions as well as the corresponding responsibilities and conditions to be assumed by them
- training programs aimed at capacity building for system operation and maintenance, water conservation, use of modern irrigation techniques etc.
- non expansion of irrigations areas under their wells and systems.

A number of WUGs fulfilling these conditions within a recognized boundary, such as a village or a tribal area, are organized into WUAs.

### 4.2.10 Water Users Associations (WUAs)

WUA is constituted by consolidating Water User Groups (WUGs) in a well defined territorial area and is registered under Law No. (39) of 1998 dealing with Cooperative Associations and Societies. An officially recognized village or well – field WUA is a prerequisite for participation in irrigation improvement program. WUAs participate actively in Basin level water management programs particularly with regard to:

- self-regulation and enforcement of ground water extraction rights, and
- execution/management or ground water conservation schemes.

WUAs have a definite role to play in a demand - responsive approach (DRA) and their functions, inter-alia; are to:

- provide a forum for coordination/exchange of information between the WUGs and participate in irrigation management decisions/practices in the best interest of the community.
- assist the projects authorities in technical/socio-economic /financial assessments and also in executing/monitoring the projects.
- coordinate the activities of WUGS and negotiates agreements on general conditions as well as specific types/locations of project interventions in the community.

### 4.2.11 Private Organizations

In the agricultural sector, control over surface resources is typically managed by the communities (springs, spate, run off) and ownership is proportional to land ownership. Control over groundwater is typically individual {vested in the owners of the 50-100,000 agricultural wells in the country). Ownership (or, more properly, right of use) of groundwater is based on individual ownership of land located over productive aquifers and on access to capital funds to develop the resource.

Private water suppliers exist in both urban and rural areas. Farmers (or ex-farmers) frequently sell water from wells for both agricultural and domestic use. In some cities, such as Sana'a, there are private-networks, and an extensive tanker and retail water trade exists in all cities. In all rural areas, communities frequently supply drinking water through self-run schemes.

Public and private organizations also interact as formal and informal institutions and are becoming integrated in the new governance system. For instance, in the northern highlands, where the tribal system is important, Sheikhs hold public office and also act as private agents, e.g. tube well farmers, drillers, etc. The mix between public and private functions can create a conflict of interest. The multiple roles of traditional leaders as heads of their tribal groupings, capitalist investors, and members of the new ruling class influence power relations and impinge on Yemen's water sector reforms.

## 4.3 Some Relevant Issues for Consideration

### 4.3.1 Water Rights and Water Usage

Traditionally, water rights were governed by the twin principles of :

Formal law - 'Sharia' -- case law and the official legal apparatus, and

Custom and Local Practice - "urf"

The relevant Constitutional provisions are as under :

- Article (8) stipulates that "all forms and types of natural resources are the property of the State and only the State shall deploy its exploitation for national benefit."
- Article (18) states that "The concession contracts pertaining to exploitation of natural resources and national facilities, will only attain legal status under the cover of a law. The law may depict those cases of limited importance that may provide a cover under which concession may be granted in accordance with its relevant conditions and procedures.'
- However, Article (19) lays down that "general property and funds' has rights of protection, therefore it is the duty of the State and the general public to protect and safeguard them and anyone who violates such laws and statutes becomes liable to prosecution in accordance with the law."
- Further, Article (20) of the Constitution asserts that "general confiscation is prohibited. No private confiscation shall take place except with a court order."

- This is reiterated in Article 7/Para C, which states that protection and respect of private ownership shall not be infringed upon or violated, except when absolutely necessary and against equitable compensation.'

The Water Laws, no. (33) of August 2002 and no. (41) of December 2006 (Amendment Act) set out, inter-alia, the general objectives and principles, the organization, management and planning of water resources, water use guidelines, sectoral water uses, water rights and licenses, conservation and protection of water from pollution/contamination/floods, general technical standards and specifications as well as control procedures and penalties.

Articles (4) and (27) to (34) of the Water Laws, deal with water rights and licenses, and the position, briefly, is as under :

- water is available for everyone and it cannot be owned except when transported or processed.
- traditional rights to use ground water or spate water for irrigation shall be exercised in accordance with regional traditions and customs, without any prior authorization.
- traditional rights on natural springs, creeks and surface wells (not exceeding (60) meters in depth) existing prior to the coming into force of the present law are preserved for the purpose for which these were available. However these rights are to be registered with NWRA.
- rights to use water in an aquifer, or in a reservoir must be authorized by NWRA

The key issue in water rights is that, these are attached to land (property) which is the domain of civil law. On questions like owning water locations, water courses as well as watering rights based on tradition and custom, the civil law shall prevail in the absence of specific stipulations in the applicable law, increasing the risk of potential conflict with the present land owners.

The other critical aspect is the issue of the law enforcement. Discussions with NWRA officials reveal that even when the applicable law is clear and unambiguous, the law enforcement agencies at the local level do not always respond urgently or promptly to control breaches of the law. They also face stiff resistance from the law violators in some cases.

In the long run, it would perhaps be necessary to move from the traditional concept of Water Rights which allow the owner complete freedom in pumping out water towards one of specific Water Usage and application, consistent with environmental considerations through a combination of measures as under:

- economic incentives which might require revision of commercial/ agricultural policies
- organizational procedures inclusive of self-discipline through local communities
- clear cut definition of water usage rights and linking it up with specific usage, and
- use of irrigation techniques/ seeds enabling farmers to use less water for crops and getting higher incomes.

### 4.3.2 Public-Private Partnership (PPP) in the Water Sector

Apart from setting up Water Supply and Sanitation Corporations, the water sector reforms initiated by the Council of Ministers' Decree in 1997 also envisaged, inter alia:

- public - private partnership (PPP)[16], and
- separation of the executive from the regulatory authority and establishment of a regulatory agency.

The progress up-to-date in these areas is briefly discussed below.
The benefits from PPP in various sectors arise primarily through

- induction of technical and management expertise
- realization of operational /investment efficiency gains
- greater-flexibility / availability of funds for capacity increase/distribution systems
- quicker and effective response to consumer demands/grievances
- more effective insulation from political influence/interference

In return, the private investor normally looks forward to:

- a fair rate of return over a specified period enabling him to recover his investments
- a well-specified contract covering various issues particularly, risk identification and risk sharing
- willingness and ability to pay of the consumers for the service provided
- a credible and fair regulatory mechanism for handling risks beyond the control of the parties.

The choice of a specific PPP format would be guided by the perception of both the parties about the investment feasibility, the attendant benefits and costs, overall socio-economic development and the last but not the least, the degree of political commitment displayed towards such risk sharing arrangements.

Some of the PPP modalities are outlined below :

- Maintenance Agreement: The private investor undertakes the operation and management of the project / facility for a particular period and on payment specified in the contract agreement. Such an agreement may also stipulate that Government might levy and collect an user charge {either by itself or through a collection agency) towards the project cost.
- Maintain-Operate-Transfer: (MOT) or Lease Contract: the private investor maintains the project/facility on lease basis as per the standards/norms specified by the

[16] Public-Private Partnership in the Water Supply and Sanitation Sector: The Experience of the Republic of Yemen - by Dr. Anwar Sahooly, (Tech. Sectt. for WSS Sector Reform, Republic of Yemen), published in Water Resources Development, Vol. 19, No. 2, P 139-152, June 2003.

Government, collects user charges for maintenance and transfers the project to Government after the expiry of the lease (contract) period.

- Rehabilitate - Operate - Transfer: (ROT): the private investor undertakes substantial rehabilitation work to bring the project / facility up to agreed standards and norms as per the contract before collecting user charges. Both rehabilitation and maintenance are financed by the user charges collected. The project/facility is transferred to Government after the expiry of the contract period.
- Build-Operate-Transfer (BOT): the private investor, (usually termed a concessionaire) undertakes to finance, construct, maintain and operate the project / facility (usually a large one) and transfers it to Government at the end of the contract / concession period. During the period of operation of the project, the concessiaire / investor is permitted to collect user charges as specified in the contract / concession agreement.
- Build-Own-Operate-Transfer (BOOT): the private investor agrees to finance, construct, operate and maintain the project/facility and it vests in him for a specified period. During the period of operation of the project, he is permitted to collect user charges as specified in the concession / contract agreement. The project / facility is transferred to the Government at the expiry of the concession / contract period.
- Joint-Venture Agreement: Government enters into an agreement with a private investor to jointly finance, construct, operate and maintain a project / facility for a period specified in the agreement. After the expiry of that period, the project / facility may or may not be required to be transferred to the Government.

It may be mentioned in this context that foreign and national investors are allowed to operate in this sector under the current investment laws, namely the Investment Law no. (22) of September 2002, the Privatization Law no. (45) of October 1999, as well as the Cabinet Resolution no. 237 of 1997 on Water Supply and Sanitation Sector Reform.

A PPP Option Study carried out by IDA in 1999 had recommended the lease contract modality for Yemen. Subsequently, the Govt. of Yemen had undertaken a detailed exercise to enter into a lease contract for Sana'a Local Corporation WSS and invited bids from private sector investors. The GOY also agreed with the World Bank to enter into such a contract by 2002 if an appropriate private operator was found. Though a few bidders responded, the contract could not be finalized and signed at that time primarily because of limited experience with such formats. However with the improving performance of quite a few of the LCWSS, and an increasing trend towards commercialization of operations, the prospects of promoting PPP options selectively appear to be better now.

Facilitating and choosing such options is inextricably linked with the issue of separation of executive and regulatory powers and setting up a Regulatory Authority. This is discussed in the subsequent section.

### 4.3.3 The issue of Regulation -- setting up a Regulatory Authority for the Water Supply and Sanitation Sector

It is now widely accepted that for promoting public-private participation (PPP) in any sector, executive power has to be separated from regulatory power. In other words, the executing agency should not exercise any regulatory authority. In this context, setting up of an autonomous, independent Regulatory Authority is essential as it plays a critical role in upholding equity and fairness in allocation of risks between the public entity and the private party as well as in setting / revising tariffs and resolving disputes.

The typical attributes of a Regulatory Authority (single or multiple members) are as under:

- maintains "an arms length" relationship with the executive authority.
- exercises full functional as well as professional and financial autonomy and independence in the discharge of its duties, staff selection, budgetary provisions and expenditure
- enjoys assured insulation from political interference in its functioning.
- is backed up and guaranteed by a suitable legislative enactment.

Broadly, the Regulatory Authority in the Water Sector would focus on:

- fixing of tariffs and revision at predetermined (and notified) intervals

- evaluating operational/financial efficiency of ongoing schemes
- guiding / moderating long term (15-20 years) planning and investment scenario in the sector.
- ensuring compliance with environmental/pollution standards, as well as relevant laws and regulations, international protocols.
- facilitating enforcement of water as well as sanitation quality control standards.
- resolving of disputes, holding conciliation / arbitration proceedings between parties as and when necessary.

These duties and functions would suggest that the Regulatory Authority should consist of at least three highly qualified and experienced members in diverse fields of expertise as under:

- a professional expert -- preferably an engineer -- with domain knowledge including environmental issues, in the water and sanitation sector.
- a reputed economist/financial management expert for dealing with issues like planning, investment, budgeting, monitoring, evaluating ongoing projects/ projected schemes.
- an experienced legal expert dealing with dispute resolution / conciliation proceedings / arbitration matters.

In other words, a Regulatory Authority comprising of at least three (3) members (one of whom would be designated as the Chairman) would be required. Further, the Authority

might extend its operations in phases, keeping in view, for example, constraints in filling up staff positions with experienced and trained personnel.

It would be relevant to note in this context, that a separate Study, undertaken by the Govt. of Yemen through Consultants, on Establishment and Development of a National Water and Sanitation Regulatory Authority submitted in 2007 two reports (which are under the consideration of the Govt. of Yemen) as under:

- Introduction and Summary Notes on Implementing the law for regulation of Urban Water Supply and Sanitation Services, -- Establishment and Development of a National Water and Sanitation Regulatory Authority, January 2007 and
- Draft Final Report on Establishment and Development of a National Water and Sanitation Regulatory Authority, January 2007

The Study recommends, inter-alia, that the National Jihaz for the Regulation of Urban Water and Sanitation Services (NJRWSS):

- shall be headed by a Director-General and shall not be subject to the direction or control of the Government or any other person in respect of its exercise of regulatory functions (Article -7)
- A Regulatory Council consisting of six members shall be the regulatory decision making body of the NJRWSS. In addition, there will be three Directorates, a Legal Advisor and a General Services Deptt. (Article -8)
- The Regulatory Council shall consist of:

| | | |
|---|---|---|
| 1. | The Director-General | Chairman |
| 2. | Director of the Directorate for Tariff Regulation | Member |
| 3. | Director of the Directorate for Service and Quality Control | Member |
| 4. | Director of the Directorate for Communication and Customer Relations | Member |
| 5. | A Customers' Representative | Member |
| 6. | A Business Community Representative | Member |

The Report also contains detailed rules and regulations regarding appointment, tenure of members, operational guidelines for the Directorates, financial provisions, budgeting and other related matters. An early decision on this important issue would go a long way in building up a helpful environment for selective private sector participation in water sector projects.

## 4.4 Decentralization and Local Governance

The enactment of the Local Authorities Law (No. 4 of 2000) and Promulgation of the Executive Decree no. 269 of February 2000, vested local authorities with greater administrative authority and fiscal responsibility as well as a larger role in decision-making in a wide range of activities including, for example, finance, development as well as water supply and sanitation. These are significant developments shaping the institutional backdrop for execution of the Water Plan.

The Law sets up, inter-alia, an elected Governorate Local Council (GLC) and an elected District Local Council (DLC) at the Governorate and the District (Municipal) level respectively. Elections would be held every 4(four) years on population basis. The Governor -- the Chief Executive at the Governorate level -- presides over the elected GLC and is appointed by a Presidential Decree. The General Director, heading the elected DLC, is appointed by a Prime Ministerial Decree. The Organization chart of the DLC is in **Annex 4.6**.

The important features and functions of the District Local Council (DLC) include,

- preparation of the Budget as well as the Annual Development Plan, and monitoring its implementation.
- supervising the work and performance of local branch officers of various Central Line Ministries.
- approval of the Budget and the Annual Development Plan by the Ministry of Local Government (MOLG) at Sana'a before implementation. Also, Central Government Ministries have the right to object to any decision of the Local Authority Councils. Any dispute in this regard is settled finally by the Cabinet.

DLCs work through three (3) Committees, namely Planning, Finance and Development, Services and Social Affairs, for discharging their responsibilities.

- Planning, Finance and Development Committee deals with matters relating mainly to budget, revenue collection and expenditure, performance appraisal of programs / projects in various sectors like agriculture, fishing, industry etc.
- Issues relating to health, water supply and sanitation, tourism and culture, Urban planning, education and technical training, etc. are the concern of the Services Committee.
- The Social Affairs Committee looks after matters relating, among others, to police, social development and welfare programs.

The District Administrative /Authority (DAA), a five member body, is the administrative agency of the DLC, and consists of the General Director, the Secretary-General of DLC and the three Councilors heading the Committees on Planning, Finance and Development, Services and Social Affairs.

The District Executive Council (DEC) functions as the DLC's Secretariat. It is headed by the General Director and includes the Secretary-General of DLC and / the Heads of the executive offices of the decentralized Line Ministries in the District.

Essentially, the Local Authorities Law, 2000, and the Executive Decree (both of 2000) envisage a legal and institutional set-up as under:

- Broad decentralization of administrative authority and fiscal responsibility to the Governorate and the District levels.
- Local branches of various Line Ministries of Central Government (e.g. Water and Environment, Health etc.) work under the guidance of the DLC.
- Central Ministries lay down general policy guidelines, implement strategic programs and projects, as well as those that exceed the capacity of the Local Councils.
- The Ministry of Local Government (MOLG) at Sana'a oversees the work of the GLCs / DLCs.
- Local Government Councils have now four sources of funds, namely, revenues levied at the District level for its own benefit, revenues levied at the District level for the benefit of the Governorate, shared local revenues at the Governorate level and annual subsidies from Central Government (covering the salaries of local government officials, strategic projects, capital investments exceeding local capacity as well as a share of autonomous specialized funds like the Road Maintenance Fund, the Youth and Sports fund etc).
- Shared local revenues are distributed as under:
  25% for the District that collected the revenue
  25% at the Governorate level
  50% among the Districts, favoring those with lesser resources and deficient infrastructure.

As is to be expected, the process of democratic decentralization is gradually taking root at administrative, institutional and fiscal level, despite difficulties particularly at the fiscal level. In this context, the functional role and responsibility set out for the GLCs/ DLCs in supervising the implementation of the water policy, protecting water resources from over exploitation and pollution as well as enforcing the regulatory provisions in the water law would play a significant role. In particular, for the water sector, Article 15 of the Executive Decree indicates broadly the function and responsibilities of the Local Councils in the Districts and Governorates as under:

- providing water for drinking/house consumption for meeting the urgent and future requirements of the people and executing projects for water supply and sanitation.
- undertaking necessary measures to prevent water pollution and over-exploitation.
- granting licenses to drill artisan wells in the district in accordance with national policy and strategies with the approval of the appropriate authority in the Governorate (i.e. NWRA branch office).
- carrying out awareness campaign among farmers about modern irrigation systems and improved irrigation method.

Article 16 mentions, inter-alia, establishment, management and maintenance of dams as one of the functional responsibilities of the Governorate Local Council.

Further it empowers the GLC to operate and maintain projects executed by central authorities and subsequently transferred/assigned (through delegation of powers) to the Governorate. This provision is in compliance with Article 72 of the Water Law of 2002 which authorizes MWE to delegate some of its powers and functions to any entity, whether a Council, Committee or office provided it does not contradict or contravene the provision of the Local Authority Law No. (4) of 2000.

Apart from strengthening, the monitoring and evaluation facility and capacity building programs (discussed in Sec, 9 later) sustained involvement of the stake holders and the civil society at large is a critical element for success in the water sector.

### 4.5 Encouraging stakeholders' involvement

The suggestions, as under, may be relevant for facilitating stakeholder's interest and cooperation in this sector:

- A legislation enactment guaranteeing the Right to Information (RTI Act)
- Promoting the concept of Corporate Social Responsibility (CSR)

A Right to Information Act would lead to a much greater transparency on accountability, efficiency and objectivity on timely planning/execution of projects it would no doubt face initial resistance/non cooperation from certain (vested) interest but given the political (and administrative) will and support it would contribute substantially to public good .

The Corporate Social Responsibility (CSR) concept implies in effect that the emerging/expanding business and commercial sector as well as articulate and well informed segments of the civil society take up public awareness programs on significant socio-economic issues on a purely objective and professional manner for public benefit, for example campaigning through Chambers of Commerce and other NGOs for water conservation/management/quality control and asking all its members to lead by their own examples.

Further greater involvement of NGOs in formation/functioning of WUAs / WUGs and participation in projects executed by the PWP and the SFD (for example rain water harvesting/ basic sanitation kits) would be of immense help in channelizing/ mobilizing public support and cooperation for various sectors/projects.

#### 4.5.1 Monitoring, Evaluation and Follow up

Monitoring, evaluation and follow up at regular intervals of policy/programs/ projects are prerequisite for sustaining operational efficiency. A well designed operational Management Information System (MIS) and an updated Data-Base -- two critical elements in this regard -- are either weak or absent in most of the institutions/agencies involved in the water sector.

Introduction of Performance Indicator Information System (PIIS) - In this context, the introduction of PIIS in the second quarter of 2005 by MWE for assessing the performance

of the Local Water Supply and Sanitation Corporations, Autonomous Urban Water Supply and Sanitation Utilities and the National Water Supply and Sanitation Authority in the urban water sub-sector at the regional and national level in a significant step forward in the sector reforms process. The system is based on 92basic data, extracted automatically from the accounting/billing software or entered manually. These data are subsequently converted into 69 performance indicators based on International Water Association (IWA) guidelines. The indicators cover 7 categories namely personnel, technical/operation, finance, billing and customer relation, consumption and coverage.

The annual PIIS Report, 2006, (released in October, 2007) indicates that since its inception one year ago, the system is getting accepted – 10 Local corporations and 13 Autonomous branches (either supervised by LCs or NWSA) are reporting the data to the PIIS unit of MWE on a monthly basis. Disregarding the data weakness, a comparison between the 2005 and 2006 indicates/reveals, inter-alia, some interesting developments:

- the no. of staff per 1000 connections increased slightly from 10.7 to 10.9 on an average, showing that the utilities have not yet started cutting down on excess staff.
- Non Revenue Water (NRW) declined in a majority of the utilities, for example
  Sana's from 43.4% to 38.8%
  Aden from 34.7% to 32.6%
  Mukallah from 35.8% to 32.4%
    - Operational Actual Cost Coverage increased on average from 107.1% to 122.1% (a positive development)
    - Collection efficiency increased at the National level from 90% to 97% within one year
    - The Debt Period declined from 191 to 172.3 days in 2006.
    - The data show slight increase of tariff in an average. The overall percentage of water supply and sanitation expenses per poor household income increased from 1.48% to 1.5%, well below the threshold value of 5%

There is no doubt that better data quality, completeness, timely submission, refining of definitions/ interpretations as well as availability of more trained personal would make PIIS more meaningful and more accurate. This would ensure its use as a significant operational and management tool for improving operational efficiency/ project planning and execution/ and financial management.

## 4.6 The Qat Issue

Qat (*Catha edulis)* continues to play a significant economic, social and cultural role in Yemen's economy. As the predominant (and most profitable) cash crop, it accounts for around 6 percent of GDP, 10 percent of consumption, 33 percent of agricultural GDP, and provides 14 percent of total employment in Yemen[17]. The income generated by Qat cultivation is an important component of rural income. However, it also depletes scarce water resources and has crowded out production of essential food crops and agricultural

[17] Yemen -- Towards Qat Demand Reduction -- World Bank Document, (Department of Middle East and North African Region) June 2007 P (i) and (ii).

exports. Qat chewing was earlier an occasional pastime. Currently 72 percent of males and 33 percent of the female population chew Qat and spend, on average, nearly 10 percent of their income on it and devote several hours in a day for this purpose. Such widespread Qat consumption has adverse health effects including amongst them high blood pressure, severe child malnutrition, dental decay/diseases and cancer (from consuming pesticide residue).

The Government of Yemen is aware of the issues and from 1999, launched a national debate on Qat while the World Bank and other Donor Agencies took cognizance of the problems in their analytical/empirical studies, some of which are listed below[18]. In recent years GOY initiated a number of bold steps in bringing the issue to the forefront. Among these are holding the National Conference in 2002, consideration of proposals for an Action Plan, public awareness measures, assessing the incentive structure and the diesel price increase in 2005 etc. However, there is no decisive impact on Qat consumption which continues to grow at 9 percent per annum.

One persisting difficulty in any comprehensive analysis of the Qat issue is the absence of credible, comprehensive data countrywide. This is critical for a better appreciation of the extent/nature of Qat consumption for framing effective policies for

persuading consumers to reduce its use. To overcome this knowledge gap, the World Bank conducted a sample survey of Qat chewing habits in April - May 2006, covering 4027 Yemenis above the age of 12 in 7 (seven) of Yemen's 21 Governorates namely, Sana'a Capital Secretariat, and the Governorates of Sana'a, Al-Hodeidah, Taiz, Marib, Aden and Hadramout. The results, published in June 2007[19] present interesting and valuable insights into this problem, a few of which are noted below.

- Qat is 10 to 20 times more profitable than competing corps and the area under cultivation has expanded 13 times in the last three decades displacing other crops and vegetables.
- Qat cultivation has potentially damaging environmental impacts on water availability. One would recall that per capita water availability in Yemen is around 2 percent of the world and 10 percent of regional averages. Using subsidized electricity and diesel, Qat farmers are using 33% of ground water available. With ground water extraction reaching 130 percent of recharge and with agriculture using 90 percent of it, Qat cultivation is contributing heavily to ground water depletion. Qat also consumes considerable amounts of plant nutrients from the soil, contributing to soil degradation.
- As noticed earlier, Qat use affects adversely health and family life and it is one of the key causes of poverty in the country. 86% of users and 98% of users feel that Qat is an important cause of poverty and is bad for the national users. Expenditure on Qat is

[18] **(i) International Development Association -- Country Assistance Strategy for the Republic of Yemen for FY 2006 to FY 2009; May 2006, Pages, 16, 29, 33.**

**(ii) World Bank -- Republic of Yemen Country Social Analysis, 2005-06, Pages 19-21**

(iii) World Bank -- Republic of Yemen Country Water Assistance Strategy, March 2005, Pages 10,16.

[19] World Bank -- Yemen -- Towards Qat Demand Reduction, June 2007, Pages 2.

about 70% of the household budget, exceeding these on food, medicine and basic necessities.

- Some 77% of chewers and 94% of non-chewers feel that it has a negative effect on the family budget. About 66% of the women and 50% of the men believe that they are unable to pay for Qat and also meet other essential household needs. In fact 18% of male users and 17% of all female Qat users were forced to borrow for regular Qat purchases. Further, the time devoted to Qat chewing represents a substantial loss of potential income, apart from the wide range of adverse health impacts -- some 80% of all male and 70% of all female users reported health disorders related to Qat consumption. 29% of male and 23% of female users are reported to suffer from sleeplessness, with its negative implications for day-after-work performance, social relations and psychological well being.
- Qat is believed to harm health and family life. 78% of users and 98% non-users believe that Qat use has negative health effects; 66% of users and 86% of non-users feel it erodes positive social values.

### 4.6.1 Reducing Qat consumption - Future policy opportunities

Though consumers are aware of the adverse effects of Qat, both as individuals and as members of the civil society as a whole, they are not able to stop on their own because of peer pressure or psychological dependence arising out of long use. Some 53% of all male and 61% of all female respondents wanted government intervention, including, inter-alia, some form of legal restriction on Qat use.

- As regards feasible alternatives, it is interesting to note that a clear majority, i.e. 42.8% (1872 respondents out of 4372), were in favor of promoting more economic activities namely, finding a job and increasing one's income or working at home or cultivating other crops.
- 25.2% (1100 out of 4372) favoured government initiatives viz. creating more sports facilities, parks and clubs, as well as more infrastructural investments in power, hospitals, factories.
- 14.5% wanted more leisure and social interaction and
- 7.8% desired more vocational training, using internet cafes.

In other words, 90% of the respondents suggested some positive alternatives to Qat.

### 4.6.2 Lessons from International Experience

The UN Declaration of Guiding Principles of Drug Demand reduction (1998) stipulates that drug control measures should have a balance of demand reduction and supply constraints for drugs. Once there is a strong negative stigma attached to drug (Qat) use, new users particularly young people would be discouraged from starting it and the demand among established users will fall in the long run. Experience worldwide also shows that deeply held beliefs / perceptions can be changed over time. For example in the 50's, tobacco consumption was viewed as glamorous and prestigious in most of the high income

countries. After five decades of persistent demand reduction policies,, cigarette smoking in the OECD countries is widely discouraged.

### 4.6.3 The Tax Element

Qat is taxed at a nominal 20% ad-valorem rate, but the effective rate is much lower - only 3 to 4 % of the value of final consumption. Increasing the tax rate, improving tax administration and replacing the ad valorem tax by a specific tax (based on quantity) would help to prevent excessive consumption particularly among the poorer segments of the society. Further, 5 per cent of the tax collection is, by law, contributed to Government's Fund for Youth and Sports and would increase resources for alternatives leisure activities.

Any vigilant Qat control program must ultimately rest on popular support. While it might seem that Qat users are strongly opposed to Qat control, the reality is strikingly differ. The survey findings show that Qat users want the government to intervene to curb consumption.

### 4.6.4 The Policy Options – Building Public Awareness

A multi-faceted approach covering a broad range of options is indicated on this issue. This might, for example, involve exploring, in association with the private sector opportunities for:

- Creation of more income generating/ vocational training facilities
- Developing alternative sports facilities
- Undertaking crop diversification experiments/ initiating safety-measures
- Facilitating research into biological/ social impacts of prolonged use of Qat

Finally, building public awareness is a prime prerequisite in implementing any scheme to help the consumers to make an improved choice about the products consumed by them. A well focused public information campaign could utilize the findings of the survey on the health, productivity loss and poverty implications of Qat consumption. The continued support of the civil society in general and framing of policies in consonance with of the socio-cultural background of the country would be critical for the success and sustainability of such program in this sphere.

## 4.7 Key Elements of a National Water and Sanitation Policy

The success of a National Water and Sanitation Policy would be assessed on its performance, inter alia, in a few critical areas like :

- integrated water resource management through, for example, more vigorous and expanding stakeholder participation.
- planning/operating/conserving water resources
- ensuring compliance with water quality/environmental/pollution control and sanitation standards
- extension of coverage of water supply and sanitation projects to both rural and urban sectors with priority to poorer sections.

- maintaining/improving service levels in WSS projects
- improving operational efficiency and profitability of Local Corporations for Water Supply and Sanitation particularly through
  - reducing current high levels of Unaccounted for Water (UFW) and
  - raising revenue collection levels
- creating an enabling environment for Public Private Participation (PPP) projects.
- recruiting, retaining skilled staff/professionals and motivating them with, among others, adequate compensation structures and performance linked incentives

In this context, as noted earlier, the National Water Sector Strategy and Investment Program, (NWSSIP 2005-2009) is a significant pioneering effort in evolving and executing a coordinated water sector program. It is gradually improving its performance and overcoming various hurdles. However, as the recent update shows, difficulties persist in critical areas have to be addressed urgently for realizing fully the benefits from the program. Briefly, these relate mainly to:

- Institutional coordination/cooperation --- lacking between the Ministries, Agencies/Organizations involved at Headquarters as well as amongst various agencies in the field and local administrative units.
- Institutional weakness/inadequacy - primarily because of professional inputs from trained, experienced staff are not available.
- Weak stake holders' participation - has to be addressed through better monitoring and evaluation of WUAs and WUGs and quicker response to their genuine difficulties at various levels.
- Response from law enforcement agencies - lack of prompt and adequate response in many instances complicates issues. With NWRA monitoring drilling operations more closely in future, quick and effective response would be needed for effective law enforcement.
- Civil service reforms - delay in implementing reforms is affecting staff morale and motivation adversely and is contributing to institutional weakness and inadequacy. Also, the full impact of various capacity building activities e.g. training programs/ services undertaken up-to-date as a part of the reforms agenda has not been realized mainly because of lack of commitment and motivation as well as high attrition rates amongst the Government employees in the absence of basic civil service reforms.

Planning from below with forward integration - As noted earlier in Section. 4.4.3 to 4.4.8, a realistic water plan, built up from below, with meaningful cooperation between all the stakeholders with the Government playing the role of a catalyst has greater chances of success. A positive factor in this sphere is the growing presence in this sector of the Local Authorities -- the DLCs and the GLCs and the Basin Committees.

The other important development is the setting up of the Inter-Ministerial Steering Committee (IMSC) and the Program Management Committee (PMC) for greater and more effective functional coordination between the Ministries involved.

- The Inter-Ministerial Steering Committee (IMSC), to be chaired by HE the Deputy Prime Minister, would include: the Ministers as well as the Deputy Ministers of: MWE, MAI, MOF, MOLA.
- The Program Management Committee (PMC) would comprise Dy. Ministers of MWE, MAI, MOF and MOPIC as well as the Donor Core Group (DCG) and would be co-chaired alternatively by them.

Water Supply and Sanitation plans for formulating a tentative District Water Plan would begin with the Projects identified in the Services Committee. These may be reviewed further with all the stakeholders and the suggestions considered in depth at the DLC/ GLC level and finalized with modifications, if any. This plan would then be forwarded through the Basin Committee for inclusion in the Basin Plan and onward transmission to the Agency concerned for technical and financial appraisal and prioritization for execution.

The responsibility of the various Sector Agencies would be demarcated as under:

NWRA: Water resource/ exploration/ licensing/ registration and management.

GDI: Irrigation improvement programs and activities.

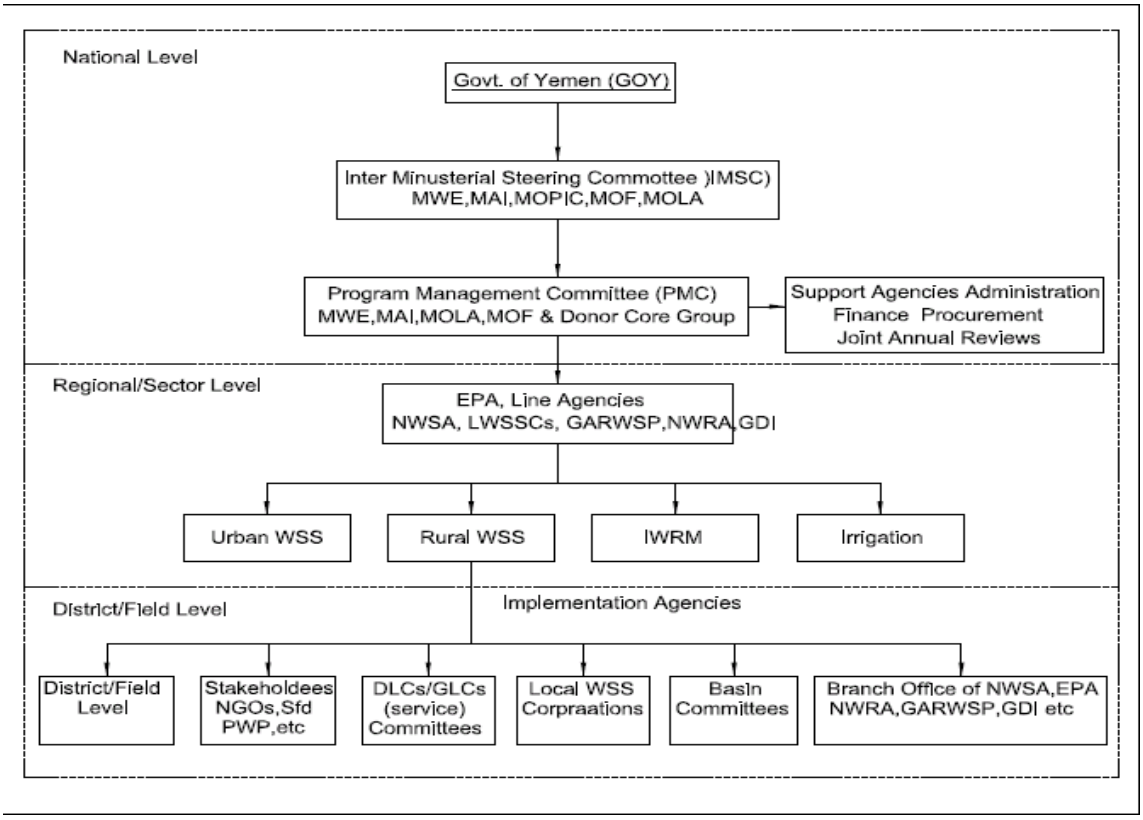
NWSA: Urban water and sanitation projects in secondary towns where Local Corporations/ AUs do not exist.

LCs/ AUs: Urban water and sanitation programs/activities in cities and secondary towns where LCs/ AUs exist.

GARWSP: Rural Water Supply and Sanitation projects.

The Agencies would transmit the WSS/ irrigation projects to the Ministries concerned, namely, the MWE and the MAI. These Ministries will consult/ co-ordinate with MOF/ MOPIC/ MOLA for comments/ suggestions and forward the proposals to the Program Management Committee (PMC). The list of projects/ activities along with appropriate funding and ranking would be finally approved by the IMSC, after reconciling differences of opinion/ perception, if any, between the Ministries/ Agencies/ Organizations.

The proposed institutional arrangement for WSS projects is depicted below:




**Source:** based on **Annex 4.4** (Working Draft): GOY -- WSSP under SWAP Framework -- Workshop on Implementation Modalities and Institutional Arrangements, April 29, 2008.

The Emerging Scenario - In this background, preparation/execution of National Water and Sanitation Plans in future would, hopefully, have the benefit of :

- relatively much larger and more accurate inputs from below, along with the reality of closer coordination, at the District / Basin / Regional levels.
- realistic interaction at the National level between the various Ministries / Organizations involved in this sector.
- more effective law-enforcement measures and procedures to supplement NWRA's programs in monitoring drilling activities and evolving water resource management practices.
- an enabling environment for promoting a larger role for the private sector and facilitating the achievement of the targets (and MDGs) in this sector.

## 4.8 Capacity Building Programs

This is discussed in Section 9.

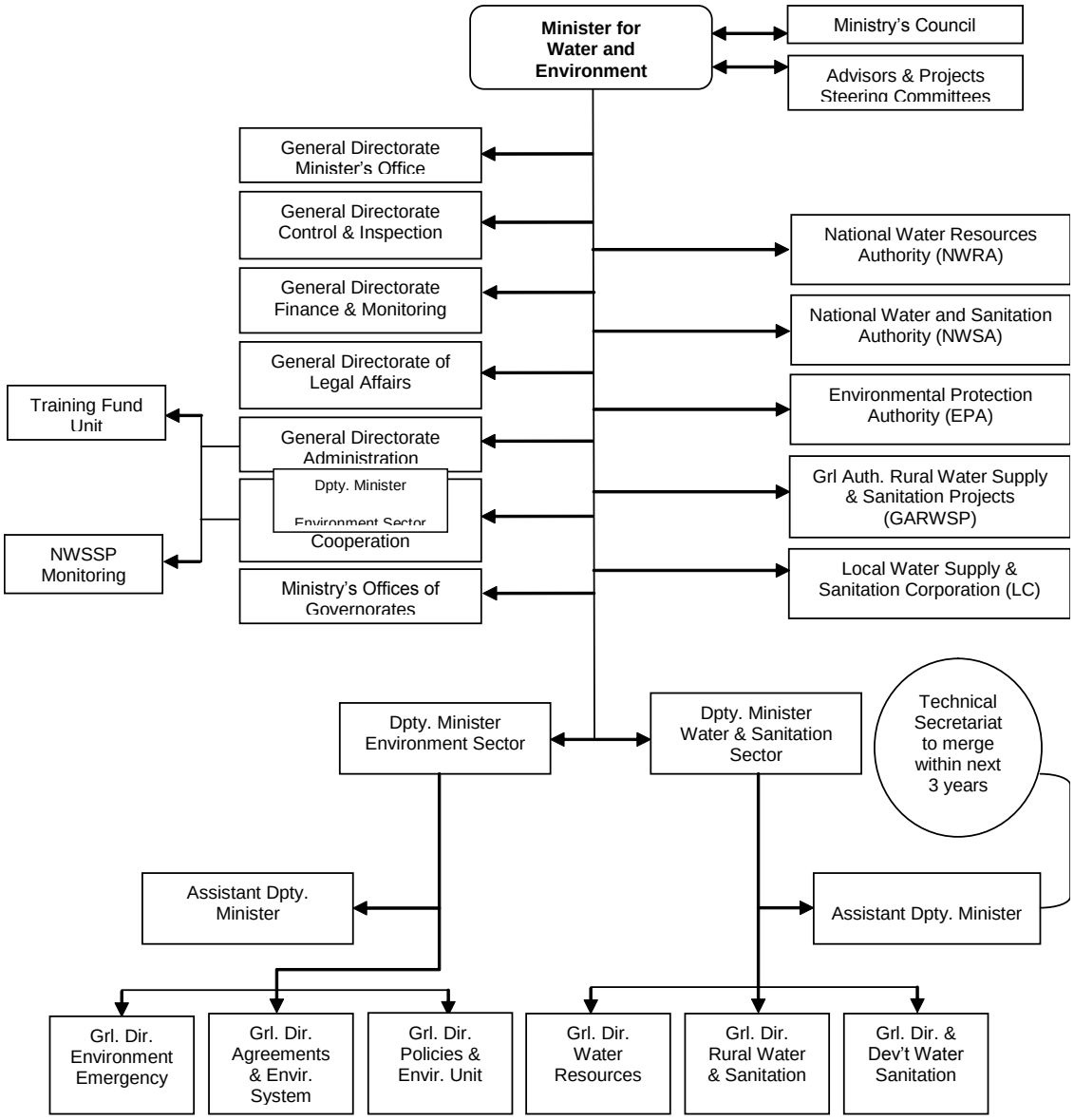
## 4.9 Conclusion

Efficient implementation of an integrated and updated National Water and Sanitation Policy presents both a challenge and an opportunity. The task requires managerial skills of

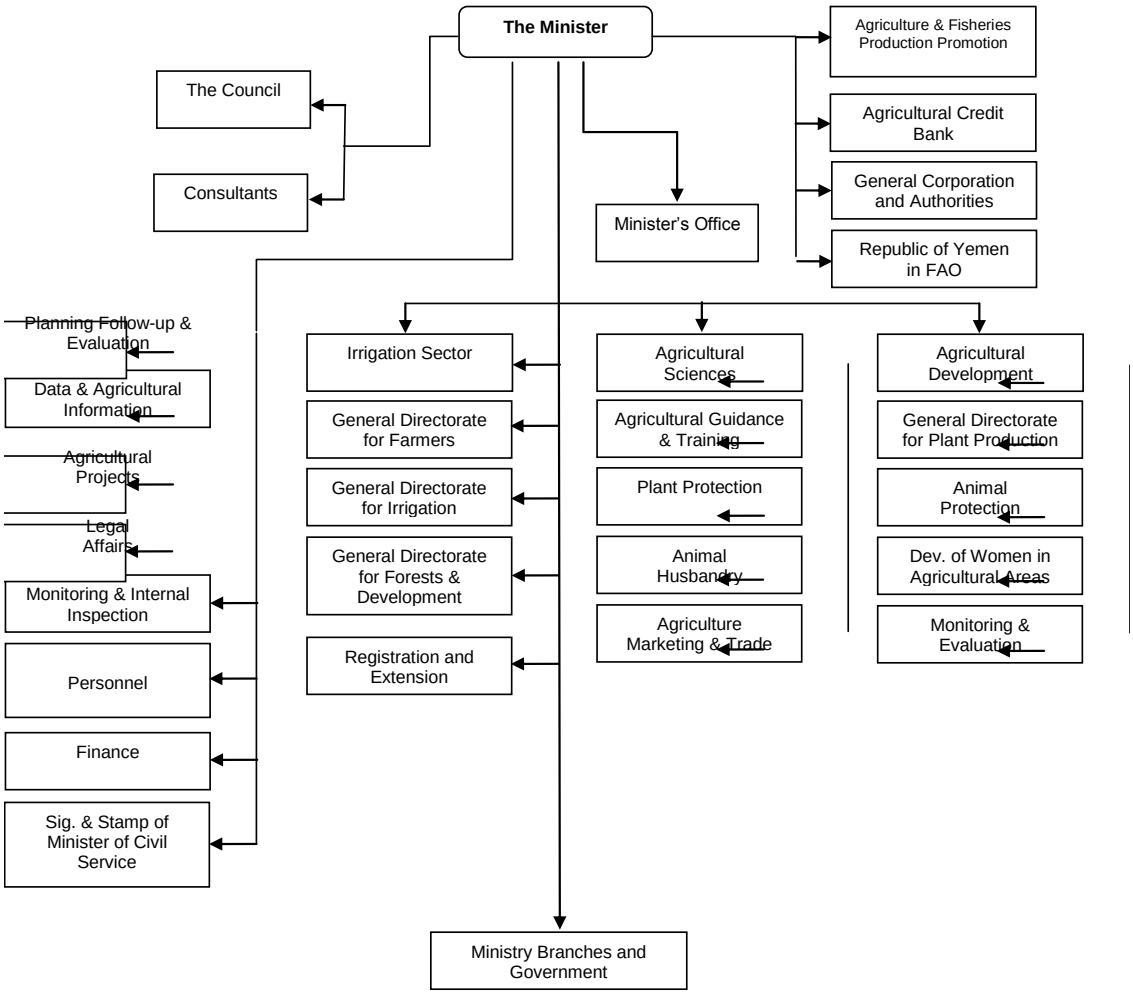
a high order for coordinating and monitoring the projects/activities to be undertaken by diverse agencies at the national / regional / local level within a time-bound action program. The challenge lies in devising new / strengthening existing institutional mechanisms with a clear mandate, appropriate authority and capability together with an effective system of delegation of powers as well as accountability in the current decentralized administrative set up.

The opportunity exists in motivating and facilitating various sections of the civil society - the citizenry, the public and the private sectors, governmental and non-governmental agencies, universities, educational institutions, voluntary organizations, social welfare agencies and the like - to play a proactive role in civil governance in this sector. A pragmatic approach in both these directions simultaneously would assist in transforming Vision 2025 into reality.

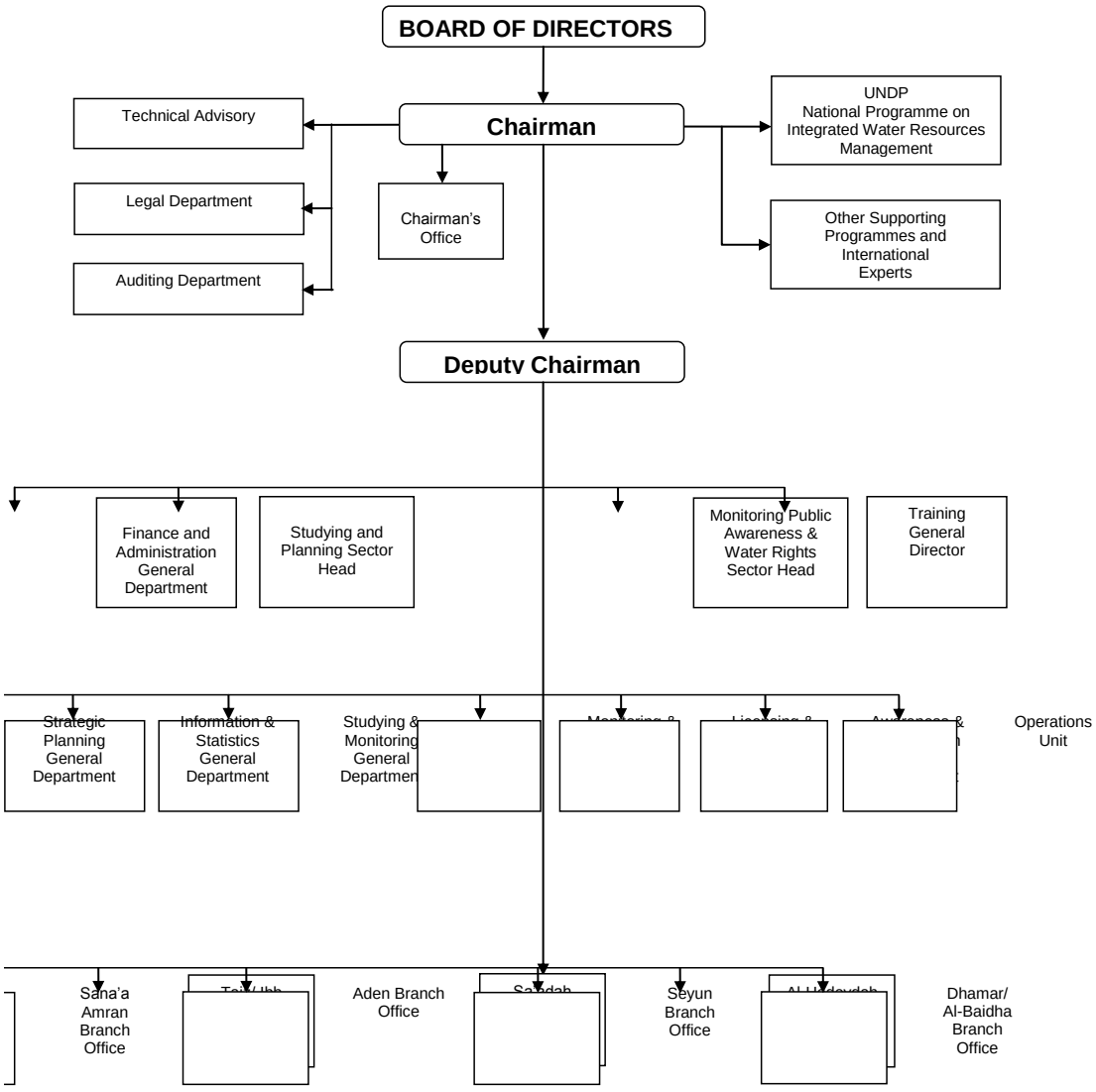
## Annex 4.1 : Schematic Organizational Chart of Ministry of Water and Environment



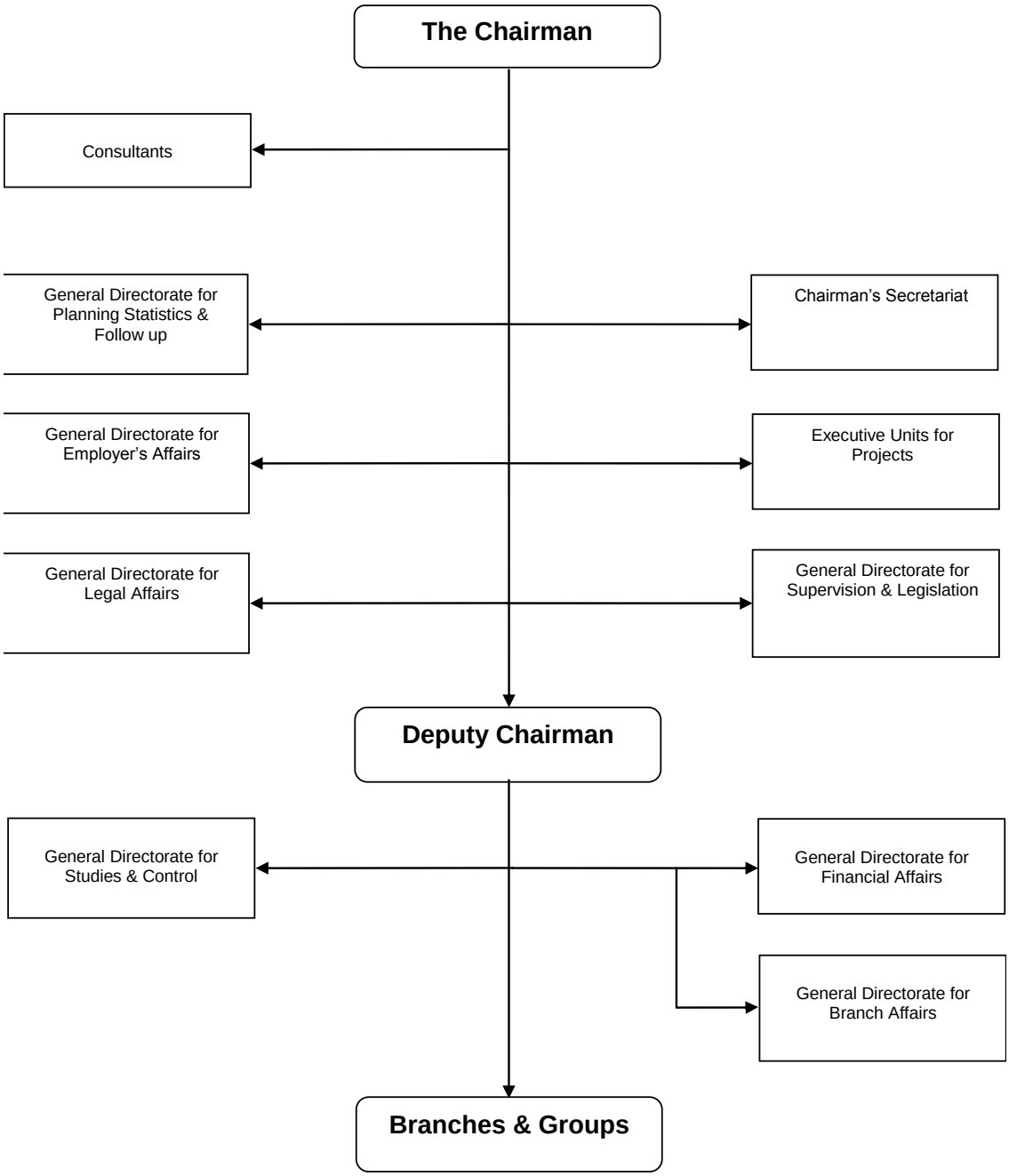
**Annex 4.2 : Organizational Chart of the Ministry of Agricultural & Irrigation**



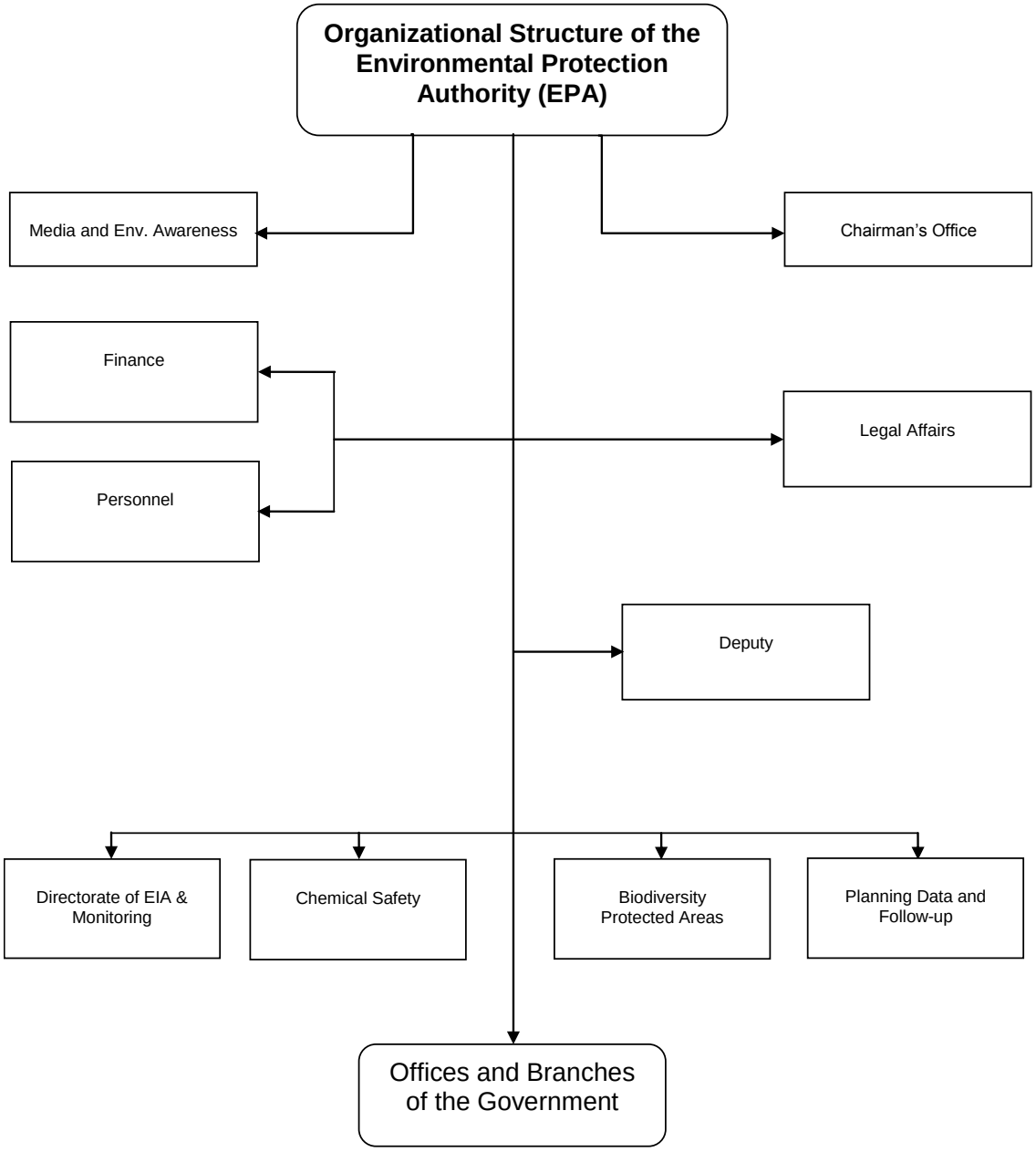
**Annex 4.3 : Organizational Structure of National Water Resources Authority (NWRA)**



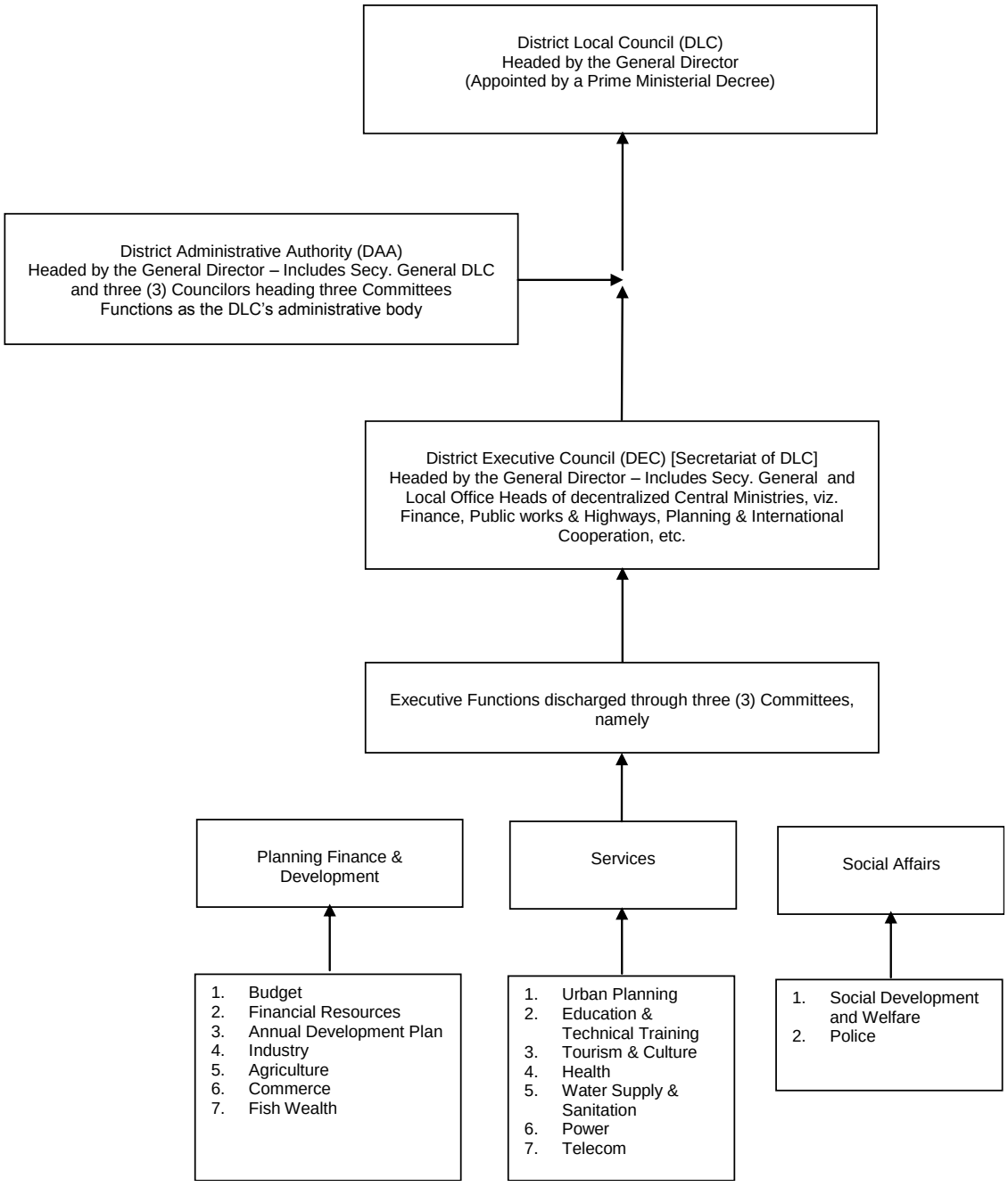
Annex 4.4 : General Authority for Rural Water Supply and Sanitation Project (GAWRSP)



Annex 4.5 : Organizational Structure of Environmental Protection Authority (EPA)



Annex 4.6 : Organizational Chart of a District Local Council (DLC)



# Table of Contents

**List of Tables**

# *SECTION-5.0: ANALYSIS OF ENVIRONMENTAL AND SOCIAL IMPACTS AT THE POLICY, PROGRAM AND PROJECT LEVELS*

This section presents an analysis of environmental, social, and economic impact of the water supply support program at various levels such as:

- Policy Level
- Program Level
- Project Level

## 5.1 Policy Level Impacts

As discussed in section 3 of this report, various strategies have been stipulated by the GoY in NWSSIP for improving water sector. The proposed WSSP will also agree with the objectives, policies, and approaches of NWSSIP. The World Bank and other donors such as the Netherlands, Germany, and DFID have corroborated the implementation of the NWSSIP policies.

Country Water Resources Assistance Strategy (CWRAS) 2005

- Technical assistance on NWSSIP Implementation and (M&E) system development during 2006 and 2007
- Sector Wide Approach (SWAp) study in 2006,
- Country Social Analysis in 2006,
- Poverty and Social Impact Analysis (PSIA) study on groundwater, irrigation and rural water and sanitation sub-sectors in 2007,
- Ongoing PSIA study in urban water and sanitation sub-sector in 2008

A Donor Core Group (DCG) comprising the World Bank, Germany, the Netherlands, and the UK through DFID has also been formulated for supporting the WSSP. The GoY has expressed its interest to expand this Group by including more donors, for example, Japan.

Further, Government's commitment to the Sector-wide approach is evident through e.g. by formulating a Program Preparation Committee (PPC) which includes five Deputy Ministers and supporting staff. A Joint Annual Review (JAR) system for NWSSIP has been introduced by government to verify the progress achieved by all water sector stakeholders and for validation polices. This shows Government's inclination to develop water sector altogether under the proposed WSSP.

Benefits of policies promulgated in NWSSIP and WSSP[20] are as follows:

- Sector Wide Approach (SWAp) will promote joint/ integrated planning and monitoring of water sector at policy level
- Formation of a Core Donor Group will boost the slow paced sector reforms and development initiated during the implementation of their ongoing projects.
- WSSP will provide more transparency and this will help improve effectiveness.

[20] Preparation Report on Water Sector Support Program – Second Draft, July 2008

- Policy adjustment in urban water supply and sanitation as shown in the box would reduce the burden on the national finances as it is difficult to achieve the 75% targets as the existing public owned utilities lack capacity.
- Adoption of low cost technologies will promote sustainability as well as more efficient use of funds.
- NGOs involvement will help in achieving the MDGs as well as public awareness on health and hygiene.
- Overall review of the policies for water sector development does not indicate any negative impact on the existing environment.
- Benefits on the existing environment under the water sector support program (WSSP) may be noticed in long run.

**NWSSIP UPDATE POLICY ADJUSTMENTError! Bookmark not defined.**

**1. Urban Water Supply and Sanitation**

**NWSSIP 2004 had proposed coverage of 75% of urban population by 2015. It is now realized that these targets are too high and a policy adjustment, as follows, is being considered:**

- **Public utilities would concentrate initially on improving the services in the areas where utility services already exist.**
- **Expansion of services will be done prudently**
- **Financial sustainability would be attempted more rapidly.**
- **Private sector would be involved for expansion and improvement of the existing services.**

**2. Rural Water Supply and Sanitation**

- **Possibilities for expanding the role of private/NGOs for achieving the millennium development goals in this sector would be explored.**
- **Self reliance and community development would be promoted through public/private partnership.**

**3. Irrigation National Program**

- **Recent restructuring of MAI is more focused on central departments than on developing and implementing effective services at the field level.**
- **MAI is considering the establishment of an Irrigation National Program so that the benefits of the experience gained by IIP, SBWPM and GSCP could be utilized in GDI branches as a human resources development measures.**
- **The Medium Term and Long Term Irrigation polices would give more emphasis on efficiency improvement of**

**The program development objectives are:**

- **Improve access to water supply and sanitation**
- **Increase returns to water use in agriculture**
- **Reduce groundwater abstraction for agricultural purpose from non-renewable aquifers in the critical basins**
- **Strengthen sector institutions for sustainable resource management and environmental protection.**

## 5.2 Program Level Impacts

Policy level discussions and the program development objectives clearly indicate that the proposed program will strengthen policies spelt out in the NWSSIP as well as its update. Beneficial Environmental Impacts at program level are summarized below:

- Provision of safe and more convenient water supply outlets will improve human health as well as savings in time, efforts, and expenses by the community.
- Availability of adequate quantity of water will improve hygienic conditions.
- Improved water supply will assure citizens adequate quantity of good quality water. This will also eliminate indiscriminate use of groundwater and thus minimize associated environmental problems.
- Public health gains such as increased output through improved health resulting in higher economic activity and productivity.

- Joint Annual Review (JAR) will offer an opportunity to assess the implementation of the various components of the program and identify the data gaps or difficulty faced at the project level.
- The program will encourage increased economic activities like commercial, industrial, etc. and will generate enhanced employment alternatives and economic growth.
- Improvement in the existing water supply and sewerage conditions will help tourism and boost the economy.
- Modern irrigation techniques will reduce the water requirement due to increased efficiency.

**Program level activities will include:**
- **Joint baseline inventories and technical audit to assess actual service coverage in rural and urban water and sanitation.**
- **Half yearly joint field sub-sector supervision**
- **Joint Annual Reviews based on field evaluation and social auditing.**
- **Harmonization of donors in the rural water sub-sector to provide targeted budget support to GARWSP and NWRA.**
- **Integration of existing IDA-financed PMUs in national institutions (RWSSP with GARWSP, SBWMP with NWRA Sana'a Branch, GSCP, IIP and SMWM Irrigation Department with the proposed INP.**
- **Coordination and alignment of all national stakeholders (SFD, PWP, Rural Development Projects)**
- **Promotion of the decentralization process, through support to Local Authorities in preparing integrated Water Master Plans as part of their District/Governorate Development Plans.**

Source: Preparation Report on Water Sector Support Program – Second Draft, July 2008

- Modern Irrigation techniques include
  - upgrading of pipe irrigation delivery systems
  - Conservation of open canals to piped irrigation canals to piped irrigation delivery system.
  - Introduction of modern on-farm pressurized irrigation systems such as bubbler, drip, etc.
- The modern irrigation system will help expand existing irrigated area, enhance crop productivity and quality of high value fruits, vegetables and commercial crops.
- Irrigation advisory services will be provided for participation of farmers in piped conveyance system and localized irrigation units through government agencies such as GDI.

**General Directorate of Irrigation (GDI) – will be responsible for planning and programming irrigation improvement and on-farm water management activities.**

Source: Preparation Report on Water Sector Support Program – Second Draft, July 2008

- Modern irrigation system will help meet the Mid-Term Sustainable Development Plan for Agricultural Food Security and Poverty Reduction based on MDG 2006-2010.
- Major benefit of the modern irrigation system will be in the form of water savings and reduce the groundwater overdraft.
- Adoption of modern irrigation technologies and public awareness will help ensure the sustainability of water resources. Life of water resources will be increased and could fulfil the long term demand of irrigation and agriculture needs.
- Due to the improved irrigation, following changes are expected at program level:
  - Passage of an irrigation law and decrees providing for user participation and cost recovery in irrigation.

- Increased Government technical and financial support for operation and maintenance of the irrigation schemes.
- Increased farmer participation in irrigation management at all levels, leading ultimately to transfer of management of the schemes to water user associations (WUAs) and their federations

- The benefits of the proposed Improved Irrigation Program are as follows:
  - Improved diversion efficiencies and installation of canal control structures, resulting in improved dependability and availability of distribution and use of spate flows to expand the irrigated areas.
  - Agronomic improvements to increase returns to water.
  - Halt of the decline in, the area cropped and crop yields that would otherwise happen, due to continuous deterioration of the spate infrastructure.
  - Decrease the risks of damage from flood events
  - Possible reduction of groundwater pumping.
- Application of Modern Irrigation System will help rural economy as the 73.4 percent of the country's rural population live in rural areas and irrigated agriculture is the main economic activity and source of income and employment in rural areas.
- Results of the earlier studies indicate that there will be savings of 13 to 20 percent of pumped groundwater from improved piped-conveyance systems and more than 30 percent from localized on-farm irrigation systems.
- Merging of GSCP, IIP, and Sana'a Basin Project in to one entity as Irrigation National Program will help harmonization of policies, planning and coordination, and implementation of the schemes.
- Better coordination among water sector stakeholders is expected during implementation of program at national, governorate level.
- Installation of meters on wells including Wells drilled by GAWRSP will provide a check on the groundwater abstraction.
- Environmental Awareness programs will be undertaken.
- Role of WUAs and WUGs will become important in providing advisory services. Extensive capacity building measures shall be undertaken to enhance their in irrigation or water participatory management.
- Role of community participation will help enforcement of laws.

### 5.3 Project Level Impacts

Impacts at this level will mainly be during the following phases, namely,

- Preconstruction Phase
- Construction Phase
- Operation Phase

Potential impacts of each phase on the environment are discussed in the subsections which are as follows:

### 5.3.1 Impacts during Preconstruction phase of the Subproject Interventions

Pre-construction activities include:

- Finalization of Engineering Design and Planning works and Project Finance
- Official meetings
- Purchasing/leasing of equipment
- Confirmation of right to access lands for survey purpose

These activities will be mainly official. Some of the preconstruction stage activities have been summarized in **Table 5.1**.

**Table 5.1: Summary of Preconstruction Phase Environmental Impacts**

| S. No. | Activity | Issues Involved | Likely Environmental Impacts | Degree of Impact |
|---|---|---|---|---|
| **Pre-Construction** | | | | |
| 1 | Preconstruction Stage | Finalization of Engineering Design and Planning works / Project Finance | No Likely impacts | Negligible |
| | | Official Meetings | | |
| | | Purchasing/leasing of Equipment | | |
| | | Confirmation of right to access lands for survey purpose | | |
| | | Site Inventory | Short term and nominal | Negligible if done properly |
| | | Vehicular traffic | Dust, sediment, and injury to vegetation or trees | Short term and nominal |
| | | Environmental Monitoring | No likely impact | Negligible if done properly |
| | | Land Acquisition | Likely Impacts on agricultural land may affect the livelihood. | Moderate to Severe (Negative Social impacts can be minimized by adopting RPF) |
| | | | Likely impacts on property | Moderate to Severe (Negative Social impacts can be minimized by adopting RPF) |
| | | | Likely impacts on Common Property Resources | Moderate to Severe (Negative Social impacts can be minimized by adopting RPF) |

### 5.3.2 Impacts during Construction Phase of the Subproject interventions

Several types of negative impacts upon environment may be caused during construction phase, primarily due to negligent practices. Appropriate techniques and responsible supervision is needed to avoid/minimize/mitigate these adversities. Environmental impacts envisaged during construction activities are discussed as under:

#### 5.3.2.1 Public Safety

Any combination of various activities listed below increases the risks of accidents (affecting especially local population) during construction phase:

- Unauthorized access to construction sites
- Absence of control over access to construction sites
- Conflict with construction/hauling vehicles
- Poor site safety measures and warning system

- Inadequate site management

Mitigation measures suggested in the Environmental Management Plan shall be adopted to avoid/minimize such impacts.

#### 5.3.2.2 Noise Quality

The construction phase noise will be generated mainly from the construction Yard/drilling sites due to the operation of various equipments and machines. The noise quality at construction sites/yards and the associated impacts will be as follows:

**a) Construction Yard**

Various site preparation and construction activities will generate increased noise levels due to operation of equipment. Construction activities are expected to produce noise levels in the range of 80 – 95 dB (A). With point source of a strength of 95 dB (A) at a reference distance of 2 m, the noise produced will not exceed 45 dB (A) beyond a distance of 250 m from the boundary of construction yard (the drop off rate will be 6 dB (A) for doubling the receptor distance from a point source). In view of this, the construction equipment shall be located at least 500 m away from the inhabitant/sensitive areas. **Table 5.2** presents international standards for noise from various construction equipments.

**Table 5.2: International Noise Emission Standards from Construction Equipments**

| Equipments | Noise Level dB(A) at 2 m | Equipments | Noise Level dB (A)at 2 m |
|---|---|---|---|
| Air Compressor | 74 - 87 | Front-end-Loader | 72 - 84 |
| Backhoe | 72 - 93 | Grader | 80 - 93 |
| Bulldozer | 80 | Jack Hammer | 81 - 98 |
| Concrete Mixer | 74 - 88 | Pavers | 86 - 88 |
| Concrete Pump | 81 - 84 | Roller | 73 - 75 |
| Concrete Vibrator | 76 | Scraper | 80 - 93 |
| Crane | 75 - 77 | Tamper | 74 - 77 |
| Crane with ball | 75 - 87 | Welding Generator | 71 - 82 |
| Dump Truck | 72 - 84 | | |

**b) Impact on Construction Workers**

Operation of construction equipments such as, drilling machine, jack hammers, excavators, pay loaders, generators, and concrete mixer will generate noise levels above the working environmental limits. Workers operating these machines may be affected if actual exposure is more than the safety limits prescribed by ACGH (American Conference of Government Industrial Hygienist). The ACGH has proposed an 8-hour long limit of 85 dB (A) for exposure in the high noise levels. Exposures to impulses of impact noise should also not exceed 140 dB (A) and peak acoustic pressure. Exposure to 10,000 impulses of 120 dB (A) is permissible per day.

Noise likely to be generated near the construction/drilling sites will be in the range of 90 – 105 dB (A) when all equipment are working together and simultaneously. This seems to be a

remote possibility. Hence, workers working near the construction equipment are likely to be exposed to a $L_{eq}$ between 80 dB (A) and 90 dB (A) in an 8-hour shift. The protection devices such as ear plugs/mufflers shall be provided to the workers operating high noise generating equipment.

#### 5.3.2.3 Air Quality

Impact on air quality during construction phase could be due to material transport, operation of construction yard, and fugitive dust emissions from the construction sites.

**a) Material Movement**

There may be fugitive emissions during loading/unloading and transport of construction materials. Mitigation measures in this respect especially in residential areas, near schools, and hospitals/clinics are very important.

**b) Operation of the Construction Yard**

Air quality impacts from the construction yard will be due to operation of equipment. Air pollution from the construction yard will be ground based and the effect will be mostly localized for the entire construction period. However, if the construction yard is located at a minimum distance of 500m away from any residential area, impacts of air pollution arising from construction yards activities will be insignificant.

#### 5.3.2.4 Impacts from Waste Material

Prolonged storage and surplus earth may cause dust pollution and soil transportation by rain water into low areas. Waste materials generated from construction sites shall be disposed of suitably in the approved landfill sites at the earliest.

#### 5.3.2.5 Other Impacts

Some short-term impacts may take place during the construction phase, - the locations and contexts of such impacts are:

**a) Site Office**

Temporary impacts may occur due to construction of site offices and labor camps. These impacts are likely to be marginal and can be mitigated by sensitizing and educating the workers.

**b) Equipment Storage and Machinery Maintenance**

The site area should have a proper maintenance shed for regular maintenance of the construction vehicles. The waste emanating from the maintenance shed should not be allowed to spread over the construction site. Oil and grease change of equipment and vehicles should be carried out in the service areas designated for vehicles. Wastes should be collected and disposed of properly and expeditiously.

**c) Employment Opportunities**

Construction activities can provide employment opportunities to the local population and residents of the neighboring area. People may come to provide labor or service the construction camps. It is necessary to ensure that after completion of construction work, such temporary establishments are removed promptly and not used for setting up squatter colonies.

**d) Property Access**

Access to buildings in sites where construction activities are going on will be affected, leading to minor economic loss. Such minor impacts will be restricted to the construction phase only. However, temporary access to such premises should be provided and such areas should be restored at the earliest.

## 5.4 Socio-economic Impact

### 5.4.1 Reduction in out-migration from the project area

Increase in employment opportunities within the project area would reduce outmigration.

### 5.4.2 Rise in Land Value

Irrigated land value will raise depending upon location and related aspects.

### 5.4.3 Increase in household income

Post project change scenarios will lead improvement in the household income in project area.

## 5.5 Impact on Local Community

**Positive Impacts**

- Project construction activities such as building material supply, construction equipment supply, transport and ancillary facilities would enhance employment potential.
- Requirement of labor, semi-skilled workers for construction would generate employment opportunities for the local population.
- Increase in land prices will benefit the local landholders.

**Adverse Impacts**

- Acquisition of private land by project activities may have adverse effects on the people affected.

## 5.6 ECONOMIC IMPACT OF WSSP IN YEMEN

### 5.6.1 Water sector crisis in Yemen

Yemen's stock of ground water is rapidly dwindling. Rural areas and the economy are under threat. Both urban and rural water coverage have only kept pace with population growth and not with commodity expression. Water sector reform is a key to economic development of Yemen.

### 5.6.2 GOY's policy initiatives

National Water Sector strategy and investment Program 2005 -2009, (NWSSIP) is the approved national strategy for the water sector in Yemen. GOY has approved NWSSIP in 2004 and

conducted two Joint Annual Reviews of NWSSIP implementation in 2006-2007. NWSSIP is regarded as one of the most advanced in the Arab World. It defines objectives, policies and approaches for the mid and long term. NWSSIP has provided valuable inputs into Yemen's development Plan for poverty Reduction (DPPR) 2006-2010. DPPR has also incorporated the objectives of the Agricultural long term Plan (AGSIP) 2006-2015, which in turn has significant bearing on the issue of rural livelihoods and sustainable water use.

### 5.6.3 Water Sector Support Program (WSSP)

GOY has desired that the World Bank and other development partners move forward within a sector wide approach (SWAp)- a Water Sector Support Program. The WSSP is designed to support the investment program laid out by GOY under the NWSSIP – which targets an investment envelope of approximately US $ 1 billion over the five- year period 2005-2009. In its entirety the WSSP is expected to cost USDM 292 It will be financed by various donors as shown in **Table 5.3.**

**Table 5.3: Funding of WSSP**

| Source | Contribution (US$ Million) |
|---|---|
| IDA | 90 |
| Germany | 120 |
| DFID | 26 |
| Netherlands | 56 |
| Total | 292 |

Note: Government of Yemen counter part pending will be USDM 70 (25% of WSSP) taking the total investment under NWSSIP to USDM 326.

The potential contribution (in US$ millions) based on investment plans and donor commitments are shown in **Table -5.4**.

**Table-5.4 WSSP: updated program budget***

| Component | IDA | Germany | DFID | Netherlands | Totals |
|---|---|---|---|---|---|
| UWSS | 30 | 110 | | 3 | 143 |
| RWSS | 15 | | 13 (TBD) | 40 | 68 |
| Irrigation Improvement and Watershed Management | 40 | | 3 (TBD) | 3 | 46 |
| Institutional Capacity Building | 5 | 10 | 10 (TBD) | 10 | 35 |
| Totals(TBD) | 90 | 120 | 26 (TBD) | 56 | 292 |

Note: (US$ million)
IWRM - Integrated Water Resource Management
Source: WSSP, Joint-AIDE-Memoire, as per Joint Preparation Mission in the World Bank, KfW 1672, EKN and DFID April 23 –May 1. 2008.

### 5.6.4 Sub-sector Urban Water Supply and Sanitation (UWSS)

The urban water strategy was approved in 1997. A major urban water investment program is under way. NWSA maintains fourteen (14) autonomous Local Corporations with 28 utilities and thirteen branches. Local Corporations are not yet fully financially autonomous and not yet operating on a commercial basis (WSSP Preparation report, May 2008, Ministry of Planning and International Cooperation, GOY, page 4. UWSS has launched its Performance Indicators Information System (PIIS). So far used by 23 utilities, NWSA and MWE planning departments; the benchmarking process has started (JAR NWSSIP Year 2006-UWSS Summary Report). With

Yemen's adoption of the MDGs , the quantitative targets for urban water supply and sanitation coverage have been set in NWSSIP as in **Table 5.5**.

**Table 5.5.: Urban Water and Sanitation Supplies (NWSSIP Targets)**

| | 2002 | 2005 | 2006 | 2009 | 2015 |
|---|---|---|---|---|---|
| Urban Population (millions) | 5.2 | 5.8 | 6.1 | 6.9 | 8.9 |
| Urban Water Demand (million cubic meters) | 129 | | | 175 | 224 |
| Urban population covered with Water supply services (millions) | 2.4 | | 4.9 | 6.6 | 6.7 |
| Percent of Urban Population Covered in Water Supply Services | 47% | | 60% | 71% | 75% |
| Urban population covered with Sanitation services (millions) | 1.3 | | | 3.7 | 6.6 |
| Percent of Urban population covered In Sanitation Services | 25% | | | 52% | 63% |
| Investment needed (USDM) | 120 | 150 | 150 | 150 | 150 |

Source: NWSSIP, 2005.

In 2006, approximately 22750 water house connections have been constructed benefitting some 171, 000. Total house connections for water stood at 483500 by end 2006. In 2006, approximately 15,000 new sewerage house connections have been constructed (see **Table5.6** for figures on progress of water connections and sewerage connections).

It is reported by NWRA that NSSWIP targets for water and sanitation coverage are achievable only with additional human and effective financial resources. It has been reported that recent NWSSIP update simulations have shown that, unrealistic financial resources would be required to reach the MDGs, using current water supplies and sewage technology.

**Table5.6: Progress of water and sanitation house connections**

| | **2005** | **2006** | **2007** |
|---|---|---|---|
| New house water connections | 26,300 | 22,750 | NA |
| No. of persons benefitted | 197,000 | 171,000 | NA |
| Total house water connections | 461,000 | 483,500 | NA |
| New sewerage house connections | 32500 | 15000 | NA |
| No. of persons benefitted with sewerage connections | 246000 | 113000 | NA |
| Total house sewerage connections | 251,000 | 26,6000 | NA |

**Source: JAR-II, 2006/07**

Life Line Tariff is presented in **Table 5.7**.

**Table: 5.7 Lifeline Tariff Structure**

**HOW THE POOR GET A FAIR SHARE OF WATER AT AFFORDABLE PRICES IN YEMEN**

- All utilities use a block tariff system that cross-subsidizes the consumption of the fist 10cbm/month.
- Consumption of 10cbm/month is considered the lifeline for the average family.
- On the average, 64 % of the households consume less than the lifeline quantity(JAR-II, 2006/07.
- The tariff rate for the lowest block is set so that the average household expenditure on water and sanitation does not exceed 7 percent of the total household budget.
- This principle does not seriously affect the utility budget because it accounts for only 12.4 % of the revenue of the utility.

**Table 5.8: Poverty Measurements (percent) by Governorate, for 2005-2006**

| Governorates | Incidence of poverty | | | Poverty Gap Index | | | Severity of Poverty Index | | |
|---|---|---|---|---|---|---|---|---|---|
| | Urban | Rural | Total | Urban | Rural | Total | Urban | Rural | Total |
| Ibb | 16.36 | 32.84 | 30.07 | 3.56 | 8.17 | 7.4 | 1.18 | 2.92 | 2.63 |
| Abyan | 31.37 | 50.44 | 45.68 | 8.17 | 14.52 | 12.94 | 3.23 | 5.73 | 5.11 |
| Sana'a City | 14.98 | 0 | 14.89 | 3.39 | 0 | 3.37 | 1.09 | 0 | 1.09 |
| Al-Baida | 16.72 | 59.76 | 51.85 | 4.14 | 21.28 | 18.13 | 1.35 | 9.61 | 8.1 |
| Taiz | 23.66 | 41.51 | 37.8 | 5.41 | 10.96 | 9.8 | 1.96 | 4.08 | 3.64 |
| Al-Jawf | 32.57 | 52.63 | 49.58 | 5.94 | 14.78 | 13.44 | 1.61 | 6.02 | 5.35 |
| Hajja | 20.9 | 50.02 | 47.53 | 4.64 | 14.41 | 13.57 | 1.63 | 5.83 | 5.47 |
| Al-Hodeida | 21.58 | 36.43 | 31.72 | 4.78 | 8.85 | 7.56 | 1.62 | 3.21 | 2.7 |
| Hadramout | 31.45 | 39.17 | 35.59 | 4.97 | 8.15 | 6.67 | 1.21 | 2.39 | 1.84 |
| Dhamar | 29.73 | 25.28 | 25.84 | 7.53 | 5.75 | 5.97 | 2.96 | 2.01 | 2.13 |
| Shabwah | 39.44 | 56.8 | 54.13 | 8.97 | 19.61 | 17.97 | 3.01 | 9.58 | 8.56 |
| Sa'adah | 18.18 | 16.23 | 16.55 | 3.6 | 3.56 | 3.57 | 1.08 | 1.09 | 1.09 |
| Sana'a Region | … | 28.13 | 28.13 | … | 7.02 | 7.02 | … | 2.29 | 2.29 |
| Aden | 16.88 | … | 16.88 | 3.08 | … | 3.08 | 0.84 | … | 0.84 |
| Laheg | 22.9 | 49.49 | 47.2 | 4.53 | 14.7 | 13.82 | 1.36 | 6.16 | 5.75 |
| Mareb | 17.95 | 50.05 | 45.88 | 4.28 | 19.2 | 17.26 | 1.53 | 9.07 | 8.09 |
| Al-Mahweet | 21.9 | 31.48 | 30.75 | 4.55 | 6.29 | 6.16 | 1.39 | 1.79 | 1.76 |
| Al-Maharh | 11.4 | 6.29 | 8.85 | 2.78 | 0.81 | 1.8 | 1.12 | 0.2 | 0.66 |
| Amran | 33.93 | 70.6 | 63.93 | 9.17 | 17.82 | 16.24 | 3.34 | 6.13 | 5.62 |
| Al-Dhale | 28.15 | 46.37 | 44.24 | 6.57 | 8.99 | 8.71 | 2.43 | 2.61 | 2.59 |
| Remah | 5.38 | 35.32 | 34.07 | 2.58 | 8.19 | 7.96 | 1.24 | 2.75 | 2.68 |
| All Yemen | 20.7 | 40.09 | 34.78 | 4.48 | 10.6 | 8.93 | 1.47 | 4.02 | 3.32 |

Original source:
Yemen Poverty Assessment Report Vol.1, page 7

### 5.6.5 Sub-sector (Rural Water Supply and Sanitation (RWSS)

Rural water supply and sanitation (RWSS) is a powerful poverty alleviation tool considering the positive impacts of access to drinking water on health, girls' education and unemployment. The water supply and sanitation MDGs for rural areas are shown in **Table 5.9.**

**Table 5.9: Water supply and sanitation MDGs for rural areas in Yemen**

| | 2009 | 2015 |
|---|---|---|
| Percentage of rural population with access to safe water supply | 47% | 65% |
| Percentage of rural population with access to safe sanitation | 37% | 52% |
| Rural population with access safe water supply (millions) | 8.2 | 13.6 |
| Rural population with access safe sanitation (millions) | 6.5 | 10.9 |
| Total rural population (millions) | 17.5 | 20.9 |
| Total annual investment required (million USD/year) | 130 | 130 |

Source: NWSSIP 2005-2009, page 28

The rural population in Yemen was 15.5 million with 42% having access to safe water at the end of 2006. The population is projected to rise to 20.9 million in 2015. Thus, 6.2 million people will need to get access to safe water if the target of 65% coverage by this year is to be met. This means that annually, about 700,000 people need to be served over the period 2007 to 2015. **Table 5.10** gives the progress of coverage of rural population with safe drinking water in Yemen.

**Table 5.10: Progress of coverage of rural population with safe drinking water in Yemen**

| **Year** | **Rural population (millions)** | **No. of people covered during the year** |
|---|---|---|
| 2004 | 14.12 | 658798 |
| 2005 | 14.54 | 580688 |
| 2006 | 14.98 | 714947 |
| 2007 | 15.43 | 808927 |
| 2008 | 15.89 | 1295575 |

Source: GARSWP

Notes:

(a) Rural population has been estimated as 71.6% of estimated total population
(b) Figures for the years 2004, 2005 & 2006 are actual
(c) Figures for the years 2007, 2008 and 2009 have been projected by GARSWP on the basis of past experience

**Poverty in Yemen & water policy**

- In 2005/06 there were seven million poor people in Yemen. Thus almost 35 percent of the population could not fulfill their food and non-food basic needs Using the food poverty line, the overall poverty is estimated at 12.5 percent representing almost 2.9 million (Yemen Poverty Assessment Report Vol.1, page 24). There is considerable regional variation in the incidence and intensity of poverty(See Table 7.2).

- The urban areas in Yemen witnessed remarkable decline poverty between 1998 and 2005/06 (Yemen Poverty Assessment Report Vol.1, page 7). The urban areas benefitted from oil-led growth. The percentage of urban poor declined from 32.2 % in 1998 to 20.7% in 2005/06 despite an increase in urbanization. During the same period, in rural areas the percentage of the poor declined only marginally from 42.4% in 1998 to 40.1% in 2005/06.

- Public & private transfers play an important role in poverty alleviation in Yemen (Yemen Poverty Assessment Report Vol.1, page 15). It has been estimated that in 2005 public and private transfers (without petroleum subsidies) accounted for nearly 9 percent of household budget expenditure. Without these transfers to households (including petroleum subsidies) the number of poor in Yemen would have swelled by 1.6 million or 8% of population.

- Policies in the water sector e.g. lifeline policy of urban water supply tariffs(see Box 2), free irrigation water to farmers who are predominantly small and poor, the policy of imposing a cess of 2 Riyals/liter on diesel and using the proceeds to support LCs(Riyals 1.8/liter and irrigation improvement projects (Fils 70/liter) all involve significant indirect transfers from rich to poor . Hence water sector has a very significant role to play in poverty alleviation.

### 5.6.6 Sub-sector : Irrigation Improvement

With its limited arable land and arid/semi-arid climate, Yemen provides a fragile environment for agricultural production. The threats to agriculture posed by naturally-occurring pests (some 115 species of pests have been recorded in Yemen) only exacerbate this situation. Pest infestation causes substantial annual losses of crop production in Yemen, some estimates ranging from 20-70 percent, depending on crop type and location. For this reason, Yemeni farmers have increasingly turned to the use of pesticides in an attempt to minimize pest damage. One field survey conducted in the Sana'a Basin in 2001 revealed that farmers had problems with pests attacking grapes and qat, the main irrigated crops in the basin, and used a number of pesticides (e.g. dimethoate and penconazole) to address the problem. In fact, the survey also revealed that most farmers had little knowledge of recommended dosages, proper application methods and times, etc., increasing concerns of improper application of pesticides with resulting threats to human health and the environment. Some traditional agricultural pest management practices remain, the most common of which is crop dusting, but the trend is on increasing use of chemical pesticides.

Recognizing this situation, the Bank's Sana'a Basin Water Management Project included a number of measures to promote improved pest management practices, including integrated pest management (IPM), in project areas where improved irrigation techniques were introduced. These measures included implementation of specific pest management plans for grapes and

qat, the principal crops raised in the project areas. The plans served both as mitigation measures against the harm to the environment and human health that may occur from excessive use of chemical pesticides and as a learning instrument for MAI's Department of Plant Protection, which oversaw plan implementation and thus gained valuable experience with alternative means to combat plant pests. The measures also included a farmer education program stressing good, safe practices for pesticide application, storage, and disposal in the field. Finally, the project also provided equipment and training to the MAI Pesticides Laboratory to support regular testing for pesticide residues in agricultural products and a program of groundwater quality monitoring for pesticide contamination.

The objectives of WSSP projects under the irrigation improvement component include improvement in farmers' livelihoods and ensuring resource sustainability both in quality and quantity through the provision of on-farm irrigation technologies throughout Yemen and through building on the experiences gained from IDA-supported projects which introduced the concepts of "Participatory Management" and "More Crop per Drop".

Rainfall is the main source of surface water in the country. Yemen receives an annual average of 50 to 60 billion cubic meters of rainfall. Rain bursts, which occur in summer, cause most rain water to be retained in upper soil layers. Runoff water has been estimated to be between 3 – 6 billion cubic meters on the average (NWSSIP 2005-2009, page 13). Except the reservoir behind the Ma'rib dam with capacity of 400 million $m^3$ which provides irrigation for 1000 Ha there are no large bodies of surface water in the country. Smaller dams have existed through out history as means of improving water control, breaking spate, or enhancing groundwater infiltration.

Until the 1970s, water use in Yemen was sustainable. Agriculture utilized surface water, spate flows in rivers, flows from springs and exploitation of shallow aquifers. All these sources being rainfall dependent and an approximate annual balance between renewable supply and utilization was maintained (WEC, 2008, page 3). The situation changed after that with the arrival of the tube well technology that allows exploitation of water from deep aquifers.

According to Agricultural Statistics (MAI, 2001) the total agricultural land in Yemen is 1.66 million ha, of which the cultivated land varies from 0.98 million ha to 1.5 million ha according to the amount of rainfall. The amount of water used in agriculture is currently about 88% followed by urban (10%) and industrial (2%) use. Table 7.3 shows that cultivated area under well irrigation increased from 2% of total cropped area in 1975 to 40% by 2000 and fell to 32% in 2005. **Table 5.11** gives the progress of coverage of rural population with safe drinking water in Yemen.

**Table 5.11: Cultivated areas (' 000 Ha) in Yemen according to the source of irrigation between 1975 and 2005**

| Year | Rain fed | Well | Spring (perennial) | Spate (flood) | Total cropped area |
|---|---|---|---|---|---|
| 1975 | 1285 | 37 | 73 | 120 | 1515 |
| 1990 | 685 | 310 | 25 | 101 | 1121 |
| 1995 | 579 | 368 | 20 | 100 | 1067 |
| 2000 | 515 | 457 | 46 | 126 | 1144 |
| 2005 | 609 | 393 | 34 | 137 | 1202 |

**Source: Agricultural Statistics, MAI, GOY, 2001**

The increasing exploitation of well irrigation has resulted in groundwater abstraction exceeding recharge. The imbalance between abstraction and recharge varies among basins and sub-

basins. In Sana'a basin, for instance, the abstracted amount is more than five times the recharge amount (**Table 5.12**).

**Table 5.12: Water Balance 2005 in million cubic meters (MCM) in Yemen and three basins**

| | Domestic abstraction | Irrigation abstraction | Industry abstraction | Total abstraction | Total recharge | Water balance |
|---|---|---|---|---|---|---|
| Yemen | 265 | 3235 | 65 | 3565 | 2500 | -1065 |
| Sana'a basin | 55.4 | 209.2 | 4.8 | 269.7 | 50.7 | -219 |
| Taiz basin | 18.5 | 39.3 | 4.2 | 62 | 20 | -42 |
| Hadramout basin | 40 | 360 | 0 | 400 | 150 | -250 |

**Source: JICA (2007)**

NWSSIP (2005) proposes an invest program of US$ 189.85 millions over the five year period 2005-2009 under irrigation and watershed management. Out of these five major investment programs which together account for US$ 138.06 (72% of total investment given in **Table 5.13**.

**Table 5.13: Five major investment projects/activities under Irrigation and Watershed Management program proposed under NWSSIP, 2005 in Million USD**

| Sl. #. | Activity Project | Location | 2005 | 2006 | 2007 | 2008 | 2009 | Total | Implementing agency |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Small dams Etc. | Yemen/ | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 40.00 | AFPPF, MAI, NWRA, MWE |
| 2 | GSCP | Yemen | 5.40 | 8.00 | 10.00 | 8.00 | 6.00 | 37.40 | MAI |
| 3 | SBWMP | Sana'a basin | 4.95 | 6.43 | 6.15 | 5.13 | | 22.66 | MWE MAI, NWRA |
| 4 | Desertification project | Pilot areas | | 5.50 | 5.50 | 5.50 | 5.50 | 22.00 | MAI |
| 5 | Research and extension | Pilot area in high lands | | 4.00 | 4.00 | 4.00 | 4.00 | 16.00 | MAI, AREA |
| Total | | | 18.35 | 31.93 | 33.65 | 30.63 | 23.5 | 138.06 | |

**Groundwater and Soil Conservation Project (GSCP)**

- The Board of Directors of IDA approved in March 2004 a credit of USD 53.6 million out of which IDA will contribute $40 million, Government of Yemen $7.55 million and beneficiaries of the project will provide the rest viz. $5.81 million to support the implementation of the project GSCP over five years.
- The objectives of the project are: (a) improving water use efficiency and increasing farmers' return to water and so creating conditions that would allow farmers to reduce pumping of groundwater from aquifers, (b) increasing surface and groundwater availability through watershed management and groundwater recharge, (c) supporting groundwater management framework and institutions that will have the incentive and capacity to manage local water resources in a sustainable manner.
- The project builds on the positive and negative aspect of the Land and Water Conservation Project (LWCP, 2000). It scales up, from 11 governorates and 10,000 Ha to 15 governorates and 28,000 Ha the successful ground water efficiency components of the predecessor project.
- GSCP will comprise of the following components: (a) modernization and improvement of groundwater irrigation systems, (b) water harvesting, groundwater recharge and soil conservation, and (c) institutional strengthening of water institutions.
- **Economic benefits** of the project would be the result of: (i) higher water use efficiencies; (ii) moderate increases in agricultural production; (iii) reduced costs of irrigation; and (iv) improved farmers' income. From the analysis of a sample of farm models, it can be concluded that farmers would see a significant increase in their on-farm income, mainly as a result of the pumping water saving investments financed under the project. Project investment would also result in an improvement in labor productivity and food security for these households contributing towards poverty alleviation. The economic value of the net water savings was not included in the ERR calculations, but estimated only as a reference to indicate its high potential values. The ERR of the project has been estimated at 16.5%.
- The project became effective from May 2004 and is expected to close in October 2009. The estimated annual disbursements by the bank and the actual total disbursements to the project are given below.

| Year | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Total |
|---|---|---|---|---|---|---|---|
| Estimated disbursements by IDA (MUSD) | 0.94 | 6.39 | 11.15 | 10.53 | 7.92 | 3.07 | 40.00 |
| Actual disbursements (MUSD) | Nil | 2.06 | 10.03 | 8.037 | | | |

Source: PAD GSCP for actual disbursements, MAI; GSCP Directorate for actual disbursements

These impacts have been summarized in **Table 5.14**.

**Table 5.14: Summary of Construction Phase impacts**

| S. No. | Activity | Issues Involved | Likely Environmental and Social Impacts | Degree of Impact |
|---|---|---|---|---|
| 1.0 | Construction Phase (General impact) | Site clearance | Decrease in vegetative cover, stripping of top soil, increase soil erosion, and water quality | Short term and mitigation measures shall be adopted. |
| | | Public Safety | Potential Injuries | Moderate as well as severe, mitigation measures shall be adopted. |
| | | Material Movement | Public Nuisance, Air quality | Mild but mitigation measures are necessary. |
| | | Operation of Construction Yards | Air quality<br>Noise Quality<br>Soil Quality,<br>Water Quality | Mild and Temporary, Restricted to construction period. |
| | | Disposal of Waste Material | | |
| | | Quarrying Operation | | |
| | | Access Road Construction | Air quality, noise quality, and soil quality | Mild, mitigation measures shall be adopted. |
| | | Traffic Congestion, Blocking or impairing access along the existing street | Circulation Impacts | Temporary, Restricted to construction period. |
| | | Influx of construction Workers | Social, infrastructure, and health | Short term |
| | | Site office | Disposal of Solid and liquid waste | Mild |
| | | Equipment Storage and Machinery Maintenance | Occupational health and Safety | Moderate |
| | | | Aquatic Ecology | Nil |
| | | | Terrestrial Ecology | Nil |
| | | | Land use pattern | Nil |
| | | Employment Opportunities | local People get Environment | Beneficial Impacts |
| | | Reduction in out-migration | Rise in employment opportunity of people within the project area, the need for out migration will be minimized | Beneficial Impacts |
| | | Rise in wage rate | Increase in demand for employment will push the wage rates high in the labor market | Beneficial Impacts |
| | | Land Acquisition (Common to All Subproject Interventions) – Refer RPF for further details. | Impact on agriculture land leads to impact on livelihood | Negative Impact (RAP will be prepared based on RPF and implemented before commencement of the construction work) |
| | | | Impact on property | Negative Impact (RAP will be prepared based on RPF and implemented before commencement of the construction work) |
| | | | Impact on Common Property Resources | Negative Impact (RAP will be prepared based on RPF and implemented before commencement of the construction work) |

| S. No. | Activity | Issues Involved | Likely Environmental and Social Impacts | Degree of Impact |
|---|---|---|---|---|
| 2.0 | Water Supply Project | Land use | No change in Land use pattern | Nil |
| | | Biological Environment (Terrestrial/Aquatic Flora and Fauna) | No impact on Aquatic or terrestrial Ecology | Nil |
| | | Flushing and disinfection pipes | Occupational health and Safety | Mild |
| | | | Soil Quality | Moderate, Mitigation measures are to be adopted. |
| | | Laying and jointing of Pipes | Disruption of Services | Mild and short term |
| | | Drilling of wells or rehabilitation of wells | Air, Noise, water, and Soil Quality | Mild and Temporary, however necessary mitigation measures are to be adopted. |
| | | Cost and Availability of Land and Housing | Increased demand for land / housing, increase in prices during construction and operations | Mild and Short Term |
| | | Employment Opportunity | Project activities will create local employment opportunities. | Mild and Short Term |
| 3.0 | Sanitation Project | Latrine installation | No negative Impact | Nil |
| | | Wastewater treatment plant | Land use | Need proper design of wastewater disposal system. |
| | | Removal of cesspits and septic tanks | Public Health | High, (Needs mitigation measures as per EMP) |
| | | | Public Nuisance | Mild |
| | | | Soil Quality | Negligible |
| | | Laying and jointing of Sewer Pipes | Access to Property | Mild |
| | | Replacement of existing pipes | Occupational health and Safety | Moderate |
| | | Traffic congestion, blockage, and access | Circulation Impacts | Mild |
| | | Employment Opportunity | Labor intensive irrigation O&M and rehabilitation activities will create local employment opportunities. | Mild and Short Term |
| 4.0 | Wastewater Treatment Plant | Land Acquisition-– Refer RPF for further details. | Change in Land use Pattern and impact on the livelihood of the PAPs | Impact may be reduced by controlling the treatment quality.<br>Mitigation measures may be adopted as detailed out in RPF. |
| | | Earthwork, grading and excavation, | Soil quality, | Mild, Mitigation measures shall be applied. (short term) |
| | | | Air quality | Moderate, mitigation measures shall be applied. (short term) |
| | | | Noise quality | Moderate, mitigation measures shall be applied. (short term) |
| | | | Side vegetation | Short term |

| S. No. | Activity | Issues Involved | Likely Environmental and Social Impacts | Degree of Impact |
|---|---|---|---|---|
| 5.0 | Dam Construction and Irrigation Projects | Site clearance | Vegetation | Short term |
| | | Tree removal | Terrestrial ecology | Moderate and permanent |
| | | Top soil stripping | Soil Quality | Moderate and permanent |
| | | Excavation, grading, | Air Quality, Noise Quality, Soil Quality | Short term |
| | | Land Acquisition-– Refer RPF for further details. | Change in Land use Pattern and impact on the livelihood of the PAPs | Mitigation measures may be adopted as detailed out in RPF |
| | | Employment Opportunity | Create local employment opportunities. | Mild and Short Term |
| 6.0 | Project closeout | Removal of temporary offices and shops (demolition and relocation) | Noise, solid waste, air quality, traffic blockages | Short term, mitigation measures shall be applied. |
| | | Site restoration – Finish grading, top soiling, Fertilizing | Air quality, noise quality, soil quality | Short term |

## 5.7 Operational Phase Impacts

Likely environmental impacts during the operation of the proposed subproject interventions are discussed in the following sub-sections and summarized in **Table 5.4**.

### 5.7.1 Water Supply Project

Potential impacts for the water supply project are as follows:

#### 5.7.1.1 Impact on Groundwater

Drilling wells for supply water will indeed cause certain negative impacts. However, protection of potable water supplies to the population centers is very important. It is also necessary to give special priority to rural and urban water supplies as this will help to reduce poverty and improve the health and hygiene conditions. Hence, in order to protect the water supplies, enforcement of water laws # 33 and # 4 of the year 2002 and 2006 respectively is a must.

### 5.7.2 Sanitation Project

- Impact on soil quality due to solid wastes
- Impact due to leakage and blockage
- Impact on occupation health of workers

#### 5.7.2.1 Impact on Soil Quality due to Solid Waste

Solid waste generation in the sewerage system (Grit/screening waste and STP sludge) is the main source of pollution. If not disposed of properly, it leads ultimately to degradation of soil quality.

#### 5.7.2.2 Impact due to Leakages and Blockages

- On soil quality by contaminating the same and disturbing soil stability
- On water supply through intrusion of contaminants into system
- On aesthetic environment due to fly, mosquito breeding, and odor nuisance

#### 5.7.2.3 Impact on Occupational Health of Workers

- In deep trenching operations
- Accumulation of gas in sewers and other confined spaces
- Contact with wastewater during repair/maintenance

#### 5.7.2.4 Impact due to Reuse of Treated Wastewater and Sludge

- Personnel working at the treatment plant, labor working in agricultural fields, and the public at large are at risk directly or indirectly through contamination of crops and groundwater.
- The development of any irrigation system brings about significant changes to the soil and water resources in the area.
  - Soil Salinity: An increase in the salinity of the profile can take place as a result of irrigation development and wastewater quality. This may due to (a) relatively high content of NaCl and toxic elements in the treated wastewater, (b) excessive irrigation water applied to crops.

– Arid climate prevailing in the project area - irrigation with wastewater may cause accumulation of salts in the soil profile. This may affect the crop growth and yield.

– Excess water from seepage or on – farm irrigation practices may result in an increase in the water table. Crops take up the water from the soil profile and leave behind most of the salts. Over the time, the salts can build up in the crop root zone to concentrations that reduce crop production and yields. Excess sodium (sodium adsorption ratio) in soil can reduce the soil permeability which restricts the water movement through the soil.

- The physical-chemical quality of the wastewater due to the presence of toxic matters may adversely affect to the plant life, soil quality, and groundwater. The salinity of water is a significant element.
- Plants nutrients in treated wastewater generally have a supplemental fertilizer source to the crops. However, the application rates of wastewater are not easily controlled compared to commercial fertilizer use.
- Wastewater irrigation could exceed the concentration of nitrogen and phosphorous requirements of many crops during the growth period.
- The sewage sludge contains pathogenic bacteria, viruses, and protozoa along with parasitic helminthes which can give rise to potential hazards to the health of humans, animals, and plants.

#### 5.7.2.5 Operation and Maintenance of Sewerage System

Treatment works, pumping, and sewerage conveyance system will not perform satisfactorily unless these are operated and maintained properly. Malfunctioning of this system may pose risks of health hazards.

### 5.7.3 Dams and Reservoir Projects

Construction of dams and reservoir project may affect the existing environment in the following ways.

- Promotion of growth of aquatic weeds such as water hyacinth
- Increase areas of mosquito-breeding and related insects – and their public health implications (e.g. malaria and schistosomiasis)
- Impacts on rare, threatened, endangered, unique flora and fauna.
- Change in microclimate of the area – more wind, humidity, and/or precipitation
- Downstream effects in terms of flow into valleys may cause change in sea water intrusion pattern.
- Developments in catchment area resulting from roads
- Downstream effects on traditional floodplains cultivation
- People relocation – resettlement ( possible change in lifestyle )
- Change in local groundwater quality
- Change in quality of impounded water (Seasonal)

### 5.8 Positive Impact on Health and Sanitation

Participants' socio-economic indicates that health and sanitation condition are very poor in urban and rural areas. Water logging and poor drainage systems result in health problems, particularly water- borne diseases. The incidences of malaria, typhoid, diarrhoea and bilharzias are very common in rural as well as urban areas. It is projected that health and sanitation conditions will be improved with interventions under WSSP

- Provide the clean and safe water that eliminate water borne diseases.
- Improve personal and home hygiene resulting from increase water consumption
- Clean and hygienic environment
- Increase number of houses that are connected to sanitation network
- Improve sanitation is directly related to improvement of women and child health
- The roads , pavements and sanitation projects improve cleanliness of public places

### 5.9 Improve Drinking Water Supply

Primary survey results quality of drinking water is not good. Water services and projects run by the government are not adequate to meet peoples' demand. Therefore in WSSP more focus would be given:

- To improve quality of drinking water by more water supply projects
- With adequate supply of safe drinking water, the incidence of illness and diseases could be dropped

### 5.10 Irrigation Improvement

Field findings reveal that spate irrigation and groundwater is the major sources of irrigation in rural areas. Agriculture is the main source of livelihood in rural areas. The farmers have limited or no knowledge of new irrigation methods. Improper use of water leads to abstraction of water. Further, inadequate sources of water and poor prevailing condition of farmers force them to use wastewater for irrigation. With WSSP, emphasis would be given to pay more attention to irrigation improvement in order to:

- Increase in water harvesting for agriculture purpose
- Increase in underground water table
- Increase in irrigated land

### 5.11 Promote Gender Equality and Empower Women

Women play a major role in rural economic life. Despite their crucial role in the economic life of the family, women face serious constraints in improving their living conditions as revealed from field study e.g. limited access to assets, higher illiteracy rates and low primary school enrolment rates, increase number of dropout as compared to men, responsibility of bringing water from far off places, spending large part of day in fetching water for their families, lack of health and educational facilities, lack of participation in decision making etc. WSSP project intervention ensures women participation would be encouraged especially during identification and prioritization of needs in planning stage. Projects to be implemented under WSSP will benefit

women; girls and children in general would be given top priority. Thus this segment of society will be main beneficiary of WSSP projects.

- Reduced time and economic burden of fetching water for household needs
- Girls enrollment in schools will be increased in rural areas
- Within reach water supply provision would reduce health problems
- Time saved would enable access to adult education and income generating activities , empowerment activities as well as leisure and rest
- Women's empowerment would be facilitated through participation in water resource development and management of water supplies
- Women will get jobs opportunities in projects under WSSP
- Improve water, sanitation and hygiene impacts on socio-cultural position of women and has potential to provide with privacy and dignity as well as increased status within the family and wider society.
- Female representation on water boards and users communities strengthens the role of women in society and has far – reaching socio-cultural impacts

### 5.12 Eradicate extreme Poverty with the focus on pro-poor

- Increase productivity of crop production, livestock and fisheries through efficient water use would contribute to lower food prices. Urban poor would benefit from reduced food expenditure
- Availability and access to safe water resources would result in improved productivity and higher income
- Improve water supply and sanitation will have positive impact individual income and poverty situation of beneficiary household
- Improve water quality will reduce health risk and also reduce costs of preventing and treating ill family members that will further have positive impact on income situation by saving money to be spend on water related diseases
- Higher subsidy and low cost technology would be affordable to pro-poor section of the society, will help them to improve their socio-economic condition
- Efficient water use and equality of water allocation for the poor will be increased
- Promote water productivity (more crop per drop) in agricultural particularly poor farmers
- Reduce poverty through increased participation of local communities/WUAs, WUGs , CBOs
- Forging partnership with local communities for co-management of water basins bring ownership of the programs

**Table 5.15: Summary of Operational Impacts Phase**

| S. No. | Activity | Issues Involved | Likely Environmental Impacts |
|---|---|---|---|
| 1 | Water Supply Project | Land use Pattern | Change in existing Land use pattern |
| | | Uncontrolled Abstraction of Groundwater | Groundwater Table |
| | | Disruption of services | Social Issues (Disruption of services for long time will create moderate impacts which may be mitigated by giving prior information through public announcements) |
| | | Increased Wastewater Generation | Water and soil Quality, Public Health |
| 2 | Sanitation Project | land use Pattern | Change in existing land use pattern |
| | | Sludge Disposal | Water Quality<br>Soil Quality |
| | | Wastewater disposal | |
| | | Operational and Maintenance | Occupational Health and Safety |
| | | Sewer Overflows | Nuisance to Public |
| | | Reuse of Sludge and wastewater | Soil quality, groundwater quality, and human beings |
| 3 | Dam, Reservoir, and Irrigation Projects | Catchments Protection | Soil Quality, Groundwater resources, Flora, and Fauna, land use pattern, local community and their livelihoods |
| | | Submergence of land | Soil quality, Terrestrial ecology, local community, livelihoods |
| | | Impounding of water | Soil quality, water quality, Air quality |

# Table of Contents



**LIST OF TABLES**

# *SECTION-6.0: RECOMMENDED PREVENTIVE ACTIONS AND MITIGATION MEASURES*

This section suggests mitigation measures / preventive actions for adverse impacts, if any, of the WSSP interventions. These mitigation measures, summarized in Section 8 of this report, are discussed at policy, program and project level.

## 6.1 Policy Level

NWSSIP policies discussed in earlier previous sections of this report will reduce dependence on groundwater and promote its sustainable use. Besides, progressive decentralization, initiative on public - private participation and objective assessment at various levels, and better co-ordination amongst the agencies involved will enhance the positive policy impacts, benefitting the entire community.

## 6.2 Program Level

The activities envisaged under WSSP would be important inputs for the development of water sector, meeting MDGs for urban/rural water supply and sanitation, improving irrigation and groundwater savings / incomes / girls' education and facilitate poverty reduction, and health and hygiene programs.

The recommendations below would make the program more environmental friendly and socially beneficial:

- WSSCS would monitor water quality of private suppliers as it is the main agency responsible for meeting urban water demand.
- Well equipped laboratories are essential for conducting wide range analysis of relevant parameters regarding, inter-alia, water quality, presence of heavy metals and microbiological tests.
- EPA should build up a database on type/quantity of solid/liquid/gaseous waste in Governorates.
- EPA branches should have more professional staff to decide quickly on EIA approvals.
- The pace of decentralization of NWRA branches should be expedited along with intake of professional staff.
- Generation stream flow and meteorological data base would facilitate designing, planning, and assessing environmental impacts of subprojects and improve cost effectiveness of WSSP interventions.
- Operation and maintenance of the Dams are of critical importance and such responsibilities should be assigned specifically along with mandatory tests/checks etc.
- Proper phasing of WSSP interventions would contribute to project efficiency and cost effectiveness.
- As indicated earlier in Section 3, climate changes will impact the country in future and suitable mitigation measures need to be planned for future water supply and any

development projects, suggestions below may reduce the intensity of climate change impacts :

- Reuse of wastewater by downstream industries, agricultural activities
- Use of desalination technology for meeting future water supply demand especially in coastal areas.
- Facilitating rainwater harvesting schemes in cities with heavy precipitation.
- Use of gray water appropriately for avenue or median tree plantation.
- Use of solar energy for running water treatment plants or as Yemen enjoys an utilizable level of solar radiation, the annual average range of solar radiation is between 5.2 to 6.8 kWh/m2/day[21].
- Preparation of water balance and drought response plans
- Development of proper watershed management schemes on an urgent basis.
- Plantation of local less water consuming plants in the catchment areas and declaring such greenbelt areas as buffer zones.
- Preparing agriculture and domestic water use plan at basin level.
- Planting and preservation of mangroves in coastal areas to check sea water intrusion and regulating uncontrolled groundwater extraction.

**During the field study, it was observed that the gray water from the Mosques is being utilized in Taiz and Aden Governorate for about 4500m$^3$/day of freshwater. However, being used for Median tree plantation on Airport road in Mukalla. At program level, uniform polices for gray water use need to be devised for the groundwater conservation.**

- Effective public awareness campaigns for sustainable water use and watershed management.

### 6.3 Project Level

As discussed earlier in Section 5, most of the adverse impacts will be at project level. Some of the negative impacts may be temporary and short term, if managed properly. Reduce the intensity of such impacts. Preventive actions and mitigation measures in this context are discussed below.

### 6.4 Managing Impacts of Construction Activities of WSSP Interventions

Various activities such as, vehicular movement, operation of equipment, setting up of construction yard, and workers colony will affect the existing environmental conditions during the construction phase which will be mitigated as under:

#### 6.4.1.1 Managing Public Safety

Maintenance of Public Safety, a critical issue, may be facilitated through:

- Keeping excavated areas open for the minimum possible time period.
- Providing appropriate crossing facilities near residential areas.

[21] Clean Development Mechanism – An Experience from Yemen, MWE, ROY

- Separately, in urban areas, pedestrian from road traffic and providing alternative pedestrian route/crossing as required.
- Temporary closure of the access may be considered in cases where roadway is restricted and the risks of pedestrian and vehicle conflict are significantly high.
- Temporary fences shall be provided near construction sites especially along deep excavated areas, particularly in the vicinity of schools, mosques, and locations of public concentration.
- Warning signs proper signals in appropriate locations 100m from the construction sites.
- Strict control of heavy and mobile equipment use will all the drivers and operators having valid license for operating such equipment.
- Operating all heavy equipment in strict accordance with manufacturer's guidelines and/or Yemeni guidelines.

#### 6.4.1.2 Access Management

Planned access management is essential for controlling movement of a large number of vehicles through-out the day during the construction period. This will involve taking measures as under:

- If roads are required to be closed/ diverted for vehicular traffic in residential areas, access to the property shall be defined through alternative routes. In areas where roads are not closed, appropriate measures will be taken for public safety and traffic management.
- preparing an approved access plan for:
  - permitted access route by vehicle type;
  - permitted times of use of routes;
  - Speed on access route; and
  - Site control, parking and unloading areas.
- Providing signboards at construction sites for clear identification of approved roads.
- A construction site in the vicinity of special sites like mosque, schools, hospitals and public buildings, would involve specific access issues like:

- Special safety measures in case of mosques for access during the hours of darkness;
- Special safety measures for access for children to schools;
- Special safety measures for access of patients to hospitals and clinics;
- Special care to minimize the inconvenience to potential visitors to public buildings.

#### 6.4.1.3 Management Impacts because of off-site Facilities

Management of environmental impacts due to siting of construction/stock facilities, maintenance, and equipment storage yard may be facilitated as under:

*a) <u>Construction/Stock Yards:</u>*

Construction/stock yards will be located downwind side of residential/sensitive areas (at least 100m away) with prior approval of the concerned government authorities. There will be no storage of hazardous materials in the stockpile yards. Adequate access to and connection with the main road network are essential.

Direct access planning may be:

- Through a dedicated access road from the site to the primary road;
- Direct frontage access to the primary road;
- Through a secondary public road suitable for heavy truck movement, keeping in view the suitability of existing land-use patterns in the area, width of the road and its surface condition.

*b) Equipment Storage and Maintenance Yard*

Equipment maintenance yard will be located taking into consideration the minimum effect on present land-use, minimum inconvenience to local population, access to the main road network, etc. It will be approved by the concerned government authorities before starting construction. Solid and liquid wastes, generated in the construction yard, should be collected, stored and disposed of in a scientific manner, fulfilling the following conditions:

- The Contractor before starting operations shall prepare a list of material to be used at site and define the procedures to be adopted for waste control and management.
- Equipment shall be inspected and audited properly before taking them from lessor.
- The Contractor should be encouraged to recover, treat and reuse materials, in particular lubricants.

*c) Use of Water on and off-site*

Substantial amount of water is required at the time of construction, may affect the local communities as under:

- The quantity of water available from their source may worsen because of construction activities;
- Water sources may be contaminated.

The suggestions below may be helpful in this regard:

- Contractors should bring all water on site in tankers and they would be allowed to fill their tankers at the sites defined in agreement with project proponent. For opening up of any new source of water, the contractor would take necessary approvals from NWRA.
- Off-site water sources proposed for use by the Contractor shall be approved by EMO of the project proponent in the context of existing local patterns of use, availability of alternative supplies.

Finally, in all cases the Contractor has to prepare a plan for restoration of any site utilized for the project to its former status. This will be submitted to EMO of the project proponent

for approval. In most of the cases, this will simply mean the removal of all waste and temporary facilities established at construction sites. Some permanent structures, hard stand area for example may need to be broken up and taken away.

#### 6.4.1.4 Managing Workers Health and Safety

The following measures are suggested for ensuring Construction workers' health and safety:

Risk to the workers can be mitigated by providing appropriate gloves, safety boots/ gumboots, clothing, and education to the workforce of the risk will be sufficient.

In case any significant health threat is identified, tests should be undertaken to confirm the same. Regular health check–ups of the workers shall be organized by the Contractor during the construction period.

The Contractor has to follow Environmental Action Plan as suggested in **Table 6.1** for ensuring Occupational Health and Workers Safety Measures during the construction period.

**Table 6.1: Environmental Action Plan for Occupational Health and Workers Safety during Construction Phase**

| Issues | Mitigation Measures | Responsibility | |
|---|---|---|---|
| | | Implementation | Supervision |
| Workers' Safety | All workers should be provided with personnel protective equipment such as safety jackets, safety boots, helmets, hand gloves, ear-muffs and nose masks. | Contractor | EMO |
| | Workers employed in rehabilitation projects of water supply/pipe and sewer network/ should be provided proper gear for handling of the debris. | Contractor | EMO |
| Occupational Health | At each construction maintenance yard, a first aid box shall be provided. | Contractor | EMO |
| | Periodical health check-up of the workers/ HIV test/shall be undertaken | Contractor | EMO |

#### 6.4.1.5 Managing Impacts on Noise Quality

Movement of heavy vehicles and operation of construction equipment will generate high noise levels and impact the existing environmental conditions. These impacts will be, however, limited to the construction period only and can be mitigated by adopting some of the following measures:

- Equipments to be utilized in Project should be fitted with vibration isolators/conform to sound level emissions stipulated.
- Vehicles producing noise levels exceeding the limits as given due to poor engine adjustments/damage to noise amelioration equipment or other inefficient operating conditions shall not be used.
- Protective devices e.g. earplugs, muffs, etc. shall be provided to the workers working in the noisy areas.

- Construction activities shall be prohibited between 10.00PM and 06.00AM in the residential area.
- Necessary due care shall be taken in sensitive areas like mosques, schools, hospitals/ health centers and important public buildings.

#### 6.4.1.6 Managing Air Quality

Moderate air quality impacts during the construction phase of the WSSP interventions are anticipated due to fugitive dust generation in and around the working site due to the movement of vehicles, operation of construction machinery and handling (loading/unloading) of materials.

Mitigation measures suggested below would reduce the above impacts:

- Methods of handling earth/cement shall have proper dust suppression measures.
- Equipment and vehicles producing excessive emissions of exhaust gases due to any mechanical fault shall not be allowed for operation.
- Asphalt and hot mix plant should be located at least 500 m away from inhabited settlement, if required.
- Regular maintenance of vehicles and equipment should be carried out.
- Weakly inspection of construction sites shall be carried out to ensure the disposal of the construction debris to the approved landfill sites.
- Low emission equipment shall be used.
- Vehicles carrying construction material shall be covered with tarpaulin or canvas sheet to avoid spilling. Additionally, any of these materials which may collect on the horizontal surfaces shall be removed before transportation.
- Regulations with respect to restriction of speed for all the vehicles operating within the construction site or on access roads shall be promulgated.
- Regular and frequent sprinkling of water at construction sites.

#### 6.4.1.7 Management of Storage of Construction Material

Of any project, the requirement for large quantity of material during construction period for construction has to be confined appropriately inside the premises/storage yard so as to discourage any unaesthetic views. In no case, it should be dumped in haphazard way along the construction site.

However, temporary storage facility may be permitted under the following conditions:

- Minimum period of temporary storage by not for more than five (5) days;
- No disturbance to existing access;
- No residual material will be allowed to be left at site

Heaps shall be located only in that area, which is temporarily acquired for construction purposes with proper approval.

#### 6.4.1.8 Managing Impacts from Water Supply Interventions

Mitigation measures for implementation during construction phase of the water supply project are as follows:

#### 6.4.1.9 Flushing and Disinfecting

For flushing and disinfecting new pipelines/existing line, disinfectants such as Chlorine gas or a solution of Sodium or Calcium Hypo-chloride will be used. These chemicals are hazardous and require special care for its storage, transportation, handling and disposal. Mitigation measures for handling such materials are given below.

- A unit specially trained would be set up for flushing and cleansing operations
  - Material should be stored in strict accordance with manufacturer's specifications
  - Access to the material should be strictly controlled and a register would be maintained of users.
  - Material should be mixed off-site in a controlled manner and then transported to the site in appropriate vehicles.
  - This would reduce the risk of public contact with raw chemicals through spillage of chemicals, vandalism or negligence etc.
  - First aid facility should be available readily in the event of accidents
- Regular inspection by the EMO of the chemical storage facility and the equipment for flushing and disinfecting operation.

#### 6.4.1.10 Drilling of Wells or Rehabilitation of Wells

Mitigation measures for reducing impacts arising from drilling operations are as under:

*Emissions from DG sets:*

Regular maintenance and efficient operation of the DG sets would minimize emissions.

*Disposal of Drill cuttings and mud:*

Adequate washing arrangements would recover large quantities of mud from drill cuttings. The drill cuttings and the unusable portion of residual mud would be disposed of in the approved landfill sites.

*Disposal of solid wastes:*

Waste will be segregated as under:

- metaliferous and non-degradable plastics/glass etc;
- general waste (galley waste, paper and wood)
- oil and oil-contaminated rags

Each type of waste, particularly in metaliferous and general wastes would be stored appropriately in bins and disposed of in approved landfill sites. Oil and oil-contaminated wastes (including rags and absorbent materials) will be stored in containers and transported to the approved disposal site. Operational staff responsible for waste disposal would be trained properly to ensure that wastes are not disposed of indiscriminately.

*Discharge of wastewater:*

DG sets with drip drainage pans would be used and drainage would be through oil separating traps. The wastewater generated during drilling operation shall be drained off properly.

**Article I. 6.3.3 Managing Impacts from Sanitation Project**

Mitigation measures adopted during construction of the sanitation project would offset the environmental and social impact:

### 6.3.3.1 Managing Public Safety at Cesspit Removal Sites or Rehabilitation of Sewers

Public safety at the time of removal of cesspit/sewers in any sanitary rehabilitation or extension project which needs special attention. The following mitigation measures are suggested:

- Preventing casual public access particularly access of children to cesspit removal sites by fencing of the sites.
- The extent, duration of work and the possible public health hazards would be discussed with local leaders (Aqils) of that area before taking up the work.
- When not in operation, pits shall not be left open especially at night. The pits should be either back filled or shall be covered with such material which can not be removed casually.
- Disallowing Public, entry to the construction sites, especially in deep trenching areas.
- Compliance with pedestrian safety norms by providing adequate and safe alternative access.
- Providing security personnel/watchman to patrol each construction site.
- Arranging specific and appropriate signage at construction sites to avoid accidents.

### 6.3.3.2 Managing Public Health Impacts at Cesspit Removal Sites / Rehabilitation of Sewers

Relevant information regarding the nature, extent and duration of the proposed works needs to be disseminated to create public awareness about possible health hazards.

Residents should also be advised to take immediate and appropriate measures in the event of any adverse impact.

Information about available medical facilities, namely the hospitals/clinics located in and around the project area, working hours/emergency facilities etc. shall be provided to the public.

### 6.3.3.3 Managing Impacts from Collection, Storage, and Disposal of Sewage

Removal of cesspits or rehabilitation of sewers requires temporary disconnection of the existing facilities and might become source of nuisance if proper measures are not taken at the construction sites. The sewage generated from such sites should be carefully collected, stored, and transported to the existing disposal facility. The mitigation measures to be adopted at construction sites are as follows:

- Users to be given advance information, about the temporary disconnection.
- Household to be connected with the temporary collection system.
- Proper storage of the wastewater and minimum spillage of wastewater.

- Avoiding spillage of wastewater during transportation of the wastewater for disposal.
- Special care to be taken while emptying the tankers.
- Deployment of specially trained units for carrying the operations.

#### 6.3.3.4Managing Disposal of Existing Sewers

Where up-gradation of pipe work is taken up, the existing sewerage network will generate waste material. The debris of sewer pipes should not be dumped at the construction site for long as this will cause breeding of flies and mosquitoes, and odor problems. The following mitigation measures shall be adopted:

- Identification and approval of the location of disposal area by the concerned government authority during the preconstruction phase.
- Keeping away the disposal sites from urban areas and well fields.
- Sprinkling of bleaching powder on the pipe debris at the construction site.
- Transportation preferably at night.
- Covering the pipes during transportation.

### Article II. 6.3.4 Managing Impacts from Irrigation and Improvement Projects

Although the WSSP's interventions in improving irrigation techniques in the agriculture sector will not directly finance or promote the purchase or use of pesticides, these interventions will continue and build on many of the irrigation improvement activities started by the Sana'a Basin Water Management Project and thus may result in increased use of agricultural chemicals at WSSP intervention sites. For this reason, the WSSP triggers the safeguard policy on Pest Management (OP/BP 4.09). Fortunately, the WSSP will benefit directly from the advances made under the Sana'a Basin Water Management Project (as mentioned above) and the increasing experience the GOY has gained in recent years with IPM practices, i.e. reinforcing capacity in the Department of Plant Protection, preparing and implementing pest management plans, and providing outreach and advice to farmers. The WSSP will reinforce and build on this institutional foundation as necessary to ensure proper pest management. ESMF procedures will ensure proper screening of proposed interventions in irrigation improvements and identification of appropriate measures to address any potential adverse impacts from agricultural chemicals. These measures may include:

- performance of participatory rural appraisals among potentially affected farmers to gather information about the crop pests, plant diseases and present knowledge and practices regarding their control, leading to the formulation of joint action plans;
- preparation of intervention-specific IPM plans, through consultation with farmers, consisting of a package of recommendations for farmers, including plant protection measures, better agronomic practices, proper use and management of pesticides;
- delivery of outreach and training on the IPM plan through field days and farmers' field schools - targeting extension agents, farmers, farmers' wives, cooperatives, pesticide importers and dealers - on the dangers and safe use of pesticides, adequate application techniques and safety precautions, etc.

- delivery of additional capacity building for the Department of Plant Protection's pesticides residue laboratory in Sana'a City, including provision of necessary equipment and training to ensure that the laboratory is fully operational and able to monitor agricultural products for pesticide residues

Overall mitigation measures for mitigating impacts due to WSSP interventions were discussed in **Subsection 6.3.1**. Some additional mitigation measures for dam and reservoir projects which require attention during the construction stage are briefly noticed below.

#### 6.3.4.1 Managing Impacts due to Loss of Vegetation

Removal of trees during the construction of dam is envisaged due to clearing the site and submergence of the area.

During the preconstruction stage, an inventory of trees to be cut or submerged shall be undertaken and shall be distinctly marked during the construction phase by the contractor. Catchment protection area shall be earmarked upstream of the dam/new for replacement tree plantation. Species of trees selected would be based on the following criteria:

- Fast growing
- Indigenous
- Preferably perennial and evergreen
- Having large leaf area index
- The ecological/ hydrological balance of the region

Further, soil erosion control measures shall be taken up in the catchment areas.

#### 6.3.4.2 Managing Impacts due to Loss of land

It is likely that some villagers may lose their land because of submergence and this may impact on their livelihood. A Resettlement Action Plan (RAP) as per the guidelines laid down in the Resettlement Policy Framework (RPF) shall be devised to reduce the degree of impact.

## 6.4 Managing Operation Phase Impact

### 6.4.1 Water Supply Project

#### 6.4.1.1 Preventive Maintenance

Preventive maintenance of water distribution system pipelines should be carried out to ensure the following objectives:

- Preserving the hygienic quality of water in the distribution mains
- Providing conditions for adequate flow through the pipelines

A few salient aspects of preventive aspects in maintenance are as:

- Assessment, detection, and prevention of water leakage from pipelines
- Maintaining pipeline capacity
- Cleaning of pipelines

Preventive maintenance includes the following:

√ Waste Assessment
√ Leak Detection Tests
√ Cleaning of pipes

After detection of leaks in the pipelines, prompt repairs are to be undertaken and flow test of the sub zones carried out to determine the extent and efficacy of the corrective measures. Further leakages, if any, are to be attended to, until the losses in the zone are reduced to the minimum.

Similarly, cleaning of pipes shall also be carried out systematically and periodically to maintain the capacity of pipe and prevent growth of:

- Slime in the pipe
- Incrustation or deposits

Flushing and swabbing of pipes also help maintain the carrying capacity of pipes.

#### 6.4.1.2 Operation and Maintenance of Pumps

- Dry running of the pumps should be avoided.
- Pumps should be operated only within the recommended range on the H (Head) – Q (Discharge) characteristics of the pump.
- Running of the duty pumps and the standbyes should be so scheduled as to ensure that all pumps are in a ready-to-run condition.
- A log book should record the daily observations on the pumps
  - Timings when the pump was run during the previous 24 hours.
  - Any undue noise or vibrations
  - Pressure, voltage, and current readings
- Semi annual audits should include:
  - Inspection of the packing and repacking, if necessary.
  - Cleaning and oiling of the gland box.
  - Checking free movement of the gland of the stuffing box.
  - Correcting alignment of the pump and the drive.
  - Cleaning of lubricated bearing and replenishing with fresh oil
- Ready availability of consumables and lubricants as well as spare parts.

### 6.4.2 Sanitation Project Interventions

Mitigation measures suggested during the operation phase are as under:

#### 6.4.2.1 Occupational Health and Safety

Health and safety are important aspects during the operational phase. Mitigation measures in this regard are:

- Employing trained workers for maintenance/cleaning of the sewers.

- Providing workers with adequate personnel protective equipment e.g. clothing, gloves, footwear (safety boots/gumboots), safety goggles for handling sewage and/or its by-products.
- Providing laundry services for personnel employed in operation and maintenance of sewer system and treatment plant.
- Provision of safety equipment (gas detection equipment, self-contained breathing apparatus, safety harnesses).
- Designing necessary facilities for workers' safety e.g. lifting equipment, access manholes, ladders, walkways, safety around rotating mechanical equipment.
- Implementing effective industrial waste pre-treatment system.
- Training operators in following necessary hygienic procedures after handling sewage or working in sewerage system.
- Training operators in safety procedures for working in confined places e.g. sewers, manholes, pump station, wet and dry wells, screw chambers at pumping station.
- Furnishing periodic health check-up of workers exposed to toxic and flammable gases e.g. hydrogen sulfide or rotten egg gas, urethane and air mixtures.

#### 6.4.2.2 Sewer Overflows

Mitigation measures for avoiding sewer overflows include:

- Regular cleaning of sewers (removal of blockages, debris, rags, etc.).
- Proper access arrangement to mechanical and electrical equipment.
- Routine inspections of sewers for illegal connections and obstructions.
- Regular checking of mechanical equipment for deterioration, wear and tear of critical parts and security of fixings.
- Provision of spare parts.
- Public awareness programs for preventing disposal of solid wastes in sewers.

#### 6.4.2.3 Pumping Station

Pumping stations are the most critical and vulnerable component during the operation phase of any sewerage system. Measures suggested below may reduce the adverse impacts:

- Regular manning of pumping stations shall be permanently manned;
- Regular inspection of mechanical and electrical equipment/instrumentation including structural and building components;
- Projection of details of planned maintenance program, and displaying it on the control panel;
- Screenings to be regularly collected and disposed of in approved sanitary landfill sites;
- Ready availability of all spare parts;
- Availability of a spare set of pumps in case of emergency; and
- Provision of alternative power supply (e.g. Diesel Generating sets).

#### 6.4.2.4 Manholes

- Regular check up of manholes for soundness and security.
- Regular cleaning, greasing of manholes.

- Regular inspection of manhole shafts, landings, and benching for defects such as, cracks, water ingress, corrosion, and concrete spilling.
- In case of surcharging occurs, the manhole shaft should be cleaned down and built by grease, sewage solids or rags removed.
- Trained team of workers for routine operation and maintenance of sewerage network.
- Each team to consist of six operation personnel.

#### 6.4.2.5 Treatment Plant

The treatment plant shall be maintained properly to reduce the environmental impacts, through, inter-alia, mitigation measures suggested below:

- Silt disposition should not be allowed.
- Influent and effluent quality of wastewater to be monitored for physical/chemical/and biological parameters.
- Public access to the treatment plant to be strictly prohibited.
- Greenbelt development or tree plantation around the Waste Water Treatment Plant.

In case of Waste Stabilization ponds, additional mitigation measures as follows may be adopted at the treatment plant sites.

- Design depths of various STP ponds to be maintained.
- Clearing of all trees and shrubs from ponds and internal side slopes of embankment.
- Regular inspection and repair of site perimeter fences as a primary safety measure.

Life preservers shall be permanently provided in highly visible posts, preferably on post sets immediately adjacent to the STP.

### 6.4.3 Reuse of Sewage Sludge

Sewage sludge contains pathogenic bacteria, viruses, and protozoa along with parasitic helminthes which can give rise to potential hazards to the health of humans, animals, and plants. The number of pathogenic and parasitic organism in the sludge can be significantly reduced before its land application by appropriate sludge treatment. Potential health risks may be further reduced by the effects of climate, soil-microorganisms, and time elapsed before sludge is applied to the soil. Sewage sludge also contains some of phyto-toxic and toxic elements harmful to humans and/or animals; hence, it is necessary to control the concentrations for potentially toxic elements and its application.

However, sewage sludge also contains useful concentrations of nitrogen, phosphorous, and organic matter.

Uncontrolled use of sludge may lead to accumulation of trace elements and over fertilization. Thus, the rate of application should be defined to avoid buildup of excess nitrate-nitrogen and phosphorous. Safe operation of treated wastewater and sludge reuse requires a comprehensive and permanent monitoring program. The Environmental Management Officer (EMO) deployed at sub-sector levels in consultation with local Agriculture department and the EPA may monitor this program also.

The following measures are suggested for reutilizing the sludge or treated wastewater:

- Regular tests by LWSSCs for effluent quality and sludge.
- Monitoring of aquifers by the NWRA
- Defining the responsibilities of the concerned agencies namely the Ministry of Agriculture and Irrigation (MAI), the Ministry of Water and Environment - MWE (LWSSC) and the Ministry of Health.
- An intensive public awareness program
- Risks of groundwater contamination by bacteria and viruses through wastewater application in agricultural may be prevented by disinfecting the effluent and a slow infiltration rate.
- Regular staff training at LWSSCs.
- Coordination between sludge applications at the time of planting, grazing, and/or harvesting for minimizing the potential risk to human, animal, and plant health.
- Sludge must not be applied to growing soft fruits or vegetable crops nor used where crops are grown under permanent glass or plastic structures.

Treated sludge may be applied to growing cereal crops but should not be applied to growing turf within 3 months of harvesting or to the fruit trees within 10 months of crop harvesting.

**Table 6.2**, showing the FAO criteria for water requirements, sensitivity to water supply and water utilization efficiency of different crops may be used for optimizing the crop production using treated wastewater.

**Table 6.2: Water Requirements, Sensitivity to Water Supply, and Water Utilization Efficiency of Some Selected Crops**

| Crop | Water requirements (mm/growing period) | Sensitivity to water supply (ky) | Water utilization efficiency for harvested yield, Ey, kg/m3 (% moisture) |
|---|---|---|---|
| Alfalfa | 800-1600 | low to medium-high (0.7-1.1) | 1.5-2.0<br>hay (10-15%) |
| Banana | 1200-2200 | high (1.2-1.35) | plant crop: 2.5-4<br>ratoon: 3.5-6<br>fruit (70%) |
| Bean | 300-500 | medium-high -1.15 | lush: 1.5-2.0 (80-90%)<br>dry: 0.3-0.6 (10%) |
| Cabbage | 380-500 | medium-low -0.95 | 20-Dec<br>head (90-95%) |
| Citrus | 900-1200 | low to medium- | 5-Feb |

**Table 6.2: Water Requirements, Sensitivity to Water Supply, and Water Utilization Efficiency of Some Selected Crops**

| Crop | Water requirements (mm/growing period) | Sensitivity to water supply (ky) | Water utilization efficiency for harvested yield, Ey, kg/m3 (% moisture) |
|---|---|---|---|
| | | high (0.8-1.1) | fruit (85%, lime: 70%) |
| Maize | 500-800 | high -1.25 | 0.8-1.6 grain (10-13%) |
| Potato | 500-700 | medium-high -1.1 | 7-Apr fresh tuber (70-75%) |
| Sorghum | 450-650 | medium-low -0.9 | 0.6-1.0 grain (12-15%) |
| Wheat | 450-650 | medium high (spring: 1.15; winter: 1.0) | 0.8-1.0 grain (12-15%) |

**Source: FAO(1979)**

### 6.4.4 Dam and Reservoir Projects

Various safety measures for dam and reservoir projects are discussed in Section 8 of this report.

# Table of Contents



**LIST OF TABLES**



**ANNEXES**

# *SECTION-7.0: ANALYSIS OF ALTERNATIVES*

Water is important not only for drinking and food production but also for sustainable development as shown by strong linkages between water availability on the one hand and poverty, public health, unemployment, women's education, and various facets of socio-economic development on the other.

Earlier studies on poverty reduction, economic development, and social perceptions highlight water scarcity as one of the major concerns of the country. Bringing all the stakeholders together and ensuring proper coordination amongst them are prerequisites for dealing with water related issues effectively. In this context, an analysis of alternative strategies and investment programs envisaged in WSSP would be helpful in bringing environmental / social considerations into the "upstream" stages of development planning - project identification, site selection, design, and implementation. An analysis of alternatives **"Without WSSP"** and **"With WSSP"** options follows.

## 7.1 Without WSSP

The country is currently facing the challenge of reversing the unsustainable use of water resources. Even with improved water planning and management procedures in place for providing safe drinking water and sanitation services to the vast majority of urban and rural population remains a formidable task.

Even before WSSP, Government of Yemen had undertaken several measures to tackle the situation, some of which are as under:

- Establishing three national-level agencies, namely:
  - National Water Resource Authority (NWRA) for water resources management.
  - National Water Supply Authority (NWSA) for urban water supply.
  - General Authority for Rural Water Supply Projects (GARWSP) for rural water supply.

All these three agencies are working currently under the Ministry of Water and Environment, set up in 2003. Responsibility for Urban water supply is being progressively decentralized to autonomous Local Water Supply and Sanitation Corporations from 2000. Irrigation Projects, dams, and watershed management continue to be the responsibility of the Ministry of Agriculture, and Irrigation (MAI).

A comprehensive National Water Sector Strategy and Investment Program (NWSSIP) (2004-2009), prepared by adopting a multi-stakeholder approach is currently under execution. It defines objectives, policies, approaches and action plans for short and mid-term horizons, as well as a mid-term (2005 – 2009) investment program.

Further, preparation and implementation of the Development Plan for Poverty Reduction (DPPR) 2006-2010, incorporating the objectives of the Agricultural Long-term Plan (AGSIP) 2006 – 2015, has had a significant impact on issues like rural livelihood and sustainable water use.

The existing ground situation is as under:

- Uncontrolled and continuing abstraction of groundwater is a matter of concern.
- Urban water supply and sanitation services have a low coverage ratio.
- The pace of reforms needs to be accelerated through decentralization, institutional strengthening and coordination, commercialization of service provision, as well as public-private partnerships in suitable formats.
- Despite new approaches, the rural water supply and sanitation program is in disarray and the MDG targets appear to be unachievable. A clear strategy, institutional reform, and extensive external support are required in this sector.
- Watershed deterioration is a major problem.
- Current efforts to build mainly small dams do not often improve overall basin efficiency.
- Watershed management programs need to be revived using an integrated approach with more focus on upstream communities and on poverty reduction.
- Implementation of the regulatory aspects of water law is weak.
- Within the sector, allocation of funds is skewed in favor of the urban population. 55% of water sector expenditure goes for urban water and sanitation benefiting 25% of the population. Rural water supply and sanitation, which covers about 75% of the population, received only 19% of total expenditure.
- Outcomes from the relatively high public expenditures in the water sector over the years are still not satisfactory in terms of coverage, sustainability and efficiency of service delivery (in water supply, sanitation and irrigation).

The latest World Human Development Report (UNDP) for 2007-08 ranks Yemen at 153 with a HDI value of 0.508. Earlier in the World Human Development Report 2001, it was ranked at 133 with a HDI value of 0.468.

### 7.2 The Scenario With WSSP

The World Bank and other Donors, viz., Germany, the Netherlands, the US and others are supporting various water sector projects individually for about a decade. It is now being appreciated that it would be worthwhile to move forward with a sector wide approach (SWAp). The Water Sector Support Program (WSSP) would facilitate integrated planning and monitoring of the water sector as a whole, fulfilling the requirements of the Paris Declaration.

The lending instrument currently selected by the World Bank for the WSSP is a Specific Investment Credit (SIC), with a possible Policy Development Component, for those components that received targeted budget support from the Netherlands. The SWAp framework would allow for the use of pooled funds from IDA and other donors to finance policy and infrastructure interventions within NWSSIP over the next five years and allow for extended use of country systems and direct implementation by GoY agencies in selected sub-sectors and hopefully for

the entire water sector in the future. The CDG brings to the table the level of resources and in-country and global experience essential to meet the government's objectives[22].

WSSP will develop/ adopt the:

- Planned Mid Term Expenditure Framework (MTEF),
- Public Investment Program (PIP),
- Financial Management Information System (FMIS)
- National bidding documents (at an appropriate time and with some agreed thresholds)

Moreover, it will be consistent with the Policy, Institutional arrangements, and Investment programs envisaged in the NWSSIP. Hence, no major impacts on the existing policies for water sector development are envisaged because of WSSP implementation. On the other hand, it would promote better coordination and cooperation amongst the water sector stakeholders at policy and decision making levels.

WSSP projects would include components for rural water supply, rain water harvesting, small dams, irrigation improvement initiatives (conveyance pipes and localized systems), spate irrigation as well as terrace rehabilitation.

Other benefits of WSSP are, inter alia, as follows:

- Government ownership and leadership
- Establishment of an Inter-ministerial Steering Committee (IMSC),
- Coordination amongst the Development Partners
- Joint Annual Reviews of programs
- Mutually agreed Sector Policy Framework Programs/Strategies based on shared vision and priorities
- Uniform Sector Program and Expenditure Framework
- Alignment of various resources towards common objectives
- Use of Local Systems/Procedures
- Joint baseline inventory and technical audit to assess actual service coverage in rural as well as urban water and sanitation
- Joint field supervision and Joint Annual Reviews based on field evaluation and social auditing
- Wider use of and benefits from targeted budget support to GARWSP and NWRA.

The Program Development Objective (PDO) is to improve access to water supply and sanitation services, increase returns to water use in agriculture, reduce groundwater abstraction for agriculture and use from non-renewable aquifers in the critical Water Basins, as well as, strengthen sector institutions for sustainable water resources management and environmental protection. WSSP would emphasize not only the safety and adequacy but also the sustainability/ affordability/ equitable access to water supply and sanitation services through a sector-wide approach.

The economic benefits of WSSP are indicated in **Table 7.1**.

**Table 7.1: Economic Benefits of the WSSP**

| |
|---|
| • Water availability in Yemen (120 -150 $m^3$ per capita per annum) is about one tenth of the corresponding figure in MENA countries and one fifth of the world average. WSSP will improve the functioning of the water sector as well as improvement of water supply and sanitation schemes in rural/ urban sector. |
| • The agricultural sector in Yemen employs more than 55% of the country's labour force and consumes around 3.1 billion cubic meters – 91% of the 3.4 billion cubic meter of water resources renewed annually. Sustainability of groundwater irrigation for the agricultural sector would depend significantly on efficient implementation of WSSP. |

### 7.2.1 Key Issues for WSSP

The key issues regarding rural/ urban water supply and sanitation as well as irrigation and drainage are briefly reviewed below.

Water Supply and Sanitation System

The issues for consideration are:

- Adoption of a mix of large-scale and small-scale development options (Refer **Annex 7.1**):

Such an option will be more environment friendly, and help to cover a cross section of urban and rural population in an economical manner. Desalinization of salty water in coastal areas, utilizing recent technological advances will augment potable water supply in rural / urban centers in coastal areas. Feasibility of other options, e.g. use of solar power and wind energy would be considered.

Simultaneously, small scale technologies such as rooftop rainwater harvesting systems/ batch type treatment plants in heavy precipitation urban/rural areas (Taiz, Ibb, and Sana'a) would be studied as alternative options in these water scarce Governorates.

- Wastewater disposal and treatment methods (Refer **Annex 7.2**)

Inappropriate disposal methods/ treatment of wastewater are sources of environmental pollution. Economically efficient treatment options for urban areas include activated sludge process, anaerobic treatment of waste, and stabilization ponds.

- Level of service provided

Level of services provided would be in accordance with public requirement. Water requirement varies with life styles; hence, water consumption among the poor is relatively low. However, the quality of potable water should be same in all cases.

- Phasing and proportion of population to be covered

Phasing of areas for coverage with various service levels will help in expanding coverage as well as meeting MDG's in cities/ villages/ urban centers.

- Loss levels and cost-effectiveness

Presently, the estimated total loss in water supply schemes is around 40%, 20% is system loss in conveyance of water and the remaining 20%, water theft through illegal connections. Such losses will be reduced by rehabilitation of existing water supply networks/ systems and provision of lawful connections. Improved level of services and/or reduced level of losses will help in cost recovery and contribute to system efficiency.

- Development of a sense of Program ownership

Decentralization in decision making process with the involvement of the community and the Local Councils will promote a sense of ownership in the participants in designing, implementing and monitoring the programs.

- Encouraging NGO participation

NGOs should be encouraged to expand their work in urban and rural water sector particularly in the poorer communities. These may be given access to public / donor financing in selected programs. Partnership between the public and private sectors should be encouraged and NGOs may be encouraged to work under the umbrella of the existing / planned Water Resource Management Bodies and the Basin Committees.

- Supporting Community or Privately run Schemes

A mechanism should be developed to support schemes run and financed by communities/ private businesses. These should be gradually integrated with water resource management plans of Basin Committees, if possible.

- Making services inclusive , affordable and sustainable

This would involve priority for introducing low cost technology; adopting a demand responsive approach and community based self management procedures to self sustaining WUAs

- Gender Mainstreaming

WSSP will play an important role in strengthening gender mainstreaming beyond the water sector including capacity building, skill upgradation, income generating activities, sustainable means of livelihood, etc. and mobilization.

- Water Resources Management (WRM)

Improving the terracing system in the high lands and rehabilitation of the existing diversion structures, will reduce farmers' dependence on groundwater. WSSP projects would facilitate groundwater conservation through:

- an improved irrigation system,
- building of a larger data base through participatory irrigation management,
- ensuring better coordination among various stakeholders

- Point of delivery of water

Crucial stakeholders like women, marginal and poor farmers may be encouraged to take part in WUA activities to improve their access to water resources. Such participatory roles and a sense of ownership will enable them to choose water delivery points for irrigation of their fields and lead to more sustainable projects.

- Benefit to crops

The improved irrigation system would benefit:

- Crops like Tobacco, Cotton, Sorghum, Sesame
- Vegetables such as Tomato, Okra, Potato, cabbage
- Cereals, Legumes
- Fruits like banana, Mango, watermelon

**Overall, the program would contribute to poverty reduction through**

- More equitable access and better service levels.
- Improved water use efficiency in agriculture.
- Sustainable resource use through water conservation.
- Improving the efficiency of the traditional system, introducing appropriate modern technology and promoting water conservation techniques amongst the farmers and water users.
- Reviewing current irrigation incentives and tariffs/ implementing regulations on water use.
- Improving extension services and programs for raising awareness among farmers and the public about the economic value of water as a precious, scarce and viable resource

### 7.3 Macroeconomic scenario in Yemen in recent years

Reduction in crude oil output by more than 12% affected adversely the economic growth and balance of payments. Overall growth rate in 2007 was estimated at 3.6 percent compared to 3.2 percent in the previous year (2006). (Table7.2)

**Table 7.2: Trends in the growth rates of GDP at Constant prices in Yemen**

| | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|
| Growth rate of GDP at constant prices (percent) | 3.82 | 4.39 | 3.2 | 3.6 |

Source: CSO,

The non-oil output remained unchanged from the previous year. Fiscal deficit fell to 5.5 % of GDP. The external sector showed deterioration with the current account balance reverting to a deficit of about 4 percent of GDP. The average inflation rate for 2007 was about 12.5 percent, a significant drop from 18.5 percent in 2006. The expected outlook for year 2008 is better on the strength of relatively lower fall in oil production and high international oil prices. Crude oil production and exports have been falling in recent years (See **Table 7.3**).

**Table 7.3: Production, trade and domestic consumption of oil in Yemen**

| | 2006 | 2007 | Change (%) |
|---|---|---|---|
| Crude oil output (gross)(million bbls) | 133.3 | 116.7 | -12.5 |
| Exports of crude oil (million bbls) | 91.5 | 76.1 | -16.8 |
| Domestic consumption of crude oil (Million bbls) | 38.6 | 36.8 | - 4.7 |
| Exports of crude oil (million US$) | 5765 | 5542 | -3.9 |

**Source: Ministry of oil and minerals, GOY**

According to the Yemen Poverty Assessment Report, Volume 4(GOY, the World Bank and UNDP, November 2007), poverty in Yemen declined between 1998 and 2006. During this period the percentage of urban poor declined from 32.2 percent to 20.7 percent despite more urbanization. During the same period, rural poverty declined marginally from 42.4 percent in 1998 to 40.1 percent in 2006. Overall, there were seven million poor people in Yemen, constituting 35 percent of the population, who could not fulfill their basic food and non-food needs. The unemployment rate in Yemen was 35 percent in 2003 and according to a report issued in 2006 by the Ministry of Planning and International Cooperation, the unemployment rate had reached 34 percent in 2006. In such a macroeconomic scenario, the agricultural sector generates more than 11 percent of GDP (**Table7.4**). Fruits and Qat are the most prominent outputs of the agricultural sector output (**Table 7.5**). Agriculture sector employs more than 55 percent of the labor force and consumes around 91 percent of the country's 3.4 billion cubic meters of the annually renewed water resources (IDA,KfW/GTZ, Netherlands, DFID, Joint Water Mission, Sana'a, May 1, 2008). Sustainability of groundwater irrigation for the agriculture sector depends crucially on efficient implementation of WSSP programs.

**Table 7.4: Structure of GDP in Yemen**

| Sector | Share in GDP in 2004 (%) | Share in GDP in 2005 (%) |
|---|---|---|
| Agriculture, Fisheries & Forestry | 11.73 | 10.54 |
| Mining & Quarrying | 31.07 | 35.72 |
| Electricity, water ad gas | 0.83 | 0.72 |
| Construction | 5.90 | 5.44 |
| Wholesale & retail trade, hotels and restaurants | 13.96 | 12.92 |
| Transport, storage & commerce | 11.36 | 10.97 |
| Financial and real estate | 7.14 | 6.37 |
| Community, social and personal services | 1.35 | 1.32 |
| Producers of Govt. services | 9.63 | 9.61 |

Source: CSO

**Table 7.5: Composition of agricultural output in Yemen**

| Item | Output (Tons) | Value(million YR) |
|---|---|---|
| Wheat | 112963 | 8896 |
| Cereals | 443459 | 33481 |
| Vegetables | 88203 | 56971 |
| Cash crops | 68961 | 21137 |
| Fruits | 764790 | 83858 |
| Qat | 121399 | 152456 |
| Fodder | 1541288 | 19019 |

Source: CSO 2006

## 7.4 Depleting Water Resources in Yemen

Per capita availability of renewable water resources in the world is estimated at 7250 cubic meters by FAO. In the Middle East and North Africa (MENA) region, the average is only 1250 cubic meters; while, in Yemen, the average per capita availability is less than 150 cubic meters and decreasing. The biggest challenge to Yemen's water resources is overdraft of groundwater. The introduction of motor pumps and tube well technology allowed farmers to tap deeply into groundwater aquifers. Traditional water rights allow unlimited access from a farmer's private land and there is a race by each farmer to capture as much of the common pool resource as possible.

The extent of water overuse in Yemen is immense according to scholars (see Stefan Kohler," The place of ancient agricultural practices and techniques in Yemen - problems and perspectives, Sana'a, Yemen, June 18-20, 2008", http://www.allys.org). International studies estimate, (ignoring seasonal and regional variations) the current water use at 135 % of sustainable use. This means that farmers, industry and domestic users take up 3400 Million cubic meters each year. This is 900 Million cubic meters over the sustainable quantity of 2500 Million cubic meters with the result that the groundwater table sinks every year by 9 meters. Overuse of water is almost exclusively caused by agricultural use as the water is used in that sector. Agricultural developments in Yemen have become unsustainable. Water resources management essentially reduces to adoption of water saving strategies. WSSP programs like the GCCP project, the Sana'a Basin project etc., are focused on introducing and promoting technical efficiency in irrigation water conveyance and use. Technological improvements in water resources management are necessary but are not enough. An appropriate economic policy package comprising of tariff for water use and economic incentives for efficient use of water has to be designed and implemented.

According to NWSSIP (2005-09), the current incentive structure (particularly the lack of limitations on extracted quantities and subsidized diesel) promotes rather than discourages groundwater overdraft. Ultimately, the overdraft problem will have to be dealt with by a comprehensive package including (a) economic incentives, including trade and agricultural policy measures, (b) regulatory measures, including self-regulation by the community, (c) clear assignment of water use rights (linking them to specific uses, and (d) technology packages that help farmers earn more income using less water.

### 7.5 Economic policy package for saving water in Yemen

At present, irrigation water is supplied free to the farmers by the government. The Water Users Associations charge from their members (farmers) the cost of maintenance of the water distribution network. In economic terms, this means that only the marginal cost of supplying water is being realized. The marginal cost pricing principle is appropriate only if the government wishes to maximize the use of water not when it wants to regulate the usage. The optimal tariff in the present situation is obviously the average cost of water supply. This can be done by imposing a charge on Water Users' Associations equal to the average cost of production of water consumed by them. This charge will then be transferred by these Associations to their members (farmers) according to a suitable criterion keeping in mind equity, poverty and other community welfare considerations.

- Water tariff can also be used to guide the use of water away from cultivation of socially and economically undesirable crops like Qat
- Further, the government can impose a tax on Water User' Associations which is proportional to the quantity of water used by the members of the association for Qat cultivation. This measure will act as a disincentive for use of irrigation water for Qat cultivation. Given the consumers' demand for Qat consumption, imports of Qat must be exempted from import duty and export of Qat must be taxed.

### 7.6 Alternative economic policy package for efficient use of water resources in Yemen

Summarizing the foregoing discussion we can say that

1. Saving of water is not only the key to development of agriculture and economic growth but also important for getting away from the emerging trends in non-sustainable use of precious water resources in Yemen.
2. Water Users Associations must be charged a tariff which equals the average cost of supplying the water to them.
3. A tax, which is proportional to the volume of water used by the members of WUA for irrigation of the area under Qat crop, must be imposed on the WUAs. Alternatively, the tax could be proportional to the land holdings of the WUA members under Qat crop.
4. The policy of subsidizing the diesel used for running pump sets must be ended.
5. The policy of imposing a levy of 200 YR per litre on diesel and using it to finance building of small dams must be reviewed. The capital cost of building a small dam must be internalized to the calculation of average cost of water supplied to Water Users' Associations of the small dam.

A comparison of various parameters between '**With WSSP'** and **'Without WSSP'** scenarios are presented in **Table 7.6**.

**Table: 7.6: Comparison of the Environmental and Socioeconomic impacts 'With WSSP' and 'Without WSSP'**

| Issues | With out WSSP | With WSSP |
|---|---|---|
| **Policies** | • Short term policies and plans | • Long term strategic plans will be prepared. |
| **Abstraction of groundwater** | • Unsustainable and inequitable. | • Abstraction to be made sustainable and equitable by emphasizing intensive participation of users through the WUG's and the WUA's.<br>• Uncontrolled abstraction of groundwater will be minimized by regular and efficient monitoring and information sharing among various stakeholders. |
| **Water sources conserving/ protecting** | • Currently only small dams are built which often do not improve overall basin efficiency.<br>• Watersheds are deteriorating as appropriate measures such as terracing, plantation of trees, etc. are not being adopted. | • Integrated Watershed management programs with focus on upstream communities and poverty reduction would be evolved.<br>• Basin planning approach will be adopted. One successful example is Sana'a Basin Water Management Project.<br>• Focus on groundwater protection will include emphasis on water use efficiency, involvement of water User Associations, community management and gradual use of as well as tradable water rights. |
| **Inventory of wells** | • Currently, no consistency making inventory of wells. | • WSSP will facilitate well inventory process through Joint Annual Reviews among all the stakeholders. |
| **Maintaining water quality** | • Water quality of private sector suppliers is not being checked. | • Better and more efficient coordination among the stakeholders will help in monitoring the water quality properly. |
| **Millennium Development Goals (MDGs) in potable water and sanitation services**. | • Pace of coverage of population is very low<br>• In rural areas, coverage in sanitation system is very poor. | • Increase in pace and quality of coverage.<br>• Better population coverage with water supply and sewerage system in rural areas. |
| **Poverty Reduction** | • Consideration of poverty reduction strategy is very weak.<br>• Lack of participatory approach.<br>• Limited role of WUA in water management<br>• Lack of capacity to water resource management | • Due consideration to equity and poverty aspects<br>• Promote water productivity in agriculture, particularly for poorer farmers<br>• Develop participatory approaches and promote "increased efficiency of water use"<br>• Increase participation of local communities/ WUAs, CBOs/ capacity building and education, in water resources management<br>• Reinforce extension and further development of WUAs with a view to "ultimately handing over schemes to them" |
| **Gender Concern** | • Weak understanding of gender mainstreaming | • Strong focus on gender awareness, capacity building, and linked to policy/ strategy and action plan |
| **Water Conservation and Water Resources** | • Follow traditional water conservation techniques<br>• Weak enforcement of law | • Promote water conservation techniques among farmers and other water users<br>• Implement the necessary legislations to enforce and update |

| Issues | With out WSSP | With WSSP |
|---|---|---|
| | • Use of conventional water resources<br>• Conflict over water resources<br>• Lack of efficiency of water use | regulations on water use and strictly enforcement of regulations<br>• Appropriate development of conventional and non-conventional water resources<br>• Equitable Resolution of conflicts over shared water resources<br>• Improve efficiency of water use |
| **Water Supply and Sanitation** | • Inadequate water supply<br>• Lack of public-private partnership<br>• Lack of sanitation facilities and programs | • Increase water supply through improved operation and loss reduction , development of new water resources, including reuse of water<br>• Sector wide management through involvement of Local Corporations with private sector participation<br>• Provide affordable sewerage facilities that ensure environmental protection and permit reuse of wastewater for agriculture or artificial recharge |
| **Decentralization process** | • Pace of decentralization is slow. | • Program will help to speed up the decentralization process |
| **Community Participation** | • Lack of community participation | • Programs will be designed and implemented through community participation |
| **Awareness campaign Programs** | • Lack of awareness programs | • Improve extension services and programs for raising awareness among farmers and public about economic value of water as precious , scarce and viable source<br>• Introduce awareness programs to address social issues like education and health and its relation to water issue |
| **Improved Irrigation System** | • Using traditional irrigation system<br>• No subsidy for the poor | • Improve the efficiency of traditional irrigation system<br>• Introduce appropriate modern irrigation technology<br>• Provide subsidy and soft loans to encourage the application of modern irrigation system |
| **Involuntary Resettlement** | • Land acquisition and compensation issues have not been properly addressed because of:<br>– weakness of the judicial system<br>– presence and prevalence of customary law<br>– enforcement of Islamic Shari'ah law<br>• Calculation of compensation is substantially lower than the replacement cost:<br>– land for land practice exist very rarely<br>– value of equivalent real estate is not followed properly<br>• Lack of proper mechanism to address grievances of PAPs | • Resettlement Policy Framework (RPF) will be developed in parallel with SwESA to address relevant social safeguard as specified on OP 4.12 on Involuntary Resettlement in consistence with Yemeni Laws.<br>• Policy dialogue with the concerned authorities to deal with resettlement issues e.g.<br>– Fair compensation to all PAPs before the start of project<br>– Special provisions for vulnerable section<br>– Consultation with PAPs in planning, implementation and monitoring stage of any project involve involuntary resettlement issues.<br>– Establish and operationalize fair , quick and transparent grievance redressal mechanism |

| Issues | With out WSSP | With WSSP |
|---|---|---|
| **Monitoring and Evaluation** | • Inadequate because of lack of coordination amongst various agencies/ stakeholders. | • Joint Annual Reviews and Technical Audits will improve the monitoring and evaluation system and would promote inter-sectoral coordination. |
| **Capacity Building** | • Existing agencies require capacity building at different level. | • Focused and sustained capacity building efforts in various spheres. |

Annex 7.1 Rainwater Harvesting

7.1.1 Rain water Harvesting is one of the alternative to meet various domestic as well Agriculture water demand in the water scarce areas.

7.1.2 Agricultural rainwater harvesting is the techniques for storing the water by constructing small dams across the valleys. The Ministry of Agriculture and Irrigation currently is constructing such structures through the down line agency General Department of Irrigation (GDI). The main purpose of such structures is to improve irrigation efficiency and increase in the agriculture produce.

7.1.3 Rainwater harvesting is one of viable and low cost alternative to the traditional systems where the public water supply system is not meet the water demand adequately. There is an urgent to trap this purest kind of water source for meeting the water demand. Some of the aspects of roof top rainwater harvesting system are discussed in the following paragraphs

7.1.4 Rainwater harvesting is process of collecting and storing the rainwater in scientific and proper manner. The type of rainwater harvesting depends on the building roofs which is the catchment area for this system. Due care as listed below shall be taken to ensure that the stored water is not polluted.

- Roof shall be cleaned before the first monsoons.
- First few minutes' rainwater shall be discarded.
- Tanks which are being used for storing water shall be closed type.
- Tanks shall be constructed in such a manner that it can protected from direct sunlight

7.1.5 Rainwater collected in such manner can be used in the following domestic demand:

- Drinking
- Cooking
- Bathing
- Washing
  - Vehicles
  - Utensils
  - Clothes
  - Floor cleaning
- Gardening
- Flushing in toilets

7.1.6 Components of the Domestic Rainwater Harvesting System

7.1.7 Collection surfaces are normally the rooftops of a house. Cleaner and better quality of roof will provide cleaner and better quality of water. Therefore, proper maintenance of the roofs is an important factor in rainwater harvesting.

7.1.8 Rainwater Storage Tanks, The second component of the rainwater harvesting system is the storage tanks. The rainwater trapped at roof is guided through the channels or gutters to the storage tanks. The size of a storage tanks depends on the rainfall and area of the roof to be used for collecting the rainwater. The size of tanks can worked out by using the following equation.

Area of the = A

Rainfall = Y mm/Year

Roof yield = A * Y = liters/year

7.1.9 Dar Al Handash has worked out using the available daily rainfall data for the city of Ibb and has recommended the following tanks sizes in the Water Resources Study for Ibb Water Supply and Sanitation Project.

| **Recommended Tank Sizes** | |
|---|---|
| Roof Area ($m^2$) | Tank Sizes ($m^3$) |
| <100 | 2 |
| 100 - 150 | 3 |
| 150 - 200 | 4 |
| >200 | 5 |

**Source**: Water Resources Study Volume 1 – Main Report, July 2006, Water Supply and Sanitation Project for Ibb City, July 2006, Ministry of Water and Environment

Note: These sizes have been recommended based on the average conditions and other detailed designs may be carried out

7.1.10 The storage structures may vary from permanent masonry tanks to plastic or metal tanks. The capacity of storage device can be decided by considering parameters such as roof area, water usage and space availability. Water consumption in a house is throughout the year and water availability from rainfall is for a limited period restricted to number of rainy days in a year.

7.1.11 To make rainwater available in non rainy days, storage device need to be designed with an optimum capacity to suit the need / requirement. The storage tank size shall be fixed by after considering meteorological features of the area since it involves the capital investment. Optimum size of the storage device and cost effective methods to store water are the key issues for a viable roof top rainwater harvesting system.

7.1.12 Guttering is used to transport the rainwater from the roof to the storage tanks. It can be made of PVC type to folded metal sheets. It shall be fixed on the roof edge, catches the water as it falls from the roof.

7.1.13 Where the slabs are of concrete, the guttering system may be connected with dwon pipes.

7.1.14 First Flush System It is necessary to discard the water of the first rains so that the unwanted material such as debris, dirt, dropping, and other inert material will be washed away and clean water may be stored in the tank.

7.1.15 Manually operated stop valve may be fixed to control the entry of inert material into the tank. This system is economical and better controlled however it is a drawback of the system that a person is require operating it.

7.1.16 Floating valve may be used for diverting the first rains. This system relies on the floating ball that forms a seal after flushing out sufficient water. However, this system requires maintenance cost for its proper operation.

7.1.17 Filtration: It is must to give some kind filtration at tank the inlet of the tank to store the clean water. Several types of filtering techniques are available. One the simplest technique is to provide slow sand filtration consisting of layers of coarse, medium and fine sand.

7.1.18 This filtration chamber may be constructed at the top of the tank and this allow rain water pass through it before going to the tank. The maintenance of such filters is rather easy just removing the inert material collected on the top layer and stirring of the filter material. Maintenance will be required at every three or two months.

7.1.19 Benefits[23] of the Rainwater Harvesting system:

- Environment friendly and easy approach for water requirements
- it is an ideal solution for water requirements in areas having inadequate water resources
- Reduce dependability on the groundwater sources.
- Improves ground water quality
- Mitigates the effects of drought
- Reduces the runoff, which other wise flood storm water drains
- Reduces flooding of roads and low-lying areas
- Reduces soil erosion
- Cost effective and easy to maintain
- Reduces water and electricity bills

[23] Website of Karnataka State Council for Science and Technology, 07/12/2007,

# Table of Contents



**LIST OF TABLES**

**ANNEXES**



# *SECTION-8.0: ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK*

In the absence of information regarding the precise type and location of proposed WSSP interventions, the potential social and environmental impacts cannot be identified as is normally

done in project specific Environmental Impact Assessment (EIA) studies. ESMF will provide a mechanism for enabling the potential environmental, social, and economic impacts of the WSSP interventions to be identified, assessed, and mitigated appropriately. It will suggest:

- Mitigation measures for reducing/ offsetting/ eliminating the adverse potential environmental and social impacts at policy, program, and project level.
- A Monitoring and Evaluation plan

ESMF will lay down the Operational Procedures for an Environmental Management Plan for projects where the specific details are not known.

## 8.1 Objectives of the Environmental and Social Management Framework (ESMF)

Relevant environmental and social issues raised by the WSSP interventions have been studied in Sections 3 to 7. For assessing and managing the relevant issues, an ESMF has been devised as an integral part of SwESA. Based on management plans, field visits, and impact assessments carried out for existing sub-sector projects the elements of a framework for the proposed ESMF is presented as under:

- A baseline data collection program
- An environmental and social screening process for WSSP interventions.
- Identification of likely environmental impacts of the program interventions
- Appropriate mitigation measures and management
- Institutional requirements, e.g. training and equipment.
- Assessment of existing Institutional capacity with Environmental Protection Authority (EPA)
- Recommendation of appropriate measures for capacity building

a) Analysis of the social context of the project, the role of traditional institutions, Water Users Associations (WUAs), Water User Groups (WUGs), the role of women, differential access to project benefits, etc.
b) Participatory process for stakeholders' consultations
c) Policies, formulae and/or criteria for resettlement or land acquisition
d) Operational guidelines for developing project design, implementation, as well as, monitoring and evaluation (M&E).

## 8.2 Establishment of Baseline Data Program

The baseline environmental status would be established by studying various significant environmental parameters which might be affected by the subproject interventions. The baseline survey should be carried out carefully to optimize data requirements.

Baseline studies normally a combination of desk studies (gathering existing documents, data sets, accumulating past lessons learned) and field surveys to address key issues outlined during scoping. The extent of desk studies shall be determined by the quality of secondary information available. The available information from secondary sources should be thoroughly reviewed before initiating field study for establishing baseline environmental status. The field studies can be greatly enhanced by the use of appropriate sampling and surveying techniques.

The significant environmental impacts could vary from one project to another, and accordingly, the parameters for data collection will also change.

The first step in any data collection process is to identify the parameters on which information would be collected. The type, extent and reliability of data that need to be collected for different variables are important for establishing baseline data collection, and assuming how the collected data would be used for environmental analysis. A set of indicators reflecting important environmental, social, and economic issues to be studied in the baseline establishment program is given **Table 8.1**.

**Table 8.1: Set of Environmental and Social Indicators to be studied in Baseline Establishment Program**

- Geology and soil quality
- Hydrology and Use of water resources
- Water Quality
- Air quality (Suspended Particulate Matter, Oxides of Nitrogen (NOx), Sulfur dioxides ($SO_2$), and Carbon emissions)
- Land use changes
- Protected Areas
- Terrestrial and Aquatic Ecology (Threatened species, Fish catches in coastal areas etc.)
- Status of Municipal Waste (Liquid and Solid)
- Use of nitrogenous fertilizers or pesticides
- Stream flow data
- Meteorology covering Annual rainfall, evaporation rate, infiltration rate, humidity, temperature (maximum and minimum), and Wind Direction
- Demographic pattern (population characteristics, educational level, sex ratio, family size)
- Employment and economic growth (Employment and Unemployment Pattern, availability of workforce)
- Land use patterns and control for the study area
- Land values in the study area
- Educational and recreational facilities
- Level of existing public services
- Transport trends
- Source of energy supply and Private fuel consumption
- Industrial and agricultural production
- Health and Social services in the study area
- Distinct settlements of ethnic groups or deprived economic or minority groups in the study area
- Community Development program in the area
- Areas of Unique significance such as cemeteries, religious structure etc.
- Archeological/Religious/Cultural Importance sites
- Public Consultation

## 8.3 Environmental and Social Screening Process for the WSSP Interventions

The screening process is relevant to determine whether a comprehensive environmental impact assessment study would be required for the project interventions. This will lead to some of the interventions' being automatically excluded. Screening will enable the project authorities to decide upon:

- The likelihood of future project interventions having potential negative environmental and social impacts
- Appropriate mitigation measures for activities with adverse impacts

- Incorporation of the mitigation measures into project design
- Reviewing/ approving proposals
- Monitoring environmental parameters during the project implementation phase

A policy based screening approach is used by the World Bank in its operational policy OP 4.01 on conducting Environmental Impact Assessment (EIA). The environmental and social screening of each subproject will be classified into categories "A", "B", and "C" depending on the nature and intensity of the potential environmental and social impacts, as under:

***Category A***

A project with significant environment impacts which are:

√ Sensitive

√ Diverse

√ Unprecedented

These impacts may affect areas larger than sites/facilities subject to physical works. EA for such projects should cover potential negative and positive environmental impacts, analysis of feasible alternatives and mitigation measures.

***Category B***

A project has less adverse impacts on human population or environmentally sensitive areas such as wetlands, forests and other natural inhabitants. These impacts can be mitigated by adopting mitigation measures more readily than category "A" projects. EA for such projects should cover potential negative and positive environmental impacts and mitigation measures.

***Category C***

A project under this category would have minimal or no adverse impact on the existing environment.

The screening of the interventions would decide the extent of the environmental and social studies required prior to taking up construction of the project. A schematic diagram for conducting of screening is given in **Annex 8.1**.

### 8.3.1 Screening of the Project Activities and Site Assessment

Preliminary Environmental and Social screening will be carried out using a format given in **Annex 8.2**. This form will be filled in by the Environmental Management Officer (EMO) deployed at Governorate level or district level. The EMO will be assisted by the sector specific WUAs/WUGs in gathering necessary information and data for filling up this format. The WUAs and the WUGs will also assist the Environmental Management officer in:

- identifying potential environmental and social impacts,
- determining the significance of impacts

- Suggesting suitable mitigation measures for mitigating the environmental and social adversities from the subproject interventions.
- Carrying out Environmental Impact Assessment studies, if necessary.

However, suitable training programs for the EMOs, representatives WUAs and WUGs have been suggested in Section 9 of this report.

The screening process will help the project authorities to decide whether a:

- Comprehensive Environmental and Social Impact (EIA) Study is required for projects with significant impacts on the existing environmental and social parameters (Typically category "A" projects and riskier category "B" subprojects.)
- Preliminary Environmental and Social Impact Assessment is required if the subprojects have less intense environmental and social impacts
- Environmental Impact Assessment is not required when the project does not have any impact on the existing environmental and social parameters.
- Comprehensive EIA is recommended for large dams; Dam safety analysis shall be carried out and dam safety measures shall be properly incorporated.
- To ensure compliance with the Banks safeguard policy OP 4.37, the project authorities shall appoint a committee of Dam Safety Experts to:
  - review the site investigation findings
  - assess the dam design and planning
  - study the various aspects of Dam failure
  - assess monitoring capacity at the commencement of the operations
  - Project Authorities will prepare construction plan, instrumentation plan, operation and maintenance plan, and disaster management plan will be responsible for implementation of these plans.
  - If the proposed project interventions result in resettlement, the resettlement procedures spelt out in Resettlement Policy Framework will apply.

### 8.3.2 Assigning Appropriate Environmental and Social Impact Categories

Assignment of appropriate environmental category will be based on the World Bank Operational Policies OP 4.01 on the Environment Assessment and the Environmental Protection Law (EPL) # 26, 1995 of Yemen.

A review of the ongoing projects past projects indicates that most of the project interventions envisaged will fall in category "B" and very few subprojects will come under category "A".

When a subproject intervention is categorized as "A" or "B", WSSP will provide the funds required by the Project proponents and the NWRA at Governorate level to consult EPA branch/ Head Office and/or affected/ interested parties. A part of this fund will also be utilized to engage Consultant to carryout the EIA study, if required.

Project interventions falling in category "C" will not have any negative environmental and social impacts on the baseline conditions of the project area and would not require any Environmental Impacts Assessment study. Hence, designed format will have all "No" entries. The EMO will forward this format to the branch level EPA office for perusal 'No Objection Certificate' for the project.

However, EPA will be free to make and giving site verification/ inspection if deemed necessary. Necessary funds shall be arranged for any site visit inspection by the EPA officials.

As indicated earlier, most of the subproject interventions of WSSP will not fall in category "A". The projects categorized as "A" or "B" will go through EIA study and such studies shall be approved by the EPA as stipulated in the EPL before project commencement. The project authorities has to be particularly vigilant if construction activity is undertaken in the catchment area/ protected areas/ costal zones/ wastewater discharges in the valleys/ rehabilitation and expansion of the existing water supply and sanitation schemes or if the project involves use of pesticides or hazardous materials.

### 8.3.3 Carrying out Environmental and Social Assessment for the WSSP Interventions

For ensuring the sustainability of the subproject options under consideration, various environmental consequences must be addressed early in the project cycle and also considered appropriately in the project design stage.

Based on the findings Annex 8.1, EMO will formulate an index of environmental and social parameters to be monitored during the implementation and operation phase of the project. This index will take into account the parameters given in **Table 8.1**. This checklist will meet the requirements for carrying out the EIA study for WSSP interventions. The Project Authorities, WUAs, and WUGs will fully coordinate with EMO for conducting the Environmental and Social Assessment study. A model 'Terms of Reference' for carrying out the EIA Study is given in **Annex 8.3**.

The suggested checklist would help in ensuring that the identified environmental and social impacts are considered during the preconstruction phase/ implementation phase/ operation phase. This may be modified based on the requirement of the specific subproject interventions, site conditions, and nature of the work. This will also guide the EMO in the preparation of the Environmental and Social Management plan for the subproject interventions.

Preparation of the Environmental and Social Management Plan will ensure the execution of mitigation measures during preconstruction/ construction/ and operation phase of the subproject interventions.

In case project/ infrastructure designs exist already, the EMO will assess the environmental and social impact on the selected site. Such assessment will be done in consultation with the Project Authorities and the WUAs/ Basin committees and may recommend suitable modifications in design to offset adverse environmental and social impacts, if any. However, a separate EIA shall be conducted to address the mitigation measures for reducing the adverse impacts. The EMO will assist the project team throughout the process.

In case of land acquisition is necessary for any WSSP interventions and is also identified in the EIA study, suitable measures as suggested in the Resettlement Policy Framework (RPF) will apply However the Project proponent has the option to select an alternative site where the involuntary settlement clause will not be triggered. However, if a change of location is not feasible and the proponent maintains a site where the operational Policy 4.12 regarding Involuntary Resettlement is triggered, a Resettlement Action Plan (RAP) shall be prepared as the RPF.

There is a need to ensure that the various environmental and social mitigation measures suggested are applied at the project level. Hence, the responsibility for executing such measures e.g. monitoring of air/ water/ noise/ soil quality and provisions of public safety should be spelt out and included in the Bill of Quantities in the Tender Documents.

### 8.3.4 Review and Approval of the Screening Activity

The EIA prepared by EMO for the proposed WSSP interventions will be reviewed by the Review Committee constituted by the EPA branch office at Governorate level comprising local experts in the fields of Social Science, Botany, Zoology, Environmental Experts and Engineers from the relevant field. An advance copy of the checklist and the EIA report will be sent to the review Committee members by the EPA branch office. Committee will satisfy itself all environmental and social mitigation measures have been addressed in the study. If it is noticed that the screening form has unjustified “Yes” or “No” entries, the EMO will have to clarify the position.

If the EPA review committee finds the EIA report does not meet the requirement of EIA or environmental checklist or format, the project proponent will revise the report. After making necessary modification in the design report or changing site as per the EIA requirement, the project proponent will resubmit it review.

After EPA approval, the Design and the EIA report will be sent to the District Level Council (DLC) for village level disclosure. If there is resettlement, the RAP shall be sent for display. EPA will then issue a conditional clearance to the project. Such conditions may, for example, relate to public safety/ environmental monitoring/ access to public and religious structures/ construction and operation practices/ restoration of disturbed areas/ full implementation of RAP/ and/or ensuring implementation of mitigation measures.

### 8.3.5 Environmental Impact Assessment

The EIA report prepared for Category “A” and “B” projects shall be reviewed by the EPA office at Governorate level and if required by the EPA Head Office, after public consultation has taken place. Findings of the public consultation shall also be furnished to the EPA for review. Such a review shall either accept or reject EIA report.

Carrying out the exercises mentioned in subsections 8.3.3 through 8.3.4, would require understanding activities like setting up Review Committee, hiring experts, issuance of EIA certificate, etc. The project proponent will deposit a fee for processing the EIA report in EPA branch office.

### 8.3.6 Disclosure and Approval Process

According to Banks’ operational policy OP 4.01, disclosure of information for Category “A” and “B” projects is a mandatory requirement. It requires consultation with the project affected

groups, local non governmental organizations, women associations, and local interest champions. Public consultation shall be organized at the following stages:

- identification of issues and impacts (scoping stage)
- comparison of alternative stages
- EIA study documentation stage.

Public participation shall be associated at all stages for major undertakings such as plans, program, project details and designs.

At scoping stage, public participation activities will primarily be devoted to informing the public about the project and determining what citizens of that area feel about the potential project.

At comparison of alternative stage, the planners would try to identify one or several preferred actions. Public participation at this stage will offer an opportunity to weigh and use local values of environmental importance. It is very important at this stage that to have public inputs in the recommendations to decision makers.

At third stage, public involvement would consist of reviews and comments on draft studies/ proposals.

The Public Participation Program has to be carefully designed to promote effective public participation various stages of the EIA process. Planning for public participation shall address the following aspects:

1. Delineation of the objectives of public participation at the pertinent stage.
2. Identification of the public groups/ associations to be involved in the pertinent EIA stage.
3. Selection of appropriate public participation techniques for meeting the objectives and communicating with the public. It will be necessary to develop techniques for conflict management and resolution.
4. Development of a practical plan for implementing the public participation program.

Soon after the finalization of the project proposal, an environmental category shall be assigned to it for early action. For category “A” and “B” projects requiring EIA, Project Reports including EIA and papers regarding approval by EPA, the World Bank and other Donors will be attached. Category “C” projects do not require an EIA study but the complete environment and social checklist will be attached with the project proposal.

The EIA reports will be disclosed to the public by presenting the findings and recommendations to the WUA’s, DLCs and branch offices of WSSP stakeholders. NGOs and other civil society organizations at the district level will also be informed. EIA report will be made available to participants in Arabic.

On completion of the EIA process, the EPA branch office will:

- Circulate the report for written comments from various agencies, e.g. NWRA, GLCs, DLCs and the NGOs.
- Notify the public place for review in local newspaper in vernacular language.

- Solicit the oral/ written comments from the affected parties

EPA will decide whether public hearing is required for review of EIA.

WSSP subproject beneficiaries or any other affected/interested party may go on to appeal, if they are dissatisfied with the decision taken at any stage of the EIA process.

### 8.4 Identification of likely Environmental impacts of the Program Interventions

Environmental impacts of program interventions are likely at the project level. Typically, the implementation phases of WSSP projects will be have four phases:

- Preconstruction phase (Planning and Designing)
- Construction and rehabilitation phase
- Operation and maintenance phase
- Decommissioning and closure phase

An analysis of environmental and social impacts has been discussed in Section 5 of this report. However, an indicative list of impacts is given in **Table 8.2**. Symbol "O", placed against each project activity indicates that it would have either positive or negative impact. This indicative summary will help the EMO to prepare the EIA for the Category "A" and "B" WSSP interventions.

**Table 8.2: Summary of Environmental Impacts Arising from the Project Level Activities**

| Project Activities | Environmental Parameters | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Terrestrial | | Aquatic | | | | | | | Economy | | | |
| | Geology | Soils | Water Quality | Noise Quality | Groundwater Resources | Archeology | Flora | Fauna | Flora | Fauna | Cultural Heritage and Religious Sites | Public safety | Traffic congestions | Local communities | Livelihoods | Occupation health and safety | Local | National | Visual Impacts |
| Finalization of Engineering Design and Planning works and Project Finance | | | | | | | | | | | | | | O | O | | O | O | |
| Official Meeting | | | | | | | | | | | | | | O | O | | O | O | |
| Purchasing/leasing of Equipment | | | | | | | | | | | | | | O | O | | O | O | |
| Site Inventory | | | | | | | O | | | | | | | O | O | | O | O | |
| Confirmation of right to access lands for survey purpose and surveying work | | | | | | | O | | | | | | O | O | O | | O | O | |
| Land Acquisition | | | | | | | | | | | | | | O | O | O | O | O | |
| Vehicular Traffic | | | | | | | | | | | | | | | | | | | |
| Site office | | | O | | | | | | | | | | | O | O | O | O | O | |
| Influx of construction Workers | | | O | | O | | O | | | | | O | | O | O | O | O | O | |
| Site clearance | | O | | | | | O | | | | | | | | | | | | O |
| Tree removal | | O | | | O | | O | O | | | | O | | O | | O | | | O |
| Top soil stripping | | O | | | O | | | | | | | | | | | | | | O |
| Earthwork | | O | O | O | | | O | O | | | | O | O | | | O | | | O |
| Excavation, grading | | O | O | O | O | O | O | O | | | | O | O | O | | O | | | O |
| Operation of Construction Yards | | O | O | O | O | | O | O | O | O | | O | | O | O | O | O | | O |
| Equipment Storage and Machinery Maintenance | | O | O | O | O | | | | O | O | | | | O | O | O | | | O |
| Quarrying Operation | | O | O | O | O | O | O | O | | | O | O | | O | O | O | | | O |

**Table 8.2 (Contd.)**

| | Environmental Parameters | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Terrestrial | | Aquatic | | | | | | | Economy | | | |
| | Geology | Soils | Water Quality | Noise Quality | Groundwater Resources | Archeology | Flora | Fauna | Flora | Fauna | Cultural Heritage and Religious Sites | Public safety | Traffic congestions | Local communities | Livelihoods | Occupation health and safety | Local | National | Visual Impacts |
| Material Movement | | O | O | O | O | | O | | O | | | | | | | | | | O |
| Drilling of wells or rehabilitation of wells | | O | O | O | O | | | | | | | O | O | O | O | O | | | O |
| Construction of Rainwater Harvesting Tanks | | O | O | O | O | | O | O | O | O | | | | O | O | | O | O | |
| Rehabilitation of existing infrastructures | | O | | | | | | | | | | | | | | | | | |
| Rain Water Harvesting Structures | | O | O | O | O | | | | | | | | | O | O | O | O | O | |
| Construction of clear water reservoir | | O | O | O | | | | | | | | O | O | O | O | O | O | O | O |
| Flushing and disinfection pipes | | O | O | | | | O | O | O | O | | O | | | | O | | | O |
| Laying and jointing of Pipes | | O | | O | | | | | | | | O | O | O | O | | | | O |
| Latrine installation | | O | O | | | | | | | | | | | O | | | | | |
| Removal of cesspits and septic tanks | | O | O | O | | | | | O | O | | O | O | | | O | | | O |
| Laying and jointing of Sewer Pipes | | O | | O | | | O | O | | | | O | O | O | O | O | O | | O |
| Replacement of existing pipes | | O | O | O | | | | | | | | O | O | O | | | O | | O |
| Construction of Wastewater treatment plants | | O | O | O | | | O | O | O | O | | O | O | O | O | O | O | O | |
| Removal of temporary offices and shops (demolition and relocation) | | O | | | | | | | | | | | | O | O | | O | | |
| Site restoration – Finish grading, top soiling, Fertilizing | | O | O | O | | | O | | | | | | | O | O | | O | | O |

**O indicate positive or negative level impacts due to the project activity**

## 8.5 Mitigation measures and Management Plan

Various activities at project implementation phase will impact the existing environment. Such impacts may be short term, limited to the implementation phase only. Intensity of such impacts can be reduced by adopting mitigation measures as per the management plan at site. A summary of mitigation measures and management plan is presented in **Table 8.3**.

### 8.5.1 Disclosure and Approval Process

Dams are important structures for storing water, regulating flows and containing flash floods. However, establishment of dams and reservoirs in a valley may pose risk and the possibility of loss of life and property to the people living downstream because of the probability of dam failure, environmental as well as social and economic aspects during construction.

In addition, operation of reservoirs, without following established rules and practices may threaten the safety of dams and become a source of undue wastage of water. Sedimentation of reservoirs is also a problem as it reduces storage capacities and hence their useful life. The General Directorate of Irrigation (GDI) undertakes construction of dams taking into account, inter alia, requirements/ demand from villagers. However, GDI is responsible for ensuring that appropriate measures are taken and sufficient resources provided for the safety of the dam, irrespective of funding sources or construction status. Dam safety is a matter of serious concern to all the stakeholders including the financing agencies/ partners.

The following measures need to be implemented to ensure dam safety:

- Dams will be constructed, operated and maintained by the GDI and its offices/ branches.
- The impounded water reservoir will be a public property and its use will be governed by established rules and regulations.
- GDI will be required to prepare dam safety monitoring plans and implement them in accordance with the established procedures.

| Table 8.3 Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No.** | **Project Activity/ Environmental Issues** | **Mitigation Measure** | **Responsible organization** | **Monitoring Institution** | **Monitoring Frequency** | **Regulatory Agency** |
| **IMPLEMENTATION PHASE:** | | | | | | |
| 1 | Air quality and noise quality due to construction yard activity | • Select sites for construction camp and storage yard on the downwind side of the village and about 500m from the nearest residential area. | Contractor | WUA/EMO of the Project Proponent | Once, before setting up the construction camp. | EPA |
| 2 | Construction Workers Colony/site office | • Install lavatory at construction workers colony/ site office.<br>• Provision for collection of domestic refuse and its disposal.<br>• Drinking water facility shall be made available. | Contractor | WUA/EMO of the Project Proponent | monthly | EPA |
| 3 | Noise Pollution at site | • Workers working in the vicinity of equipment generating high noise levels provided with earplugs, proper maintenance of construction equipment /machinery and vehicles. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 4 | Air Pollution | • Construction equipment/ machinery and vehicles to be maintained in good condition.<br>• Dust cover to the vehicles carrying construction material.<br>• Sprinkling of water in dusty area.<br>Vehicles shall be covered with tarpaulin sheets. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 5 | Equipment storage and maintenance yard | • Waste collection, storage and disposal in proper manner.<br>• Whenever possible (in case of lubricants) should be reused. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 6 | Occupational Health and Safety | • Regular health check-ups for the workers, HIV and AIDS tests. | Contractor | WUA/EMO of the Project Proponent | half yearly | EPA |
| 7 | Transportation of Construction material | • Routine check of vehicles used for transportation for adequate maintenance and compliance with emission norms. | Contractor | WUA/EMO of the Project Proponent | half yearly | EPA |
| 8 | Pollution (Water, soil quality) | • No waste shall be allowed to discharge into the existing valley or water body.<br>No water logging shall be allowed at | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |

| Table 8.3 Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No.** | **Project Activity/ Environmental Issues** | **Mitigation Measure** | **Responsible organization** | **Monitoring Institution** | **Monitoring Frequency** | **Regulatory Agency** |
| | | construction site. | | | | |
| 9 | Severance due to trench opening | • Proper signboards/caution board shall be place near the construction sites | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 10 | Use of water on and off-site | • All water on site will be transported in tankers by the Contractor of its own. No new well be allowed to dug for construction activity without proper approval from NWRA and EPA | Contractor | WUA/EMO of the Project Proponent | weekly/Once before digging up any new well | EPA |
| 11 | Borrow pits and quarrying | • Firm-up contact with approved quarry and borrow pit sources owner, obtain balance output and requirement of material, if available. No new Quarry will be opened unless clearance obtained from the EPA. | Contractor | WUA/EMO of the Project Proponent | Once | EPA |
| 12 | Disposal of Construction debris | • Disposal of debris to the approved landfill sites located away from habitations and well fields. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 13 | Top soil | • Top 150 mm soil from virgin construction sites, borrow areas shall be stored properly and should be reused. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 14 | Earthwork, Rock cutting, grading, and compaction | • Proper safety measures shall be taken at site, construction sites shall be properly demarcated and entry or trespassing through such sites shall be prohibited.<br>• Worker shall use personnel protective equipments such as helmets, earmuffs, and helmets | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 15 | Traffic Management | • Secure assistance from local police for traffic control during construction phase.<br>• Warning signs/cautionary boards shall be placed near the construction site in urban areas/populated areas | Contractor | WUA/EMO of the Project Proponent | monthly | EPA |

| Table 8.3 Summary of Mitigation Measures and Management Plan | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No.** | **Project Activity/ Environmental Issues** | **Mitigation Measure** | **Responsible organization** | **Monitoring Institution** | **Monitoring Frequency** | **Regulatory Agency** |
| 16 | Public safety | • Proper warning sign shall be placed at the construction sites.<br>• Speed of construction vehicles shall be restricted to 50Km/hr. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 17 | Nuisance to Public | • Proper access shall be provided to the religious structures, markets, schools, and hospitals.<br>• Use of Noise generating equipments at such points shall be restricted. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 18 | Flushing and disinfecting | • Strict control of the material. Material shall be transported to the site in appropriate vehicles.<br>• Provision of first aid facility at construction camp and contacts with nearby clinics.. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 19 | Drilling of wells/Rehabilitation of Wells | • Regular maintenance of DG sets, reuse of the drilling mud, wastewater generated during drilling shall be properly drained off. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 20 | Disposal of Sewer pipes debris | • Disposal of debris to the approved landfill sites located away from habitations and well fields. | Contractor | WUA/EMO of the Project Proponent | weekly | EPA |
| 21 | Environmental Monitoring | • Establish monitoring system. | Contractor | WUA/EMO of the Project Proponent | Quarterly | EPA |

### 8.5.2 Rationale For Dam Safety

Dam Safety aims at taking corrective actions to reduce or eliminate identified or potential risks in an efficient and cost effective manner and to protect public safety, life and property. Hence, any Dam Project proposed must have a dam safety management program to incorporate dam safety values as part of the day-to-day operations and the work culture of the organization.

The program will comprise policies, procedures and investigations that minimize the risk of dam failure. Any dam constructed under the WSSP would have a dam safety management program, incorporating, among other, the following:

- ✓ Site Investigation, Design
- ✓ Construction, Operation and Maintenance,
- ✓ Surveillance, Remedial Action and Modification.

### 8.5.3 Dam Classifications

The Bank operational OP 4.37 classifies dams into two categories, namely, Large Dams and Small Dams, defined as follows:

- **Small dams** are normally less than 15 meters in height and includes, for example, farm ponds, local silt retention dams, and low embankment tanks.
- **Large dams** are 15 meters or more in height. Dams, between 10 and 15 meters in height, are treated as large dams if these present special design complexities—for example, an unusually large flood-handling requirement, location in a high seismic zone, foundations that are complex and difficult to prepare, or retention of toxic materials. http://wbln0011.worldbank.org/Institutional/Manuals/OpManual.nsf/58aa50b14b6bc071852565a30061beb6/14f8e95499c0ce2285256763006252c0?OpenDocumentDams under 10 meters in height are treated as large dams if they are expected to become large dams during the operation of the facility

It is expected that WSSP rainwater harvesting structures will be small dams and, generic dam safety measures designed by qualified engineers for such dams are usually adequate.

### 8.5.4 Safeguard Management Associated With Dams

#### 8.5.4.1 Generic Dam Safety Management

Dam management envisages measures necessary to ensure corrective actions for reducing or eliminating identified or potential risks in an efficient and cost effective manner in order to protect the public safety/life and property. Such measures would, inter alia ensure that the dam (including the foundation). Further, Dam Management must:

- are stable under all loading conditions (i.e. construction, operation and seismic)
- have adequate seepage
- have sufficient spillway and outlet capacity along with adequate freeboard to prevent overtopping by the reservoir and wave action
- are environmentally responsive in both upstream and downstream side of a dam.

- provide operation and maintenance manual
- install adequate instrumentation to monitor performance
- provide monitoring and surveillance plans
- formulate emergency action plan: emergency identification, notification and response plans
- Ensure schedule for comprehensive review, evaluation and periodic inspection.

#### 8.5.4.2 Dam Safety Requirement

The requirements for ensuring dam safety, before and after construction, are summarized in **Table 8.4**.

**Table 8.4: Dam Safety Requirement**

| Sl. No. | Safety Measures before construction | After Construction - Operation |
|---|---|---|
| 1 | Environmentally responsive in terms of site selection conservation of flora and fauna both up and down stream of dam | Taken inventory for all dams in the country in order to establish priority for dam safety inspection, based on damage potentials. |
| 2 | Monitoring and surveillance plans documentation – design, construction, and operation records. | Create and maintain a dam safety file for evaluation, investigation program, develop appropriate mitigation measure and potential information availability. |
| | Emergency action plan shall include emergency identification, notification, and response plans | Conduct regular periodic dam safety inspections as per schedule. Such inspection will help determine status of a dam relative to structural and operational safety. |
| | Schedule for comprehensive review, evaluation and periodic inspection. | Analyze potential deficiencies |
| | Dam shall be stable in all loading conditions (i.e. construction, operation, and seismic). | Take corrective actions immediately after identification. |
| | Dam shall have sufficient capacity spillway and outlet along with adequate capacity freeboard to prevent any over-topping by the reservoir wave action. | Physical inspection of dam is a must. |
| | Dam and foundation must have adequate seepage | Monitor seepage by instrument. |
| | Operation and maintenance manual must be provided | Conduct regular inspections as per the manual |

## 8.6 Standards to be Adopted for Various Environmental Parameters

Various standards below would be useful for giving proper instructions to the Contractor for taking necessary mitigation measures during the implementation phase.

### 8.6.1 Relevant Water Quality Standards

Relevant water quality standards stipulated limits in the Republic of Yemen and the World Health Organization (WHO) are given in **Table 8.5**.

**Table 8.5: Standards for Quality of Drinking Water**

| Sl. No. | Item | Unit | Limit in Yemen | | WHO Standards |
|---|---|---|---|---|---|
| | | | Desirable | Permissible | |
| Physical Parameter | | | | | |
| 1. | Taste | - | Acceptable to people | | Should be acceptable |
| 2. | Odor | - | Acceptable to people | | Should be acceptable |
| 3. | Color | Pt-Co | 15 | 15 | 15 TCU |
| 4. | Turbidity | NTU | 1 | 5 | Median 5 ≤1<br>Single ≤5 |
| 5. | Temperature | C | 8-25 | 25 | - |
| 6. | pH | - | 6.5-8.5 | 5.5-9 | - |
| 7. | Electrical Conductivity (EC) | μmhos/cm | 450-1000 | 2500 | - |
| Chemical Parameters | | | | | |
| 1. | Total Dissolved Solids (TDS) | mg/l | 650 | 1500 | - |
| 2. | Bicarbonate ($HCO_3$) | mg/l | 150 | 500 | - |
| 3. | Chloride(Cl) | mg/l | 200 | 600 | 250 |
| 4. | Sulfate ($SO_4$) | mg/l | 200 | 600 | - |
| 5. | Fluoride(F) | mg/l | 0.5 | 1.5 | 1.5 |
| 6. | Calcium (Ca) | mg/l | 75 | 200 | - |
| 7. | Magnesium (Mg) | mg/l | 30 | | - |
| 8. | Barium (Ba) | mg/l | 0.1 | 0.15 | 0.7 |
| 9. | Sodium (Na) | mg/l | 200 | 400 | - |
| 10. | Potassium (K) | mg/l | 12 | 12 | - |
| 11. | Nitrate ($NO_3$) | mg/l | 45 | 50 | 50 |
| 12. | Iron (Fe) | mg/l | 0.3 | 1 | 0.3 |
| 13. | Manganese (Mn) | mg/l | 0.1 | 0.2 | 0.1 |
| 14. | Copper (Cu) | mg/l | 1 | 1.5 | 1 |
| 15. | Zinc (Zn) | mg/l | 5 | 15 | - |
| 16. | Silver (Ag) | mg/l | 0.01 | 0.02 | - |
| 17. | Aluminium (Al) | mg/l | 0.2 | 0.3 | 0.2 |
| 18. | Nickel (Ni) | mg/l | 0.05 | 0.1 | 0.02 |
| 19. | Boron (B) | mg/l | 0.5 | 1 | 0.3 |
| Organic Compounds | | | | | |
| 1. | Endrin | mg/l | 0.0002 | | - |
| 2. | Methoxine | mg/l | 0.1 | | - |
| 3. | Toxaphene | mg/l | 0.002 | | - |
| 1. | Lead | mg/l | 0.05 | | 0.01 |
| 2. | Selenium | mg/l | 0.01 | | 0.01 |
| 3. | Arsenic | mg/l | 0.05 | | 0.01 |
| 4. | Chromium | mg/l | 0.05 | | 0.05 |
| 5. | Cyanide | mg/l | 0.1 | | 0.07 |
| 6. | Cadmium | mg/l | 0.005 | | 0.003 |
| 7. | Mercury | mg/l | 0.001 | | 0.001 |
| 8. | Antimony | mg/l | 0.01 | | 0.005 |
| **Chemical Pollutants** | | | | | |
| 1. | Ammonium Hydroxide | mg/l | 0.5 | | 1.5 |
| 2. | Phosphorous Pentoxide | mg/l | 5 | | - |
| 3. | Silicon Dioxide | mg/l | 40 | | - |
| 4. | Biochemical Oxygen Demand | mg/l | NA | | - |
| 5. | Chemical Oxygen Demand | mg/l | 3 | | - |

| | | | | | |
|---|---|---|---|---|---|
| **Radio Active Compounds** | | | | | |
| 1. | Alpha emitters | pCi/l | 0.1 | | 0.1 μg/l |
| 2. | Beta emitters | pCi/l | 1 | | 1 μg/l |
| **Viruses** | | | | | |
| 1. | Coliforms | No./100 ml | Nil | | - |
| 2. | Fecal Coliforms | No./100 ml | Nil | | - |

### 8.6.2 Relevant Wastewater Quality Standards

Standards stipulated by various agencies for wastewater reutilization for agricultural purposes and Maximum allowable concentration of various parameters as stipulated by Yemen EPA and the FAO for reutilization of treated effluent in Irrigation are in **Table 8.6** below.

The microbiological quality parameters stipulated by the Yemen EPA for wastewater utilization in agriculture are given in **Table 8.7**. These are to be maintained for the use of wastewater in agriculture.

Microbiological quality of wastewater utilization in agriculture prescribed by the WHO is indicated in **Table 8.8**.

**Table 8.6: Maximum Allowable Concentration in Treated Effluent for Irrigational Use**

| Sl. No. | Item | Code | Unit | Permissible Limit | |
|---|---|---|---|---|---|
| | | | | Yemen-EPA | FAO |
| 1. | Biochemical Oxygen Demand | BOD | mg/l | 150 | - |
| 2. | Chemical Oxygen Demand | COD | mg/l | 500 | - |
| 3. | Dissolved Oxygen | $O_2$ | mg/l | 2 | - |
| 4. | Sodium | Na | mg/l | 200 | 900 |
| 5. | Phosphate | $PO_4$ | mg/l | 30 | - |
| 6. | Aluminium | Al | mg/l | 5 | 5 |
| 7. | Arsenic | As | mg/l | 0.1 | 0.1 |
| 8. | Beryllium | Be | mg/l | 0.1 | 0.1 |
| 9. | Cadmium | Cd | mg/l | 0.01 | 0.01 |
| 10. | Cobalt | Co | mg/l | 0.05 | 0.05 |
| 11. | Chromium | Cr | mg/l | 0.1 | 0.1 |
| 12. | Copper | Cu | mg/l | 0.2 | 0.2 |
| 13. | Fluoride | F | mg/l | 1 | 1 |
| 14. | Iron | Fe | mg/l | 5 | 5 |
| 15. | Lithium | Li | mg/l | 2.5 | 2.5 |
| 16. | Manganese | Mn | mg/l | 0.2 | 0.2 |
| 17. | Molybdenum | Mo | mg/l | 0.01 | 0.01 |
| 18. | Nickel | Ni | mg/l | 0.2 | 0.2 |
| 19. | Lead | Pb | mg/l | 5 | 5 |
| 20. | Selenium | Se | mg/l | 0.03 | 0.02 |
| 21. | Vanadium | V | mg/l | 0.1 | 0.1 |
| 22. | Zinc | Zn | mg/l | 2 | 2 |
| 23. | Mercury | Hg | mg/l | 0.005 | - |
| 24. | Cyanide | CN | mg/l | 0.1 | - |

**Table 8.7: Microbiological Quality Guidelines of Yemen-EPA for Wastewater Use in Agriculture**

| Sl.No. | Re-use Conditions | Intestinal Nematodes (Arithmetic mean of no. of eggs per 1 liter) | Fecal Coliforms (Geometric mean of no. per 100 ml) |
|---|---|---|---|
| 1 | Irrigation of crops likely to be eaten uncooked | $\leq 1$ | $\leq 1000$ |
| 2 | Irrigation of sports fields, public parks & garden with which the public may come into direct contact | $\leq 1$ | $\leq 200$ |
| 3 | Irrigation of cereal crops, industrial crops, fodder crops, pasture & trees | $\leq 1$ | - |

| Sl.No. | Re-use Conditions | Intestinal Nematodes (Arithmetic mean of no. of eggs per 1 liter) | Fecal Coliforms (Geometric mean of no. per 100 ml) |
|---|---|---|---|
| 4 | Irrigation of fruit trees (irrigation should cease 2 weeks before fruit is picked up and no fruit should be picked off the ground) | ≤ 1 | - |

**Table 8.8: Microbiological Quality Guidelines of WHO (1989) [a] for Wastewater Use in Agriculture**

| Category | Re-use Conditions | Exposed Groups | Intestinal Nematodes (AM of No. of eggs per 100 ml)[b] | Fecal Coliforms (GM of No. per 100 ml)[c] | Wastewater treatment expected to achieve the required micro-biological quality |
|---|---|---|---|---|---|
| A | Irrigation of crops likely to be eaten uncooked, sports fields, public parks[d] | Workers, consumers, public | < 1 | < 1000 | A series of stabilization ponds designed to achieve the micro-biological quality indicated or equivalent |
| B | Irrigation of cereal crops, industrial crops, fodder crops, pasture & trees[e] | Workers | < 1 | No standard | Retention in stabilization ponds for 8-10 days or equivalent helminth and fecal coliform removal |
| C | Localized irrigation of crops in category B if exposure of workers and the public does not occur | None | Not Applicable | Not Applicable | Pre-treatment as required by the irrigation technology, but not less than primary sedimentation |

AM- Arithmetic Mean, GM- Geometric Mean

Maximum allowable limits of various parameters for irrigation water as stipulated in Yemen – EPA and FAO are indicated in **Table 8.9**.

**Table 8.9: Maximum Allowable Concentration in Irrigation Water**

| Sl. No. | Potential | Unit | Permissible Limit as per Yemen- EPA | FAO Standard (in Degree of Restriction on Use) | | |
|---|---|---|---|---|---|---|
| | | | | None | Slight to Moderate | Severe |
| 1 | Salinity affecting crop water availability: | | | | | |
| | $EC_w$ | mmho/cm | 0.7-2 | < 0.7 | 0.7-3 | > 3 |
| | TDS | mg/l | 450-2500 | < 450 | 450-2000 | > 2000 |
| 2 | Information (affects infiltration rate of water into the soil): | | | | | |
| | SAR = 0-3 $EC_w$ = | mmho/cm | 0.7-0.2 | < 0.7 | 0.7-0.2 | > 0.2 |
| | SAR = 3-6 $EC_w$ = | mmho/cm | 1.2-0.3 | < 1.2 | 1.2-0.3 | > 0.3 |
| | SAR = 6-12 $EC_w$ = | mmho/cm | 1.9-0.5 | < 1.9 | 1.9-0.5 | > 0.5 |
| | SAR = 12-20 $EC_w$ = | mmho/cm | 2.9-1.3 | < 2.9 | 2.9-1.3 | > 1.3 |
| | SAR = 20-40 $EC_w$ = | mmho/cm | - | < 5 | 5-2.9 | > 2.9 |
| 3 | Specific ion toxicity (affects sensitive crops): | | | | | |
| | Sodium (Na): | | | | | |
| | Surface irrigation | SAR | ≤ 9 | < 3 | 3-9 | > 3 |
| | Sprinkler irrigation | me/l | ≤ 2 | < 3 | > 3 | |
| | Chloride (Cl): | | | | | |
| | Surface irrigation | SAR | ≤ 10 | < 4 | 4-10 | > 10 |

| Sl. No. | Potential | Unit | Permissible Limit as per Yemen- EPA | FAO Standard (in Degree of Restriction on Use) | | |
|---|---|---|---|---|---|---|
| | | | | None | Slight to Moderate | Severe |
| | Sprinkler irrigation | me/l | ≤ 2 | < 3 | > 3 | |
| | Boron (B) | mg/l | ≤ 2 | < 0.7 | 0.7-3 | > 3 |
| 4 | Miscellaneous effects (affects susceptible crops): | | | | | |
| | Nitrogen ($NO_3$-N) | mg/l | ≤ 20 | < 5 | 5-30 | > 30 |
| | Bicarbonate ($HCO_3$) | me/l | ≤ 5.8 | < 1.5 | 1.5-8.5 | > 8.5 |
| | pH | - | 6.5-8.4 | Normal | 6.5-8.4 | 6.5-8.4 |

### 8.6.3 Relevant Air and Noise Quality Standards

Ambient air quality standards prescribed by various agencies, e.g. Yemen, EPA, USEPA, and the World Bank are given in **Table 8.10**.

**Table 8.10: Ambient Air Quality Standards (in μg/m$^3$) of Yemen, WHO & USEPA**

| Air Pollutants | Time Weighted Average | Yemen-EPA[1] | WHO (1999)[2] | USEPA (July 1997)[3] | World Bank Guidelines |
|---|---|---|---|---|---|
| Nitrogen Dioxide ($NO_2$) | Annual | - | 40 | 100 (P&S) | 100 |
| | 24 hours | 150 | 200 | - | 150 |
| | 1 hour | 400 | - | - | - |
| Sulfur Dioxide ($SO_2$) | Annual | - | 50 | 80 (P) | 80 |
| | 24 hours | - | 125 | 365 (P) | 150 |
| | 3 hours | - | - | 1300 (S) | - |
| | 10 minutes | - | 500 | - | - |
| Carbon Monoxide (CO) | 8 hours | 10,000 | 10,000 | 10,000 (P) | - |
| | 1 hour | 20,000 | 30,000 | 40,000 (P) | - |
| | 30 minutes | - | 60,000 | - | - |
| | 15 minutes | - | 100,000 | - | - |
| Lead (Pb) | Annual | 1 | 0.5 | - | - |
| | Quarterly | - | - | 1.5 (P&S) | - |
| Particulate Matters | Annual | 60 | - | - | 80 |
| | 24 hours | 150 | - | - | 230 |
| $PM_{10}$ | Annual | - | - | 50 (P&S) | - |
| | 24 hours | 70 | - | 150 (P&S) | - |
| $PM_{2.5}$ | Annual | - | - | 15 (P&S) | - |
| | 24 hours | - | - | 65 (P&S) | - |
| Ozone ($O_3$) | 8 hours | 120 | 120 | 157 (P&S) | - |
| | 1 hour | 200 | - | 235 (P&S) | - |
| Carbon Dioxide ($CO_2$) | Annual | 60 | - | - | - |
| | 24 hours | 150 | - | - | - |
| | 1 hour | 250 | - | - | - |

Table legend: P- Primary standard, S-Secondary standard

References: [1] Guidelines and Regulations of EPA; Republic of Yemen, Council of Ministers, Decree No. 148 of year 2000.

[2] WHO, Air Quality Guidelines

[3] USEPA, July 1997, EPA Office of Air Quality Planning & Standards, USEPA, Triangle Park, USA

The ambient noise levels for different land uses as prescribed in the environmental protection law of Yemen is given in **Table 8.11**.

**Table 8.11: Permissible Noise Limits as per Environment Protection Law, Yemen**

| Type of Area | Limit in dB(A) as per Article A of the Law | | | Limit in dB(A) as per Article B of the Law | | |
|---|---|---|---|---|---|---|
| | Time | | | Time | | |
| | A | B | C | A | B | C |
| Country side residential area & park area | 45 | 40 | 35 | 60 | 55 | 55 |
| Residential area (outside the city) | 50 | 45 | 40 | 65 | 60 | 55 |
| Residential area (inside the city) | 55 | 50 | 45 | 65 | 60 | 55 |
| Residential area (inside the city around workshops & commercial areas) | 60 | 55 | 50 | 65 | 60 | 55 |
| Industrial & commercial area | 70 | 70 | 70 | 70 | 65 | 60 |

Note: "A" indicates From 07:00hrs to 18:00hrs, "B" indicates From 18:00hrs to 23:00hrs, and "C" indicates From 23:00hrs to 07:00hrs

### 8.6.4 Establishment of criteria for sub-project prioritization, site selection and other anticipated decision-making needs

Subproject alternatives may encompass a wide range of considerations. For example, alternatives for dam and irrigation projects may include project construction and operation at different sites, differences in design and operational procedures, including incorporation of various mitigation measures, and the timing options for construction and operational phases.

Hence, general guidelines for subproject prioritization, site selection, and decision making needs are briefly discussed in the following subsections keeping in view the environmental and social aspects.

#### 8.6.4.1 Criteria for Subproject Prioritization

The subprojects may be prioritized by the adopting the importance scale given in **Table 8.12**.

**Table 8.12: Criteria for Subproject Prioritization**.

| Sl.No. | Scale Reference | Definition of the scale reference |
|---|---|---|
| 1 | Very Important | • First order priority<br>• It has direct beneficial impact on major issues such as easy access to potable water, sanitation, health and hygiene, reduction in uncontrolled abstraction of groundwater, water savings, girls' education, and poverty reduction.<br>• No land acquisition<br>• No conflict on land<br>• Improve social cohesion in the community |
| 2 | Important | • Second order priority as it has significant impacts because of huge land acquisition.<br>• But has relevance to the issues like easy access to potable water, sanitation, health and hygiene, reduction in uncontrolled abstraction of groundwater, water savings, girls' education, and poverty reduction.<br>• Improve social cohesion among the villagers. |
| 3 | Moderately Important | • Third order priority<br>• The project is relevant to the issues but have other significant impacts.<br>• Land acquisition may be a determining factor.<br>• Moderate impact on existing or proposed land use.<br>• Disharmony among the villagers about the project. |
| 4 | Unimportant | • Subproject is insignificantly relevant to the issues<br>• Low priority |

| Sl.No. | Scale Reference | Definition of the scale reference |
|---|---|---|
| | | • Has little impact on poverty reduction, girls' education, health and hygiene, and water saving, preventing uncontrolled abstraction.<br>• The project does not have a determining factor for major issues. |
| 5 | Most unimportant | • No priority<br>• No relevance to the major issues<br>• No measurable impact.<br>• Should be dropped as an item for future consideration. |

### 8.6.4.2 Site Selections

The following factors may be considered for selection of sites for any subproject:

- geological investigations especially for dam sites
- hydrological data – valley flow data – especially for dam or irrigation projects
- Downstream users in case of Dam or irrigation structures
- Disputes
- No major land acquisition regarding sites, if any, disturbance to the livelihoods involved
- Away from protected areas
- Away from forest areas
- Away from high tide line in the coastal areas
- Minimal inconvenience to the local people during construction/ operational phase
- Land Cost

### 8.6.4.3 Anticipated Decision Needs

Some of the relevant aspects for selecting WSSP interventions are listed in **Table 8.13.**

**Table 8.13: Check List of Factors to be considered before Decision Making**

| Sl. No. | Decision Factor | Significance | Rating for different Project Proposal | Importance Weight |
|---|---|---|---|---|
| 1 | Construction cost | One time cost | | 1 |
| 2 | Operating Cost | Ongoing cost including energy , fuel and labor | | 2 |
| 3 | Land Availability | Minimum or no land acquisition/Land acquisition problems. | | 2 |
| 4 | Site Area Available | Future expansion capability, flexibility | | 1 |
| 5 | Other land use conflicts | Potential to interfere with agriculture – residential land. | | 1 |
| 6 | Construction Impacts | Public safety, environmental pollutions | | 1 |
| 7 | Health of Workers | Air and Noise pollution | | 1 |
| 8 | Cost benefit | Safe and economic benefits | | 2 |
| 9 | Environmental impacts | Preservation of the environment | | 2 |
| 10 | Operability | Easy to operate with less maintenance | | 2 |

**Note**: 1 Rating may be as 1 = worst, 2 = average, 3 = Best
1 Total will be determined as = rating X importance, Cumulative (Highest score)

## 8.7 Resettlement and Land Acquisition

Resettlement Policy Framework provides the necessary background to ensure that any WSSP project/ subproject involving land acquisition/ resettlement of people will comply with both the Yemeni law and the Bank OP 4.12. During implementation of WSSP activities, there may be a need to acquire land and it will affect people, their assets, livelihood and have a negative impact on socio-economic life of the PAPs (particularly the poor and the vulnerable). At that stage, OP 4.12 calls for preparation of individual Resettlement and Compensation Plans that must be consistent with the RPF.

Resettlement and Compensation plans under the RPF must include the following measures:

a) Carrying out census of affected assets/ affected persons or groups

b) Inform the PAPs about their options and rights pertaining to resettlement and compensation

c) Consult the PAPs on choices offered to them including technically and economically feasible resettlement and compensation alternatives; and

d) Provide prompt and effective compensation at full replacement cost for losses of assets to attribute to the Program

### 8.8 Participatory Process for Stakeholders' Consultation

This ESMF is based on a strong participatory approach in undertaking all key activities in WSSP. The implementing agencies will make all efforts to contact relevant stakeholders (including the affected communities and the NGOs, WUAs, WUGs, CBOs, especially for a project/ subproject with potentially significant environment and social impacts), incorporate local community needs and resolve conflicts. The concerned Project Authority/ PMC will ensure that project affected persons are consulted in a meaningful way and allowed to participate actively in the consultation process. The consultations will be carried out in an appropriate manner taking into account differences based, among others, on culture, gender, etc. among the stakeholders. The PIU will initiate these consultation as early as possible, and provide relevant informative material in time prior to the consultation. The views and needs of the vulnerable groups will be given due consideration.

Stakeholders' consultation through participatory rural appraisal should be mandatory for all projects requiring land acquisition, compensation and resettlement for WSSP project activities.

During the screening stage, there must be adequate consultation and involvement of local communities, stakeholders and affected persons. Specifically, the affected persons must be informed about the intentions to use the earmarked sites for WSSP project activities, facilities and structures. The affected persons must be made aware of:

a) Their options and rights pertaining to resettlement and compensation;
b) Specific technically and economically feasible options and alternatives for resettlement sites;
c) Process of and proposed dates for resettlement and compensation;
d) effective compensation rates at full replacement cost for loss of assets and services; and
e) Proposed measures and costs to maintain or improve their living standards.

The aim of stakeholders' consultations at the screening stage would be to:

- disseminate information about proposed project activities with a view to provoking project interest amongst the communities;
- promote a sense of ownership for the project and resettlement activities;
- invite contributions to and participation in the selection of project sites;
- assess communities' willingness to contribute in kind towards project implementation; and
- review community's willingness to contribute towards long term maintenance of the project facilities.

Comprehensive and regular consultation with identified stakeholders should be done at every level during project planning and design. This will help in getting their feedback and suggestions for the analysis of alternative options and finalization of plans. Such consultation would be a pre-requisite for project implementation. Proper documentation, viz. of list of participants, minutes of meetings and photographs would be kept.

## 8.9 Role of traditional institutions, Water Users Associations (WUAs) , Water Users Groups (WUGs), the role of women in differential access to Project Benefits

### 8.9.1 Role of Community Based Traditional Institutions

It is observed that community based traditional institutions are playing very important role in managing community projects. The traditional way of monitoring water projects e.g. managing a well for irrigation/ agricultural use is based on joint ownership and shared by a group of individuals. The benefit in utilization of the well (i.e. diversion of abstracted water to their farm land) is equitably allocated in proportion to their contribution to well construction and/or operation and maintenance. Operation and maintenance cost is also shared among them in proportion to the benefits received.

Such traditional and informal rule of water sharing is effective in preventing conflicts among users and regulate/ limit quantity of water to each of the users "within the capacity of well". However, there is no binding, regulatory mechanism in this arrangement to limit the total amount of water extracted from a well. Moreover, such rule of water sharing is applicable only to a single well, but not to a number of neighboring wells in the community and/or other communities of the area. Thus, the traditional rule of water sharing fails to control the quantity of water abstraction from wells sharing the same aquifer in the area. Indeed it promotes competition in well drilling and overexploitation of groundwater in the area.

Such traditional institutions/stakeholder organizations could play very important role in managing the WSSP projects. These organizations have to be strengthened suitably and their management skills improved for effective participation in water management. In particular, these groups could contribute a lot in areas like:

1) Integrating and Social Investigation
- Gaining social acceptance
- Understanding and analyzing the social , cultural and political dimensions among and between the communities
- Creating awareness programs

2) Animation
- Identifying potential leaders

- Conducting formal meetings
- Motivating the community to realize their problems

3) Formalization
- Formulation of By-laws
- Membership enrollment
- Deciding criteria for representation in the WUA

4) Mobilizing Financial Resources
- Guiding the community to identify sources and mange for sustainability

### 8.9.2 Role of WUG/ WUA

Traditional Institutions/Community Organizers, such as "Water Users Group (WUG) and Water Users Association (WUA)", will be promoted and strengthened in WSSP project activities for participatory decision making and execution of projects. Capacity improvement measures of the WUG and WUA have been discussed in **Section 9-Institutional Capacity Building Programs**.

Some of the project components under WSSP, viz. demand responsive approach (DRA), including introduction of low cost technologies for pro-poor and improved irrigation technologies will involve participation of farmers' groups especially poor farmers and enhance their living standards.

### 8.9.3 Gender Participation

Women are the primary collectors, transporters, users, and managers of domestic water and promoters of home and community – based sanitation activities. Yet, the role of women in water management in Yemen country has not so far been appreciated. WSSP will suggest a strong link between a focus on gender and women's participation, on the one hand, and program sustainability, on the other.

By establishing and strengthening WUGs for women leads to benefits such as O & M, cost recovery, and health & hygiene awareness. The other benefits include the following:

- **Economic benefit:** Better access to water gives women more time for income-generating activities, the needs of family members, or their own welfare and leisure. The economy, as a whole, therefore also benefits.
- **Benefit to children:** Freed from the drudgery of water collection and management, children, especially girls, can go to school. Hence, the impact can be expected to be intergenerational.
- **Empowerment of women:** Involvement in WSSP projects empowers women, especially when project activities are linked to income-generating activities and productive resources such as credit.

Article III. **8.9.3.1 Nongovernmental Organizations and Especially Women's Group will Facilitate a Gender Balanced Approach**

NGOs will act as partners or intermediaries to mobilize local communities. Projects under WSSP could take advantage of existing NGOs with expertise and experience in working with local women to help project staff in reaching out to local women. Such an approach would enable women to take an active role in discussing project issues by forming women's' groups.

These groups would facilitate women's participation in activities like saving and loan group to improve their economic standards, family planning, local school parents committees, public awareness programs on issues related to women, promotion of handicrafts as well as other training and income generating schemes to upgrade existing skills and improve their socio-economic status. The NGOs/ Women's Groups could be involved in the sectors mentioned above, to facilitate empowerment of women in:

***Economic Upliftment***

- Promote economic opportunities for women, mainly in local handicrafts/ small-scale units and services.
- Provide credit to encourage women for off-farm work.
- 
- Facilitate skill upgradation and income generating activities
- Encourage private sector initiatives to employ women.

***Health Intervention***

- Provide affordable/ accessible health care services.
- Increase coverage and improve the quality of PHC services.
- Integrate reproductive and sexual health services with primary health care and better awareness of both sexes on reproductive issues in educational institutions/ community organizations.
- Improve the quality of health services, through provision of adequate medicine/ equipment/ training programs.
- Provide free health services for the poor and disadvantageous/ vulnerable groups; especially women.
- Encourage/ awareness/ and use of family planning methods by both men and women.

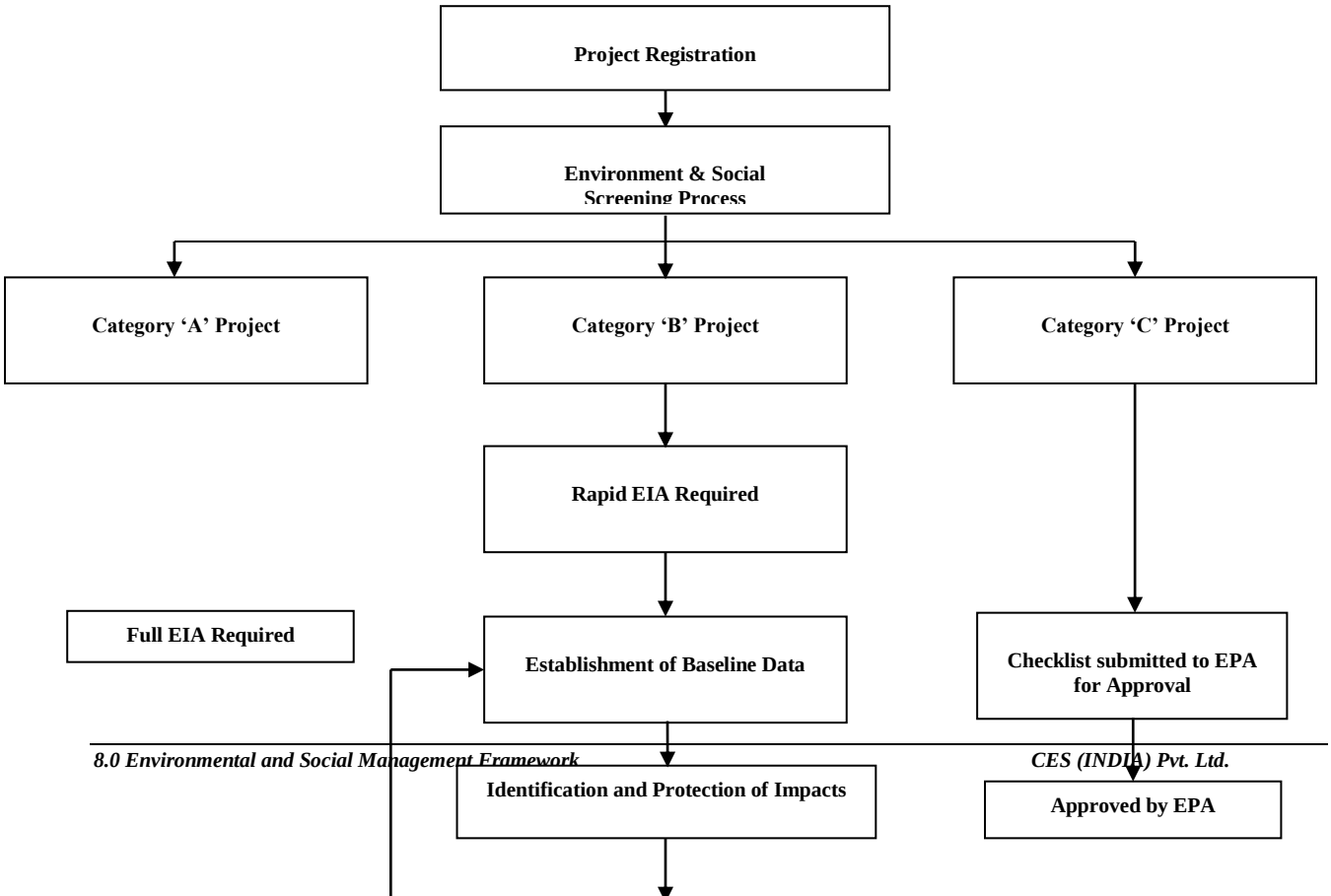
***Women's Participation and Awareness Campaign/ Training Programs***

- Encourage women to participate in local decision making
- Promote women participation at all levels in the political process.
- Involve women in participatory management process in WSSP projects
- Encourage greater number of women as members in WUGs/WUAs
- Design training programs for leadership and campaigning skills for women candidates, and increase their visibility in media.
- Awareness programmes regarding importance of girl child education, health and hygiene, sanitation, water rights and other social issues.

## 8.10 Institutional Needs Including Training and Equipment

Effective implementation of ESMF requires deployment of an Environmental Management officer in the office of the Project proponent for conducting and supervising the EIA study/screening of projects. The functions and duties to be performed by the EMO are discussed in detail in Section 10. Training aspects are discussed in Section 9.

**Annex 8.1 : Schematic Diagram for Conduction of Screening**



Note: Rapid EIA 4 Months and Full EIA 12 Months

## Annex 8.2 : Environmental Baseline Information of the Project Site

| CATEGORY OF BASELINE INFORMATIN | BRIEF DESCRIPTION |
|---|---|
| **GEOGRAPHICAL LOCATION**<br>• Name of the Area (District, Village)<br>• Proposed location of the project (include a site map of at least 1:10,000 scale) | No project area identified yet |
| **LAND RESOURCES**<br>• Topography and Geology of the area<br>• Soils of the area<br>• Main land uses and economic activities | No project area identified yet |
| **WATER RESOURCES**<br>• Surface water resources (e.g. rivers, lakes, etc) quantity and quality<br>• Groundwater resources quantity and quality | No project area identified yet |
| **BIOLOGICAL RESOURCES**<br>• Flora (include threatened/ endangered/ endemic species)<br>• Fauna (include threatened/ endangered/ endemic species)<br>• Sensitive habitats including protected areas e.g. national parks and forest reserves | No project area identified yet |
| **CLIMATE**<br>• Temperature | No project area identified yet |

| | |
|---|---|
| • Rainfall | |

| | AREAS OF IMPACT | | | IMPACT EVALUATION | | | | | | POTENTIAL MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|
| | Is the project site/ activity within and/ or will it affect the following environmentally sensitive areas? | | | Extent or coverage (on site, within 3km – 5km or beyond 5km) | | | Significance (Low, Medium, High) | | | |
| | | No | Yes | On Site | Within 3-5 km | Beyond 5km | Low | Medium | High | |
| **1.0 SCREENING CRITERIA FOR IMPACTS DURING PROJECT PLANNING AND DESIGN** | | | | | | | | | | |
| 1.1 | National Parks and game reserve | | | | | | | | | |
| 1.2 | Wet-lands | | | | | | | | | |
| 1.3 | Productive traditional agricultural/ grazing lands | | | | | | | | | |
| 1.4 | Areas with rare or endangered flora or fauna | | | | | | | | | |
| 1.5 | Areas with outstanding scenery/ tourist site | | | | | | | | | |
| 1.6 | Within steep slopes/ mountains | | | | | | | | | |
| 1.7 | Dry tropical forests | | | | | | | | | |
| 1.8 | Along lakes, along beaches, riverine | | | | | | | | | |
| 1.9 | Near industrial activities | | | | | | | | | |
| 1.10 | Near human settlements | | | | | | | | | |
| 1.11 | Near cultural heritage sites | | | | | | | | | |
| 1.12 | Within prime ground water recharge area | | | | | | | | | |
| 1.13 | Within prime surface run off | | | | | | | | | |
| **2.0 SCREENING CRITERIA FOR IMPACTS DURING IMPLEMENTATION AND OPERATION** | | | | | | | | | | |
| 2.1 | Deforestation | | | | | | | | | |
| 2.2 | Soil erosion and siltation | | | | | | | | | |
| 2.3 | Siltation of watercourses, dams | | | | | | | | | |
| 2.4 | Environmental | | | | | | | | | |

| | AREAS OF IMPACT | | | IMPACT EVALUATION | | | | | | POTENTIAL MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|
| | Is the project site/ activity within and/ or will it affect the following environmentally sensitive areas? | | | Extent or coverage (on site, within 3km – 5km or beyond 5km) | | | Significance (Low, Medium, High) | | | |
| | | No | Yes | On Site | Within 3-5 km | Beyond 5km | Low | Medium | High | |
| | degradation arising from mining of construction materials | | | | | | | | | |
| 2.5 | Damage of wildlife species and habitat | | | | | | | | | |
| 2.6 | Increased exposure to agro-chemical pollutants | | | | | | | | | |
| 2.7 | Hazardous wastes, Asbestos, PCB's | | | | | | | | | |
| 2.8 | Nuisance – smell or noise | | | | | | | | | |
| 2.9 | Reduced water quality | | | | | | | | | |
| 2.10 | Increase in costs of water treatment | | | | | | | | | |
| 2.11 | Soil contamination | | | | | | | | | |
| 2.12 | Loss of soil fertility | | | | | | | | | |
| 2.13 | Salinization or alkalinization of soils | | | | | | | | | |
| 2.14 | Reduced flow and availability of water | | | | | | | | | |
| 2.15 | Long term depletion of water resource | | | | | | | | | |
| 2.16 | Incidence of flooding | | | | | | | | | |
| 2.17 | Changes in migration patterns of animals | | | | | | | | | |
| 2.18 | Introduce alien plants and animals | | | | | | | | | |
| 2.19 | Increased incidence of plant and animal diseases | | | | | | | | | |
| **3.0 SCREENING CRITERIA FOR SOCIAL AND ECONOMIC IMPACTS** | | | | | | | | | | |
| 3.1 | Loss of land/ and acquisition for human settlement, farming, grazing | | | | | | | | | |
| 3.2 | Loss of assets, property-houses, agricultural produce, etc. | | | | | | | | | |
| 3.3 | Loss of livelihood | | | | | | | | | |
| 3.4 | Require a RAP or ARAP | | | | | | | | | |
| 3.5 | Loss of cultural sites, graveyards, monuments | | | | | | | | | |
| 3.6 | Disruption of social fabric | | | | | | | | | |
| 3.7 | Interference in marriages for local people by workers | | | | | | | | | |
| 3.8 | Spread of STIs and HIV and AIDS, due to migrant workers | | | | | | | | | |
| 3.9 | Increased incidence of communicable diseases | | | | | | | | | |
| 3.10 | Health hazards to workers and communities | | | | | | | | | |
| 3.11 | Changes in human settlement patterns | | | | | | | | | |
| 3.12 | Conflicts over use of natural resources e.g. water, land, etc. | | | | | | | | | |
| 3.13 | Conflicts on land ownership | | | | | | | | | |
| 3.14 | Disruption of important pathways, roads | | | | | | | | | |
| 3.15 | Increased population influx | | | | | | | | | |
| 3.16 | Loss of cultural identity | | | | | | | | | |
| 3.17 | Loss of income generating capacity | | | | | | | | | |

## Annex 8.3: Terms of Reference for the Environmental Impact Assessment

### 1. Introduction

At time of scoping, several key environmental issues will be after holding consultations with stakeholders of the project and review of the secondary data. Expert opinion is considered for identifying the issues.

The purpose of the Terms of Reference (TOR) therefore, is to ensure that the Consultant selected for the proposed Environmental Impact Assessment study will carry out necessary tasks as detailed out herein according to the standard procedures and ensure that all salient issues are covered in the study. This will form the basis for subsequent review process. In these Terms of Reference, strategies for addressing the issues identified during scoping have been provided to make the detailed study and hence the EMP review more focused.

### 2. Scope of Work for a Detailed Environmental Study

***Task 1: Project Description***

Present detailed description of the relevant project components and its activities.

Review information about the project and provide any missing information and data about the following:

- Location,
- General layout.
- Size and capacity,
- Production methods,
- Pre-construction and construction,
- scheduling of construction development activities
- Construction Material requirement and its sources
- Skilled and non-skilled workers requirement
- Life span of operations.

***Task 2: Baseline Environmental Set-up***

With reference to the baseline data and information existing at the project site and that contained in the scoping report, assemble, evaluate and present baseline data on relevant environmental characteristics of the study areas such as biophysical and socio economics and cultural aspects. Elaborate on the study areas and adjacent (marginal) areas should be considered, for example;

**Physical environment:**

- Geology;
- Topography;
- Hydrology
- Soils;
- Climate and meteorology;

- Ambient air quality;
- Surface water resources;
- Groundwater resources;
- Existing sources of air emission;
- Existing pollution discharges and receiving water quality;
- The borrow pits and waste rock disposal areas ( dams);
- Location of roadways and other support infrastructure.

**Biological environment:**

- Present baseline data on both the terrestrial and aquatic communities of flora and fauna found in the project area: General spatial arrangement of vegetative community types, vegetative species abundance listings, record of rare or endangered species, sensitive habitats, significant natural sites, species of commercial importance etc.;
- Nature of aquatic habitats;
- Conduct specific studies on the ecological/vegetation characteristics of all areas earmarked for project activities and facilities e.g., areas borrow pit sites for the raw materials and waste rock disposal, workshops and other infrastructure facilities.

**Social environment:**

Review baseline data and information on the socio-economic environment as provided in the scoping report and present any additional data related to the project area.

Task 3: Policy Legal and Administrative Framework

Describes pertinent regulations and standards governing environmental quality and management, health, safety, protection of sensitive areas, endangered species, land use control at relevant local, regional, national, and international levels.

***Task 4: Determination of Potential Impacts of the Proposed Project***

Identify and predict all possible impacts qualitatively and where possible quantitatively, of the project on the biophysical, socio economic and cultural environment. Specify the methodology used on predictions. In particular, the following issues will be addressed.

**Biophysical issues:**

- Provide baseline data on dust, quality of surface and groundwater;
- Examine and determine the requirements of water for construction operations and establish the possible potential sources;
- Identify current sources of pollution in main water sources such as rives and springs by taking into considerations the surrounding activities, e.g. animal grazing, charcoal burning, etc.;
- Examine the handling, storage and use of any chemical in the catchment around the source mining operations i.e., factory discharges, mining, and mechanical farming activities.
- Evaluate the loss and disturbance of biodiversity and threatened species resulting from the vegetation clearance during construction and operation and recommend mitigation measures;

- Examine evaluate the impacts that may result from generation of odors and noise from the equipment and machinery operating in the area and impounded waters;
- Evaluate health and nuisance problems resulting from dust, air and oil pollution from mobile equipment and machinery. Identify other existing pollutants in the project environment and recommend mitigation measures;
- Determine rehabilitation programs after project closure, with regard to land reclamation, re-vegetation, infrastructure, etc.;
- Guided by acceptable standards and regulations make recommendations on the design criteria to be used for the project quarry sites, borrow pit waste, rock dumps and support infrastructure.

**Socio-economic issues:**

- Conduct further consultations with those stakeholders who were not covered in the scoping stage and incorporate their suggestions accordingly;
- Examine possibilities and devise mechanisms for compensation of loss of income by people whose activities will be affected by the dam operations, e.g., irrigation, beekeeping and harvesting of medicinal plants within the project area;
- Review Government procedures and compensation rates for people living in areas earmarked for quarrying, involuntary displacement;
- Review the current and planned project outreach programs in relation with addressing issues associated with the influx of job seekers in the area versus pressure on resources and social services in the District;
- Conduct further consultations to ascertain the extent of both negative and positive social and economic contributions of the project;
- Identify people and groups (with gender considerations) that are most likely to benefit/be affected;
- Identify and evaluate the impacts resulting from influx of new people to the area, who may influence and affect the attitudes and behavior of people in the area;

***Task 5: Analysis and assessment of impacts***

The description of impacts should indicate whether impacts are positive or negative, direct or indirect, short or long term, reversible or irreversible.

Furthermore, the study should consider cumulative impact on a regional scale.

Guided by acceptable standards and regulations recommended the most feasible measures to eliminate/reduce/mitigate the impacts.

***Task 6: Analysis of Alternatives***

Describe alternatives that were considered or examined in the course of developing the proposed project. Also, identify other alternatives of achieving the same objectives in the case of sitting, design, technology, construction techniques, phasing, etc and compare them in relation to suitability under local conditions, potential environmental impacts and institutional training and monitoring requirements. The zero alternative scenarios should also be considered.

***Task 7: Develop an Environmental Management Plan to Mitigate Negative Impacts***

Propose feasible and cost effective measures to reduce the negative impacts.

Prepare an environmental management and monitoring plan in relation to operations in the project area to include the proposed programs, budget estimates, schedules, staffing and training requirements to implement the mitigation measures and impacts of the projects during the construction and the operational phase.

***Task 8: Develop the Monitoring Plan***

Prepare a detailed plan to monitor the implementation of the proposed mitigation measures and reduction of environmental impact of the new project during construction and operation phases. This plan should specify which parameters are to be monitored, at what interval and frequency, costing and assign responsibility i.e., who will be doing what, when and how.

***Task 9: Public involvement***

Ensure adequate public consultation and involvement in the environmental study process by consulting key stakeholders that were not covered during the scoping study. Review the consultation process undertaken during the scoping exercise. Ensure concerned stakeholders are involved and their concerns are taken to the board. The result of public consultations should be documented in the report.

**3. Reporting**

The final draft of the EIA report covering EMP will be prepared taking into account the requirement of Environmental Protection Law # 26, 1995. The report submitted in Arabic and English language. Consultant will submit the soft copy of the report. Upon approval of the draft report, Consultant will submit 10 (Ten) copies of the EIA reports including Executive summary covering all related information to the office of project proponent at sub –sector level (Project Level).

**4. References**

The objective of this section is to identify and record the written materials used in the study.

This is extremely important because some of the material used as background information may be in unpublished form, and yet it may be necessary that these are available during the review process. A list of references will be included in the final report together with the list of people contacted and summary of interviews.

# Table of Contents



**List of Tables**

# *SECTION-9.0: INSTITUTIONAL CAPACITY BUILDING PROGRAM*

The Water Sector Support Program (WSSP) will facilitate and expedite the implementation of the policies/ plans/ programs as outlined in the NWSSIP through existing government/ non-government agencies/ channels at national, governorate, and district levels.

Roles of various Governmental and Non-governmental agencies working in the water sector have already been discussed in Section 4.

The Environmental and Social Management framework (ESMF) in Section 8 has been devised to address the adversities which might arise from proposed sub-project interventions of WSSP.

Capacity building of various Governmental and non-governmental agencies is a prerequisite for successful implementation of the WSSP and the ESMF. In this context, a few the capacity building measures are briefly outlined below, aimed particularly at professionals involved in planning, programming, executing, monitoring and evaluating various activities.

## 9.1 Institutional Capacity Building Assessment

The Consultant has reviewed the current capacity of various governmental agencies working in the water sector. These have also been reviewed in the field using various tools such as key informant interviews, consultation meetings and discussions at national, governorate and agency levels.

### 9.1.1 Ministry of Water and Environment (MWE)

As indicated earlier in Section 4, MWE was established in 2003 to consolidate the government plans and activities in the water, sanitation, and environment sectors. The following agencies are operating in this sphere.

- Environmental Protection Authority (EPA)
- National Water Resources Authority (NWRA)
- General Authority Rural Water Supply and Sanitation Project (GARWSP)
- Local Water Supply and Sanitation Corporations (LC)
- National Water and Sanitation Authority (NWSA)

#### 9.1.1.1 *Environmental Protection Authority (EPA)*

As noticed earlier, EPA has a clear mandate for conservation of natural resources and implementation of environmental legislations for sustainable development covering, inter alia, the following objectives:

- Mitigation of adverse environmental impacts, if any, of various developmental activities.
- Reducing air pollution and moderating the impacts of climate change.
- Protecting human health and the civil society from environmentally damaging activities.

EPA has branch offices covering most of the Governorates. However, may of these are not adequately staffed and lack professional personnel and office. There is also a fund constraint.

Budgetary promises for the branch offices should be made available in time. EPA should be involved at policy, program and project level. EPA branch offices need to be involved closely in conducting awareness programs in various ongoing projects on deputation basis. EPA may, for example, be assigned the role of water quality monitoring in collaboration with NWRA and LC.

It was learnt during discussion with EPA officials that a program is underway for imparting training on Environment Impact Assessment with funding made available by the Government of the Netherlands. Their skills may be used for providing training on the relevant issues to the other line agencies, e.g., Public and Private Water suppliers, WUA's, WUG's, and Basin Committees.

- Introduction to the Environmental Management System.
- Implementation of environmental protection law, and other relevant laws/ regulations at policy, program, and project level.
- Role of various stakeholders in preservation of groundwater and the environment.
- Adverse Environment and Social Impacts of uncontrolled abstraction of groundwater.
- Positive impacts of groundwater savings through progressive use of modern irrigation techniques/ technologies.
- Negative impacts of improper use of groundwater.
- Associated adverse impacts on health due to the poor water quality.

#### 9.1.1.2 National Water Resources Authority *(NWRA)*

NWRA requires capacity building of its staff to discharge its functions including implementation of programs and activities like the ESMF and the WSSP. This would involve, among others, suggested measures:

- Proper attention to staff skill up-gradation through training programs/ refreshers courses.
- Regular appraisal of staff performance to ensure consistency.
- Incentives/ payments for promoting excellence and sustaining efficient staff.

The operational efficiency of the institution would also be benefited from:

- Expansion of the National network of monitoring stations and their linkage with the NWRA Information Center.
- Regular up-gradation of data on the country's water resources for professional reviewing of water resources availability and quality.
- Promoting and strengthening local community participation in water resources management from the planning to the implementation and monitoring/ evaluation stage.
- Establishing Water Quality Testing laboratories at national/ governorate/ district levels for more accurate monitoring of all parameters.

The skills and knowledge acquired by such trained staff may be used for mounting public awareness campaigns among the WUA's, WUG's, Basin Committees, and other community based organizations.

#### 9.1.1.3 *Local Water Supply and Sanitation Corporations*

The Government began a program of decentralization of urban water supply and sanitation services, under the 'Sectoral Reform Agenda'. In this, the functions of NWSA have been merged into new Regional Water Corporations in accordance with the Local Administration Act.

New water sector branches have been taken over and expanded the role of NWSA in the form of Local Water Supply and Sanitation Corporations.

There is a need to strengthen the branches of LWSSCs in order to implement the ESMF and EMP at construction site.

#### 9.1.1.4 *General Authority for Rural Water Supply Project (GARWSP)*

GARWSP is the lead agency for rural water supply and sanitation. It is actively involved in meeting the Millennium Development Goals along with other agencies and programs. A brief capacity assessment of this agency is as follows.

- GARWSP has established 20 branches covering all the Governorates.
- There is annual assessment of these branches in terms of technical, managerial, financial and administrative capabilities and performances.
- Based on the annual assessment, the branches are classified as A, B and C taking categories taking into account the availability of human resources, logistics and facilities such as staffing, furniture, equipment, instruments, and transportation facilities.
- GARWSP has plans for building capacities for various branches aiming at full decentralisation including transfer of the budgets to the accounts of these branches at governorates.
- Currently the recurrent budgets are transferred to the bank accounts of the branches.
- In order to strengthen the branches, category “A” branches may receive the investment budgets from 2009 and the other branches in 2010.
- Category “A” branches have powers of appointing financial, accounting and controlling staff to overview the delegated responsibilities of the branch.
- GARWSP has undertaken the following measures, among others, to develop and strengthen institutional capacity:

- Formulation and implementation of job descriptions indicating the tasks and mandates, organisational structures and implementation plans at the level of the general departments, sections and units and specialists.
- Mechanisms to simplify transactions within the authority and dissemination of information.
- Reviewing and updating price indicators for the evaluating bids to control process and costs for the works taken up by the authority.
- Annual review for qualification of the contractors and suppliers for quality control.
- Performance assessment of the staff of the authority and determining incentives accordingly.
- Eradication of the computer illiteracy among the staff of GARWSP and introducing computerised systems in its day to day operations to shift from manual to computerised functioning.
- Value for Money Audit especially for projects operations funded by the Government of the Netherlands (KNE). This will be applied to the general budget allocated by the GOY in future.

As suggested in the **Table 7.1,**.institutional measures for evaluating the project shall be adopted for strengthening the implementation of the EMP at construction site.

### 9.1.2 Ministry of Agriculture and Irrigation (MAI)

The Ministry of Agriculture and Irrigation (MAI) has responsibility for irrigation, dams and watershed management. Operation and maintenance of secondary canals in the main spate irrigation systems of the country is the responsibility of the MAI.

- Improve the irrigation efficiencies using the participatory management system.
- Restructuring of Regional/National Irrigation Institutions in Line with the Aden Agenda.
- As the decentralization and participation program proceeds, it is envisaged that the regional agencies like TDA and the Lahej Irrigation Department will reorganize to play a smaller technical support role whilst their scheme level staff may join the scheme management team that will be employed and paid for by the Scheme Water User Federations (SWUFs).
- General Directorate of Irrigation (GDI) is mainly involved in construction of small and medium dams. It does not have virtually role in planning irrigation development.
- It is envisaged that GDI is expected to take on a role, at the central level, in the overall planning of the sector, beginning with the spate improvement program.
- However, GDI is currently very weak and focused almost exclusively on the small dams program.

There is a need to strengthen the institutional capacity of GDI in the following aspects:

- ✓ Overall planning role.
- ✓ Preparation of guidelines and policies for irrigation improvement.
- ✓ Dam designing, operation and maintenance of dam
- ✓ Dam safety.
- ✓ Watershed management, catchments protection.
- ✓ Environmental and social impacts of the dam and their mitigation measures.

## 9.2 Non Governmental Agencies

### 9.2.1 Basin Committees

The Water Law 2002 supports decentralization process and encourages the formation of basin committees working closely with Local Councils in implementation of water management measures. But for all of this to translate into effective water management the following measures are prerequisite:

- Training of the committees in the environmental aspects covering
  - ✓ Groundwater conservation.
  - ✓ Efficient use of water in irrigation.
  - ✓ Salt water intrusion in the coastal areas
  - ✓ Lowering of water table,
  - ✓ Health impacts of drinking water quality.
  - ✓ Sanitation and hygiene.
- For sustainability of WSSP, the basin committee members will also need training for the implementation of ESMF particularly in the screening process.
- Mobilization of communities in support of the water resources management plans.

They will as act as training of trainers for the line agencies such as WUAs, and WUGs.

### 9.2.2 Water User Groups (WUGs)

WUGs are lowest level institutions to be supported by the project component for involvement of water users in the water resources management in the basin. WUGs around the well are already existing community groups. These “conventional” WUGs are informal farmers group that are usually organized around wells for irrigation comprising 5 to 10 co-owners. They are functioning on informal but customary bases as traditional entities to operate and maintain wells, structures, associated irrigations system (such as pumps, pipes, and distribution networks. WUGs are expected to perform the following role:

- Participate in project discussions and negotiating meetings at village level.
- Assist and cooperate with the project in its initial technical, organizational, socio-economic, and financial assessment.
- Establishment of village based WUA and deputation of WUG representative in it.
- Participate in demonstration of the project interventions.
- Types of investment to be made in their system.
- Amounts and mode of financial.
- Ensuring that implemented schemes under their wells and systems are not expanded.

In order to effective and successful implementation of the ESMF, it is a must that capacity building of this lowest rung stakeholder of any project intervention should get training on the following aspects:

- ✓ Environmental and social screening of the sub-project interventions of the WSSP
- ✓ Mitigation measures for the environmental impacts on the existing baseline conditions.
- ✓ Environmental and water laws
- ✓ Merits of the groundwater conservation
- ✓ Watershed Management and Terracing
- ✓ Catchments protection
- ✓ Ill effects of the uncontrolled abstraction of groundwater
- ✓ Importance of tree plantation on the groundwater conservation
- ✓ abuse of overdose of pesticides on health, soils, and groundwater
- ✓ Reasons of sea water intrusion in coastal areas.
- ✓ Their role towards conservation of environment
- ✓ Water resources Management and conservation
- ✓ Use of modern irrigation techniques and water savings
- ✓ Operation and maintenance of their project systems
- ✓ Health and hygiene

- ✓ Importance of girls' educations

### 9.2.3 Water User Associations

Water user associations (WUAs) are being promoted in different parts of the country for the efficient use of water. WUAs are formulated by consolidating number of WUGs for monitoring the relevant activities of the projects within a defined boundary. These organizations are legally recognized as they got registered in accordance with Law # 39 of 1998 regarding Cooperative Associations and Societies. An officially recognized village or well-field WUA is a prerequisite for participation in the program. WUAs are official stakeholders in the basin committees.

The role of WUAs is:[24]

- Coordination and exchange of information between WUGs.
- Formulation of water resources and irrigation management decisions and measures in the best interest of the community as a whole.
- Assist the project with coordination and execution of initial organizational, technical and socio-economic/financial assessments.
- Negotiate and research agreement on general conditions of the project interventions in community and specific types and locations of these.
- Ensuring that the project interventions expansion is contained in accordance with project conditions and its monitoring.

Project-related training to associations of water users is required for field-level managers of water resources in their area. In order to strengthen the role of WUA's, urgent attention is needed to impart training to them on the following aspects:

- ✓ Enhancement of their skill to mainstream environmental and social aspects in project planning, design, and implementation.
- ✓ Environmental and social screening of the sub-project interventions of the WSSP.
- ✓ Mitigation measures for the environmental impacts on the existing baseline conditions.
- ✓ Monitoring and evaluation process of the environmental and social indicators.
- ✓ Role of the WUA's in the implementation of WSSP.
- ✓ Environmental impacts of the uncontrolled abstraction.
- ✓ Watershed Management and Terracing.
- ✓ Catchments protection.
- ✓ Ill effects of the uncontrolled abstraction of groundwater.
- ✓ Importance of tree plantation on the groundwater conservation.
- ✓ Abuse of overdose of pesticides on health, soils, and groundwater.
- ✓ Reasons of sea water intrusion in coastal areas.
- ✓ Their role towards conservation of environment.

[24] The Study for Water Resources Management and Rural Water Supply, JICA, 2007

- ✓ Water resources Management and conservation.
- ✓ Use of modern irrigation techniques and water savings.
- ✓ Operation and maintenance of their project systems.
- ✓ Health and hygiene.
- ✓ Importance of girls' educations.

NWRA intended to work with MWE to set up a review process of WUA's. MAI also supported the need for a study of WUAs working in irrigation[25].

The training of these staff will be imparted through the already trained professional from EPA, NWRA, GAWRSP, and MAI. This training program will act as training of trainers in the field of environmental and social screening, impact assessment, devising mitigation measures, monitoring and reporting etc.

### 9.2.4 Water Users Association for GAWRSP

As GAWRSP is implementing the projects on the demand responsive approach for rural water supply projects, there is a need to form Water User Associations for GAWRSP. The committees' roles should be clearing defined while formulating the project report. In order to make the projects environmental sustainable, there is need to impart training to the committee staff. They will be formulated where no other projects are underway and Rural Water Supply Projects are in fray.

## 9.3 Environmental Management Officers at Village Level and Community Level

One of the members of WUAs, WUGs, and Watsan committees shall be assigned the responsibility of Environmental Management officers. Special training to EMOs shall be imparted on the following aspects with the help of branch level EPA, NWRA, and MAI officers.

- ✓ How to screen the subproject interventions of WSSP
- ✓ How to implement and monitor the EMPs
- ✓ How to manage the EIA process as suggested herein.

Trained staff will act as training of trainers to the other members and it would be appropriate to assign the duties of the environmental management officers annually.

## 9.4 Role of Water and Environment Center

The water and Environmental Center are currently imparting training courses on the following aspects:

- Water Resources Management
- Wadi Hydrology and Hydrogeology
- Water Quality Control
- Wastewater characteristics and its role in operation of the treatment plants
- Book and training: Rainwater harvesting projects; (awareness, operation and maintenance)

[25] Yemen's Water Sector Reform Program - A Poverty and Social Impact Analysis (PSIA), 2007

- Environmental Management Plan
- Water Resources Management
- Hydrochemistry and Water Quality
- Socio-economic Survey
- Supervising drilling
- Wadi Hydrology and Hydrogeology
- Introduction to IWRM
- Groundwater Modeling (Introduction)
- Wastewater management
- Decentralized awareness program on Wastewater management
- Groundwater Fundamentals
- Wastewater collection systems
- Wastewater treatment systems
- Unaccounted for Water
- Sanitation inside and outside buildings

It appears from the above listed topics that the WEC is having sufficient experience in framing modules for training courses on water and environment. Their expertise in imparting training to water sector stakeholder may be considered for strengthening the capacity of the water sector stakeholders.

**Table 9.1 Institutional Capacity Program (Information, Education, and Communication)**

| Sl. # | Training Issues | Trainees | Trainer | Minimum number of staff trained per year |
|---|---|---|---|---|
| 5. | ☞Global concern for Environmental protection<br>☞International treaties on Environment by the ROY and their importance<br>☞Global warming and climate change<br>☞Role of respective organization in conservation of Environment<br>☞Relevant Environmental Protection and Water Laws<br>☞Discuss Water Sector Support Program<br>☞Environmental and social impact assessment<br>☞Environmental and Social screening process of the subprojects<br>☞Discuss Environment and Social Management Framework | Head Quarter staff of MWE, MAI<br>✓ EPA,<br>✓ NWRA,<br>✓ LWSSC,<br>✓ GARWSP,<br>✓ GDI<br>✓ IIP<br>✓ GSCP | International Trainers/consultants in association with national training institutes such as Water and Environment Center of Sana'a University | At least Seven (7) staff per year, one from each agency |
| 6. | ☞Role of respective organization in conservation of Environment<br>☞Relevant Environmental Protection and Water Laws<br>☞Global warming and climate change<br>☞Discuss Water Sector Support Program and project interventions<br>☞Environmental and social impact assessment<br>☞Environmental and Social screening process of the subprojects<br>☞Discuss Environment and Social Management Framework | ✓ Environmental Management officers<br>✓ Representatives of the EPA, NWRA, GARWSP, LWSSC, and MAI branch offices<br>✓ Representative Basin Committees | Water and Environment Center of Sana'a University, and Trained staff from the Head Quarter | At least (25) staff per year, one from each agency<br>14 from basin committee – one from each basin |
| 7. | ☞Relevant Environmental Protection and Water Laws<br>☞Global warming and climate change<br>☞Discuss Water Sector Support Program and project interventions<br>☞Environmental and social impact assessment<br>☞Environmental and Social screening process of the subprojects<br>☞Discuss Environment and Social Management Framework<br>☞Health and Hygiene covering water supply and sanitation, solid waste disposal<br>☞Social Issues such as HIV, AIDS, Girls Educations Dam | Representative of WUA's, WUGs who is in-charge of Environmental Management | EPA and NWRA Branch offices | At least (25) staff per year, one from each agency<br>14 from basin committee – one from each basin<br>20 representative from WUA's |

**Table 9.1 Institutional Capacity Program (Information, Education, and Communication)**

| Sl. # | Training Issues | Trainees | Trainer | Minimum number of staff trained per year |
|---|---|---|---|---|
| | Safety<br>☞Importance of Data sharing<br>☞Role of respective organization in conservation of Environment | | | |
| 8. | Public Awareness Campaign on Groundwater conservation, Health and Hygiene, Water Borne Disease, Merits of controlling of Illegal Drilling, Modern Irrigation Technology, Demerits of Water theft or illegal connections | | Through EPA, NWRA, and WEC | In All governorates at |
| | | | | |

## Table of Contents



**LIST OF TABLES**



**LIST OF FIGURES**



**ANNEXES**

# *SECTION-10: ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM (ESMP)*

Proper implementation of the mitigation measures suggested in **Section 6.0** would require a monitoring mechanism for evaluating specified environmental parameters during the implementation and operational phases of the project. Such a mechanism is discussed in the following sub-sections.

## 10.1 Institutional Arrangement for Environmental Monitoring

MWE will be responsible overall for monitoring the environmental issues through the EPA. It would be specified that the function envisaged for Environment Protection Law #26 of 1995 include:

- Preparing and implementation of policies/ strategies/ plans to protect the environment.
- Conducting environmental surveys.
- Assessing the areas/ resources/ species which are to be protected through necessary enactment.
- Conserving the ecosystem including flora and fauna, wild and marine life according the existing laws and monitors their application.
- Developing proposals for legislations with respect to protection of the environmental in coordination with related agencies.
- Developing a national emergency plan to combat natural disaster and environmental pollution in consultation with the concerned agencies.
- Executing the environmental laws in coordination to with agencies concerned.
- Pursuing the execution of policies, and stipulations.
- Reviewing EIA studies of public and private projects for giving its views and monitoring their implementation.
- Implementing the criteria stipulated for protecting the environment and natural resources.

### 10.1.1 Monitoring at National Level

The review of EPA's function clearly shows that the EPA has a mandate to monitor the implementation of environmental polices and the criteria stipulated to protect the natural resources, and mitigate environmental pollution. Hence, the WSSP project interventions will also be monitored by EPA. Its involvement at policy and program level would have an important impact on policy project preparation/ evaluation. EPA may depute its representatives for site visits during project implementation/ operation phases. However, necessary funds have to be allocated so that EPA can have effective involvement in such activities.

### 10.1.2 Monitoring at Governorate Level

The existing EPA branch offices will be responsible for evaluating Environmental and Social screening processes as well as EIA reports prepared by the project activities of the WSSP interventions.

EPA office at Governorate level may monitor closely implementation of the management plan more frequently. Environmental Management officers located in project level will submit quarterly environmental audit reports to the branch office

### 10.1.3 Governorate Level (Environmental Management Officer – Implementation Phase)

Environment Management Officer (EMO) will be deployed for project level monitoring. Such officers may be either on contract basis or from other governmental agencies with necessary qualification and experience. The EMO will ensure the implementation of the environmental management plan in detail. Hence, it is essential that the EMO should have appropriate be knowledge and adequate work experience in Environmental and Social Screening as well as EMP execution. He will be directly responsible to the Project Director or the Head of the project unit at the Governorate level. He will interact regularly with the EPA/ NWRA, and other related agencies, e.g. WUAs, WUGs and Basin Committee.

The EMO will give comments/ suggestions as and when necessary on the environmental issues relating to the mitigation measures and management plan. He will visit borrow areas/quarry sites opened by the Contractor after approval from EPA, construction yards/ camps as per the EMP. The scope of work of EMO is given in **Annex 10.1**.

## 10.2 The EMO's Role during Preconstruction Phase

The EMO's role during the preconstruction phase would, inter alia, involve:

- Interaction with the EPA/NWRA/Basin Committees/WUAs/WUGs/ NGOs
- Monitoring Environmental and Social Screening Process
- Screening of Project Activities and Site Assessment
- Environmental and Social Impact Assessment
- Assigning the appropriate category to the project
- Liaison with the EPA during review and approval process
- Attending Public Consultation Meetings during disclosure and approval process
- Establishment of baseline data
- Identification of Environmental Impacts for project intervention

## 10.3 The EMO's Role during Construction Phase

The EMO's role during the preconstruction phase would, inter alia, involve:

- Monitoring with the help of environmental committees, the parameters given in the schedule **Table 8.3** earlier, viz.:
  - Air quality and noise quality due to construction yard activity

- Construction Workers Colony/site office
- Noise Pollution at site

- Air Pollution at site
- Equipment storage and maintenance yard
- Occupational Health and Safety
- Borrow pits and quarrying areas
- Disposal of Debris
- Public Safety Arrangements
- Environmental Monitoring
- Necessary clearances from the EPA/ NWRA etc.

### 10.4 Monitoring Plan during Operational Phase

Post construction, project monitoring will have the following objectives:

- Identifying/ evaluating alterations in the existing physical, chemical, biological, and social environment.
- Determining whether any detected changes in the environmental parameters are caused by the project intervention or natural occurrence.
- Assessing the effectiveness of the ameliorating measures.
- Providing early warnings of any potentially serious problem.
- Reviewing long term impacts.

#### 10.4.1 Site Inspections

During construction and operation phases, occasional site visits by the Regulatory Authorities viz., the EPA/ NWRA etc. are recommended. This will help implementation of mitigation measures suggested in the ESMF. The Contractor has to ensure access to all construction sites without any reservation.

The EMO will make regular site visits as per the suggested monitoring plan to follow up implementation of the mitigation measures during construction and operation phase.

To facilitate site visits during the construction phase, a checklist is given in **Annex10.2**. The checklist will be distributed to all parties concerned with the construction process.

#### 10.4.2 Environmental Audit Reports

Based on site observations, EMO will prepare and submit monthly environmental audit reports to the project authorities. Quarterly implementation progress will be submitted to the EPA. The audit report will broadly assess the issues as under:

- compliance with regulatory requirements
- compliance with the mitigation measures stipulated in the ESMF

- EMP implementation plans of the Contractor
- preventive and corrective actions and suggestions for effective ESMF implementation
- environmental performance of the contractors at the project site
- progress of EMP implementation and compliances
- environmental capacity building measures

### 10.5 Village Level

It is proposed that within the Basin Committees/ the WUAs/ WUGs/ the village representatives will form environmental management committee at the village level to supervise the day to day implementation of the EMP. These committees will report to the EMO at project level. These committees will specifically monitor:

- Execution of environmental and social work
- Implementation of resettlement plans
- Environmental parameters and issues
- Traffic and public safety arrangements
- Occupation health and safety arrangements at civil construction sites
- Environmental parameters during operations and maintenance of the infrastructure facilities
- Submission of the monitoring reports to EMO

### 10.6 Annual Reviews

It is proposed that the implementation of the provisions of the ESMF shall be recorded in the environmental audit report prepared by EMO on monthly basis. Basin committees, WUAs, and WUGs will also help EMO in preparation of the reports. EMO will send the monitoring reports to the branch EPA offices.

Annual reviews would promote and strengthen the implementation and monitoring of the ESMF. Such reviews may be held with the joint annual review. The objective of such reviews will be to:

- evaluate compliance with the provision of ESMF
- assess the occurrence of, and potential for, cumulative impacts due of WSSP interventions and other developmental activities in the area.

Such annual reviews will also help the Donors to evaluate the implementation of ESMF provisions.

Annual reviews would broadly cover, among others, a summary of results, frequency of site visited by EMO, recommendations made by EMO during site visits, ESMF performance, and methodology adopted to resolve the other social issues.

Copies of such reports shall be forwarded to EPA head quarters/ WSSP unit at MWE. WSSP unit at MWE may include ESMF progress in the JAR workshops where EPA shall make a presentation.

The budgetary cost estimates for monitoring plan is given in **Table: 10.1**.

## Table 10.1: Budgetary Cost Estimates

| Sl. No. | Activity | Unit | Amount per Annum | |
|---|---|---|---|---|
| 6. | Salary of EMO including all allowances | USD | 1512000 | |
| 7. | Assess adequacy of the subproject Approval and procedures | USD | 84000 | EPA |
| 8. | Assess adequacy of roles and responsibilities, procedures, forms, information resource materials | USD | 84000 | EPA |
| 9. | Monitoring and Site Visits by EPA officials | USD | 84000 | EPA |
| 10. | Identify key risks to the environmental and social sustainability of subprojects | USD | 110000 | Lump sum for whole period |
| Total | | | 1874000 | |

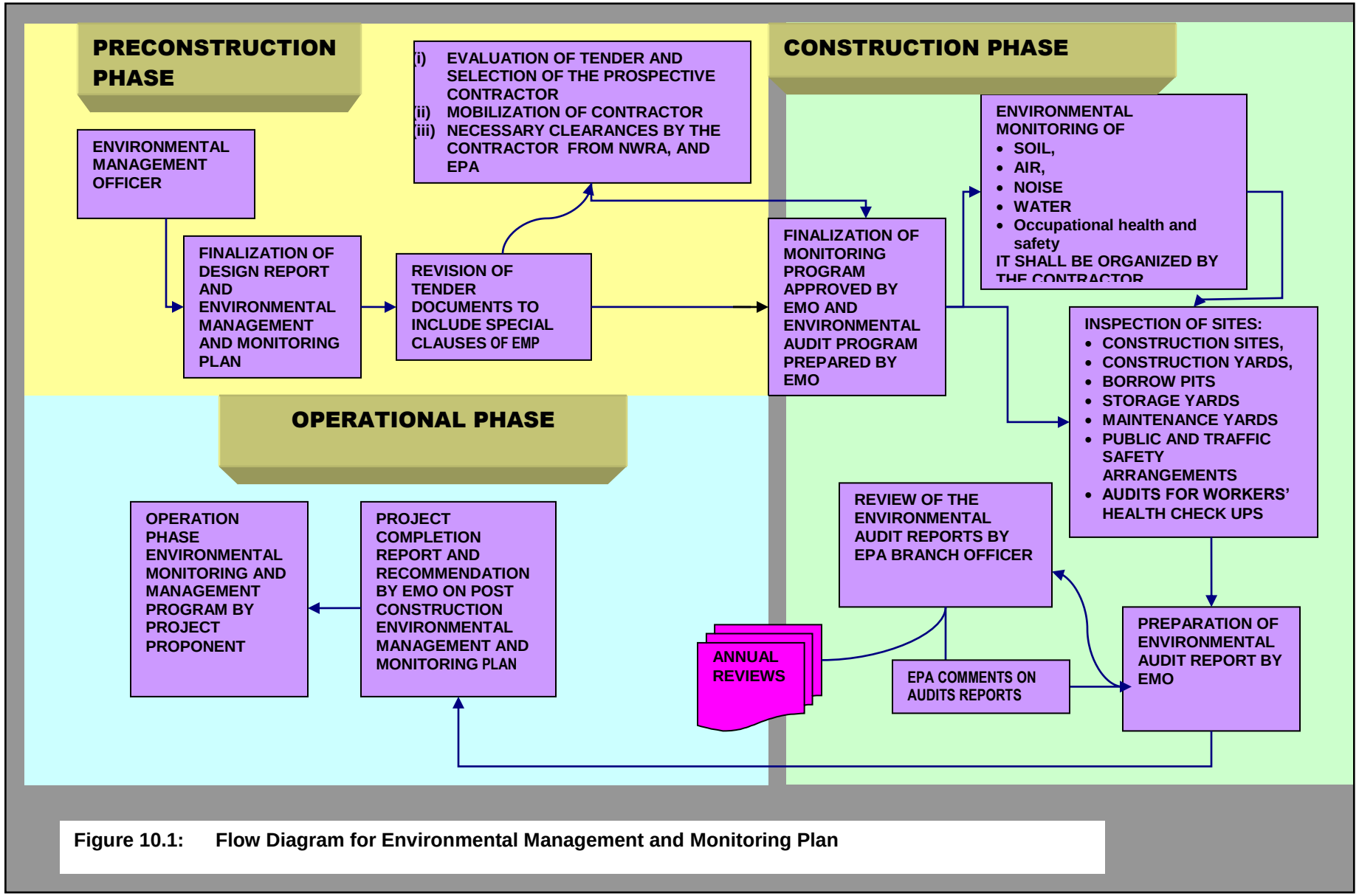



**Figure 10.1: Flow Diagram for Environmental Management and Monitoring Plan**

### 10.7 Monitoring and Evaluation of Resettlement Plan

Regular monitoring and evaluation are critical for resettlement and rehabilitation programs. Monitoring involves periodic checking to ascertain whether the resettlement and rehabilitation activities are helping the PAPs in setting down in new resettlement areas. Evaluation is essentially a summing up of the progress of resettlement and rehabilitation at the end of the project, assessing the actual achievement in comparison to those aimed at during the implementation period.

Project Management Committee (PMC) will be responsible for internal monitoring through their Project Implementation Unit (PIU). It should prepare quarterly reports on the progress of the implementation of Resettlement Action Plan (RAP).

An Independent monitoring agency or a local consulting firm or a local NGO will carry out an external monitoring of the implementation of resettlement plan on periodical basis. Such an agency will not be a fault finding but also will act as a catalyst in facilitating the process of Resettlement and Rehabilitation (R&R) and provide a helping hand for proper implementation of rehabilitation programs. PMC should select and hire the consulting firm/ NGO.

### 10.8 Annual Reviews/ Internal Monitoring

The Resettlement Plan includes indicators and bench marks for achievement of the objectives as under:

**a. Process indicators**

Resettlement and Rehabilitation process including project inputs, expenditures, staff deployments, etc will be monitored by the PMC and the project office. In case of any delay or any obstacle the work program has to be adjusted. The major items for monitoring process indicators are;

- Information campaign and consultation with PAPs;
- Status of land acquisition and payments on land compensation;
- Resettlement of Project Affected Persons (PAPs);

**b. Output indicators**

Output indicators are:

- Results in terms of numbers of affected persons compensated and resettle; and
- Incomes restored; and
- Additional assistance provided

**c. Impact indicators**

Impact indicators are factors related to the long-term effect of the project not only on PAPs but also on those people in the project affected area as a whole. Field level monitoring will cover:

- Review of census information for all PAPs;

- Consultation and informal interviews with PAPs on their life and feelings in the resettlement areas;
- In-depth case studies, in case there is any particular case worth paying special attention;
- Informal sample survey of PAPs;
- Key informant interviews; and
- Holding a number of community meetings at the resettlement site as well as the site directly affected by the Project.

### 10.9 Monitoring at Field Level

A Performa data sheet will be used in order to carry out monitoring works at the field level as detailed in **Table 10.2**.

**Table 10.2: Indicators to be Used to Carryout Monitoring Work**

| Sl. No | Indicator | Unit | Pre Project Status | After Project Implementation |
|---|---|---|---|---|
| **1** | ***Literacy (PAPs)*** | % | | |
| **2** | ***Economic*** | | | |
| | Annual Income (in Rs.) | Average | | |
| | Earning person per family | Average | | |
| | Family under debt ( No.) | % | | |
| | Family under debt (in Rs.) | Average | | |
| | Families living in low income (poor families) | No. | | |
| **3** | ***Land holding before land acquisition*** | | | |
| | Land holding size (in Ha.) | Average | | |
| **4** | ***Productivity*** | | | |
| | Rice/Acre (in 100 Kg.) | Average | | |
| | Wheat/Acre (in 100 Kg.) | Average | | |
| | Maize/Acre (in 100 Kg.) | Average | | |
| **5** | ***Animal Stock*** | | | |
| | No. of livestock (Draught animal, milk animal, young stocks, sheep, goats, etc) | Average | | |
| **6** | ***Vehicles for personal use*** | | | |
| | Two Wheeler | No. | | |
| | Four Wheeler | No. | | |
| **7** | ***Vehicle for commercial use*** | No. | | |
| **8** | ***Occupation*** | | | |
| | Cultivators | % | | |
| | Agriculture labor | % | | |
| | Wage Labor | % | | |
| | Business | % | | |
| | Service | % | | |
| **9** | ***House Type*** | | | |

| Sl. No | Indicator | Unit | Pre Project Status | After Project Implementation |
|---|---|---|---|---|
| | Temporary | % | | |
| | Semi Permanent | % | | |
| | Permanent | % | | |
| | Separate Kitchen | % | | |
| | Separate Toilet | % | | |
| | Rooms | Average | | |
| | Size of House (Sq. ft.) | Average | | |
| **10** | ***Material Assets*** | | | |
| | T.V. (No ) | % | | |
| | Refrigerator (No.) | % | | |
| | LPG (No.) | % | | |
| **11** | ***Health Related*** | | | |
| | Major Disease if any ( Bilharzias, Asthma, Gastric – families) | % | | |
| | Families hospitalized | No | | |
| | Expenditure on health | Average | | |

### 10.10 External Monitoring

During implementation, monitoring will be carried out by Independent Consultants/ NGO. They should inter alia:

- identify and select impact indicators,
- carry out impact assessment through formal and informal surveys with the PAPs
- local government officials and community leaders
- assess efficiency of the process of rehabilitation procedures in terms of effectiveness and sustainability
- draw attention to the lessons learnt during resettlement and rehabilitation activities, and
- suggest the future rehabilitation policy and planning method.

The items of monitoring would cover:

- Review and verification of the internal monitoring reports prepared by Project Implementation Unit and the field offices;
- Review of the socio-economic baseline census information of the PAPs;
- Socio-economic conditions of the PAPs in the post-resettlement period;
- Opinions of the PAPs on the entitlements, compensations, general assistance, alternative development programs to livelihood restoration program and their timetable;
- Actual changes in housing conditions and income levels in the post-resettlement period;

- Livelihood rehabilitation of non-title settlers; and
- Grievance procedures.

NGO assisting PIU will conduct Information and Community Consultation Program (ICCP) in the project area in respect of resettlement and rehabilitation plan. It is a part of social environment monitoring plan of the resettlement and rehabilitation of PAPs. The NGOs would:

a. Assist the PIU in implementation of resettlement and rehabilitation plan including mitigation measures for avoiding adverse effects imposed on PAPs by the Project;

b. Prepare information materials in local language explaining the resettlement and rehabilitation plan, e.g. project brochures and pamphlets to be used for disclosure of information regarding the project objectives, entitlement, compensation principles and procedures, and implementation schedules;

c. Advise and assist PIU in the provisions for implementation of resettlement and rehabilitation plan concerning the livelihood and income restoration programs;

d. Work in close cooperation with PMC and relevant agencies involved in the valuation of assets acquired and payment of compensation;

e. Educate the PAPs on their right to entitlements and obligations;

f. Ensure that the PAPs are paid their full dues and entitlements;

g. Facilitate and organize training programs and provide support and gather information from PAPs for income restoration program;

h. Assist the PAPs in redressing of their grievances through the grievance redress mechanism;

i. Assist the Project Implementation Unit of PCU discharging properly the social responsibilities of the Project, regarding among others, safety regulations, prohibition of child labor, HIV/AIDS and gender issues; and

k. Participate in the monitoring system and prepare progress reports.

### 10.11 Reporting Cycle/ Frequency

PIU should collect information from the project site and report it through monthly progress report to assess the progress and results of the implementation of resettlement plan and submit it to PMC. The MWE may submit these reports to the funding agency/ Donors or may be stipulated in the project agreement. The external M&E expert will submit annual review to the PMC and assess whether resettlement goals have been achieved, more importantly whether the livelihoods and living standards have been restored/ enhanced and suggest suitable recommendations for improvements. **Table 10.3** provides details on the contents and timing for various reports associated with Monitoring and Evaluation (M&E).

**Table 10.3: Reporting Cycle/ Frequency**

| Activity | Content | Timetable |
|---|---|---|
| Monthly Progress Report | Narrative as per Monitoring Plan format giving details on activity, results, issues affecting performance and variance, if any, and reasons for the same and corrections recommended | To be submitted within 10 days of the next month |
| Quarterly Progress Report | Expenditure Vs. budgeted amount by budget heads and sub-heads | To be submitted within 30 days of end of financial quarter |
| Mid-term and Annual Reports | Narrative as per reporting format giving details on activity, results, issues affecting performance and variance, if any, and reasons for the same and corrections recommended | To be submitted within 30 days after the mid-term and year-end |
| Annual Financial Audit | Project achievements, failures and impacts | To be submitted within 90 days of end of the project |

## Annex 10.1: Terms of Reference for Environment Management Office

The activities to be performed by the Environmental Management officer (EMO) are as follows:

### A-10.1.1 Construction: Inspections and Audits

The EMO will have responsibility for **environmental audits,** which should be contracted out to responsible agencies, or individuals, on a commercial basis. Independent reports of audit findings will be prepared as part of the contract.

### A- 10.1.2 Environmental Quality Monitoring

The EMO will directly supervise EMP related implementation. He will contact responsible agencies such as the Faculty of Engineering at the Sana'a University and EPA. He will liaise with the agency, if any, employed to carry out the required monitoring and testing program. Monitoring agency, if any, will also provide the assessment reports. Each report shall cover at least the following sections:

- Equipment calibration reports including other background material findings.
- Sampling procedures and analysis methodologies
- Analysis of the findings highlighting any changes of significance and probable causes of change
- Recommendations on actions to be taken
- Follow up on any previous recommendations and possible,

Deliverables prepared by the Monitoring Agency will be submitted to the EMO, EPA through the project authorities, and agencies such as, NWRA, NGOs, Citizen's Committee, etc.

### A-10.1.3 Construction Monitoring

The construction monitoring phase will require at least but not limited to the following;

#### A-10.1.3.1 Inspection Reporting

After each inspection, EMO will prepare a report containing location and activity under progress, areas of non-compliance with the EMP.

He will give remarks on actions to be taken for proper implementation of the mitigation measures at the construction sites/yards.

The significance of the non-compliance shall also be noted. Copies of these reports will be submitted to project authorities, the EPA, the supervising engineer, the traditional institutions, and the contractor for their action.

The inspection reports shall be compiled quarterly as a review document. It will also highlight any areas of persistent negligence by the contractor. This document will also contain records of any communications between the supervising engineer, EMO and the contractor on matters relating to the environment.

#### A-10.1.3.2 Audit Reports

After each audit, reports will be prepared containing:

- Background data, time, facility, operations underway, etc.

- Statement of Findings of the Audit
- Statement of compliance with the recommendations of the previous audit
- Recommendations for future action

These will be submitted by the sub-contractor to the EMO. He will review the documents and circulate to the site owners and operators with any additional recommendations from project authorities. All these reports will be properly maintained for any reference in the future.

#### A-10.1.3.3 Semi-Annual Environmental Reports

The EMO will be responsible for the preparation of semi-annual Environmental Reports. These reports should be produced throughout the construction period. They will be prepared following the Donor Group supervision missions. These reports will cover findings of the environmental audit and consultation processes. It is envisaged that each report will have two main sections:

(i) Review of Project Performance

This will outline the performance of all agencies involved in the Project, improvement or deterioration, as measured against previous baselines and established targets where appropriate; and establish new performance targets.

In this context, it is also recommended that appropriate, specific targets be employed in the assessment process to ensure that the findings permit direct comparison with previous performance and in the context of defined objectives. If a specific evaluation technique or framework is not adopted, annual targets for achievement will need to be defined for the upcoming year in the annual report.

The assessment should draw on the findings of the inspection reports, monitoring programs and environmental audits.

(ii) Review of Project Works

This would comprise a review of all actions undertaken within the Project in the previous period. It will include:

- progress reports 6n project and program implementation comparison to Baseline Indicators
- summary report on training program/workshops held, etc. activity report on the awareness campaign
- activity report of site inspections program
- activity report from the monitoring and audit program

In general terms each report will contain:

- background to the project/program/works summary statements of methodologies adopted summaries of findings
- analysis of environmental audits
- a statement of lessons learnt
- any new mitigation measures to be implemented recommendations for future works

#### A-10.1.3.4 End of Project Report

On completion of project construction works, the EMO will prepare an end of project monitoring review report. This will contain:

- background to the project
- the empirical findings of the monitoring program and the site inspections
- a statement on the methodologies adopted for monitoring, the suitability of equipment utilized, its performance, the practical and technical difficulties experienced in collecting and analyzing the data, recommendations for future works
- a statement on suitability of resources available for monitoring and inspection and recommendations for future works
- a statement on the efficiency, or otherwise, of mitigation measures proposed
- a statement on the significance of any changes identified, both physical and social, as compared to those predicted
- a statement of lessons to be learnt and recommendations on any actions to be taken to ensure that these lessons are translated into positive actions on future projects
- a summary statement of the overall impact on the environment of the construction phase

## Annex 10.2: Checklist for Monitoring the Implementation of EMP

A model check list is given below for monitoring the implementation of mitigation. The representatives of WUAs and WUGs will fill this checklist and EMO may also verify these monitoring indicators during his field inspections.

**Checklist of the activities to be checked by the EMO**

| Description of Activities | Yes | No | Remarks, if any |
|---|---|---|---|
| **1. General:** | | | |
| - Are required recommendations of EMP generally being met and maintained? | | | |
| - Have workers working in the noisy areas been provided with protective devices? | | | |
| - Are workers working in good sanitation system? | | | |
| - Are medical check-up being done for the workers and particularly tests for HIV/AIDS? | | | |
| - Are construction personnel, equipment, and vehicles operating within the defined work area? | | | |
| - Is sprinkling of water being done in densely populated areas? | | | |
| - Are garbage, construction debris, and other waste being collected regularly and disposed off properly? | | | |
| - Are the vehicles carrying material and debris being covered properly? | | | |
| - Are the vehicles using approved access routes? | | | |
| - Are all necessary utility approvals, diversion plans, and traffic management plans in place? | | | |
| **2. Access Roads:** | | | |
| - Are access roads properly demarcated? | | | |
| - Is run-off from access roads causing water logging? | | | |
| **3. Camps:** | | | |
| - Are camps located correctly? | | | |
| - Are lavatory facilities provided in construction camps? | | | |
| - Is septic tank built in the camps? | | | |
| - Is proper drainage system provided? | | | |
| - Is water logging condition prevailing inside the camp? | | | |
| - Are potable water facilities provided inside the camp? | | | |
| - Are domestic refuse and solid waste collected regularly and disposed to the approved landfill sites? | | | |
| - Are camps secured properly? | | | |
| - Are all fuel stores etc placed on appropriately sized hard stands? | | | |
| - Are fuelling and maintenance of equipment conducted at defined sites? | | | |
| - Are proper records being kept on volume of waste generated? | | | |

**Checklist of the activities to be checked by the EMO**

| Description of Activities | Yes | No | Remarks, if any |
|---|---|---|---|
| - Are first aid facilities provided at sites and camps? | | | |
| - Are good house keeping practices followed at camps? | | | |
| **4. Material storage:** | | | |
| - Are spoil heaps of an appropriate size? | | | |
| - Are materials stored properly? | | | |
| - Is there evidence of excessive wind blowing off material? If so, such material should be stored in confined places. | | | |
| - Is there evidence of turbid waters running off from heaps? | | | |
| **5. Excavation and digging works:** | | | |
| - Are excavated sites shielded properly at/near sensitive receptors like schools, mosques, and institutional buildings? | | | |
| - Are access points to the excavated sites or trenches appropriate? | | | |
| - Is top soil being salvaged and placed as specified in the contract specifications? | | | |
| - Are men working in excavated site or trenches equipped and protected properly? | | | |
| - Is cut material placed away from sides of excavated sites or trenches? | | | |
| **6. Backfill:** | | | |
| - Are soil and topsoil properly replaced without mixing? | | | |
| - Is backfill done properly? | | | |
| **7. Construction sites:** | | | |
| - Are site secured properly? | | | |
| - Are warning signs/cautionary boards placed near the construction site? | | | |
| - Are deep excavated sites barricaded properly especially near schools, mosques, hospitals, and the roads? | | | |
| - Are good house keeping practices followed at construction sites? | | | |
| - Are proper public safety provided near the operation of heavy equipments? | | | |
| - Are materials stored properly especially bitumen? | | | |
| **8. Clean up:** | | | |
| - Is the final clean up appropriately timed up? | | | |
| - Has all man-made debris peers removed? | | | |
| - Has access to all areas been restored? | | | |
| - Have all excavated sites /trenches/construction camps/workers camps been restored to as close as practicable to original configurations? | | | |

## Table of Contents



**ANNEXES**



■

# *SECTION-11.0: THE PUBLIC CONSULTATION PROCESS AND ITS OUTCOME*

## 11.1 Consultative Process of Study

Public consultation is an important tool for collection / dissemination of information as well as awareness creation during the project planning stage. It provides valuable inputs and facilitates public participation and involvement project implementation.

## 11.2 Objectives of Public Consultation Meetings

Public Consultation Meetings were held to promote public awareness and understanding of the proposed Water Sector Support Program interventions at the sector level, disseminate information about the program and provide opportunities to the stakeholders for participation in the assessment process. The objectives are as under:

- Encourage participation of the stakeholders in the design, implementation and review of the project through:
  - timely disclosure of frank and comprehensive project information, its benefits and disadvantages; and
  - provide opportunities for information disclosure and maintaining communications in a culturally appropriate and practical manner.
- Identify stakeholder issues and concerns; and
- Build trust and allay suspicions/ fears by documenting consultations/ discussions, and by being accountable and transparent in the process.

## 11.3 The Process

Public Consultation includes the following steps:

- Identify stakeholders with a specific interest or concern in a program.
- Consult those stakeholders to appreciate their interests/ concerns/ expectations.
- Develop appropriate strategies, approaches and plans to address stakeholder interests and concerns.
- Review plans with stakeholders for revision/ improvements
- Follow up with stakeholders over plans and progress on specific initiatives.

## 11.4 Level of Public Consultation Meetings

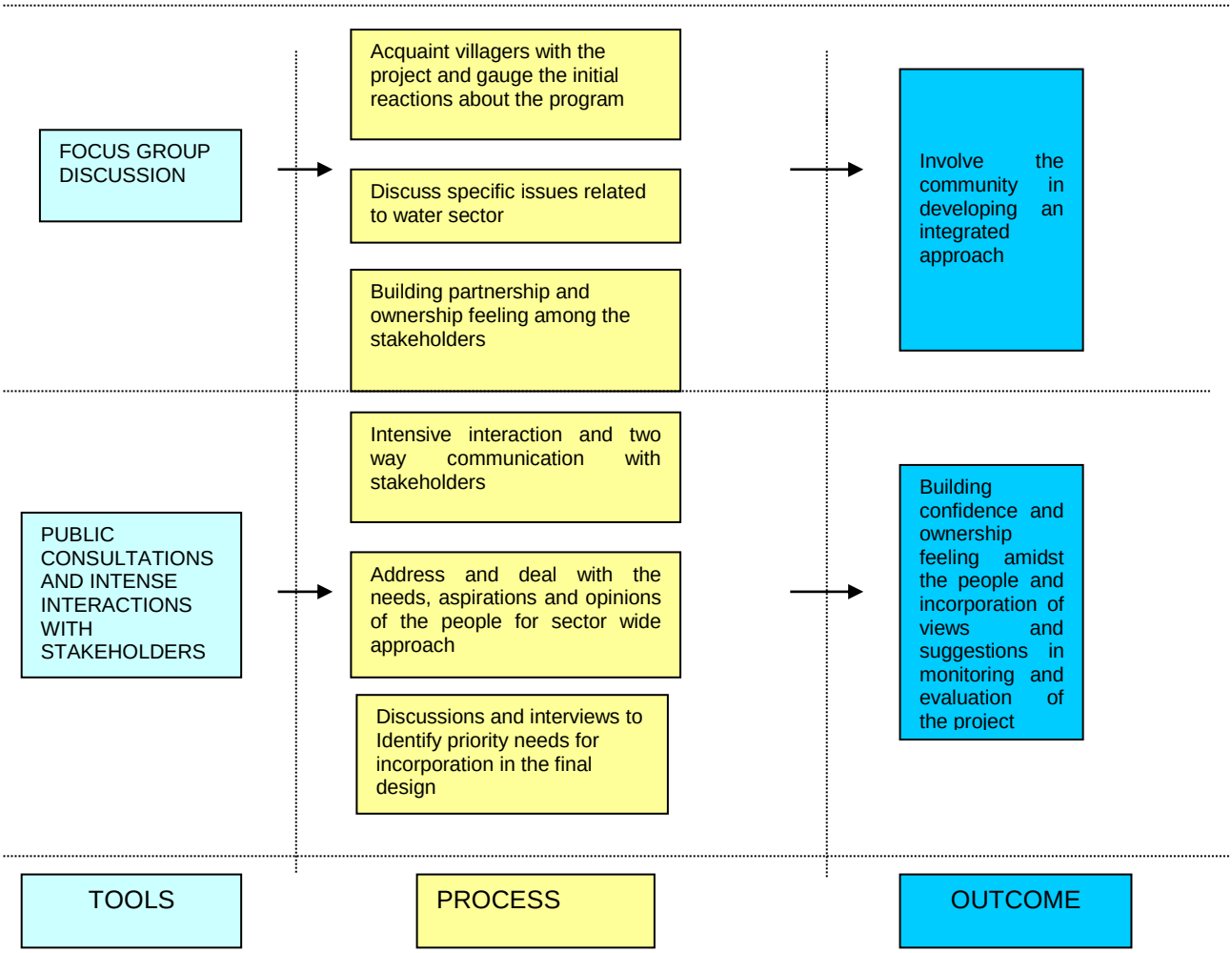
Three levels of public participation and consultation process were adopted in carrying out the study, namely,

4. Focus Group Discussions
5. Public Consultation Meetings

- Scoping Stage
- Draft SwESA Stage

6. Qualitative Interviews with Key Informants

**THE CONSULTATION PROCEDURE ADOPTED IN FGD/PUBLIC CONSULTATION**




## ▪ 11.5 Focus Group Discussion (FGD)

FGDs are an important tool of enquiry specially in the context of issues regarding conceptual clarity, levels of involvement and concern, attitudinal pre-disposition and other areas requiring the use of sensitive and flexible research tools. The group situation provides respondents with the comfort of peer security, and enables the use of snowballing and synergetic techniques for discussing new emerging issues.

Nine FGDs including three FGDs with women were conducted amongst the selected primary stakeholders, viz. women poor farmers, land owners, village leaders and WUAs/WUGs to elicit their attitude towards the project, as well as problems and solutions/ mitigatory measures perceived by them. FGDs were carried out in five Governorates e.g. Sana'a, Ibb , Taiz , Lahej for Aden governorate and Hadramout as under:

| Sl. No | Date | Governorate | Participants | No. of Participants |
|---|---|---|---|---|
| 1 | 21 June 2008 | Sana'a | WUAs/WUGs, Villagers Farmers, NGO, Women Association | 24 |
| 2 | 22 June 2008 | Sana'a | WUAs/WUGs, Villagers, Farmers | 21 |
| 3 | 22 June 2008 | Sana'a | Women and Girls | 20 |
| 4 | 25 June 2008 | Ibb | WUAs/WUGs, Villagers, Farmers | 23 |
| 5 | 28 June 2008 | Taiz | WUAs/WUGs, Villagers, Farmers, NGOs | 14 |
| 6 | 29 June 2008 | Taiz | Women and Girls | 20 |
| 7 | 29 June | Taiz | NGO, Headmistress of school , Women and Girls | 7 |
| 8 | 1 July 2008 | Lahej for Aden Governorate | Water Association, Local people, farmers | 16 |
| 9 | 5 July 2008 | Al-Mukalla, Hadramout | Agriculture cooperative, local people, farmers | 20 |

- 

- **11.5.1 Methodology for Focus Group Discussion (FGD)**

- FGD were arranged to gather qualitative information pertaining to water related issues with women , farmers , land owners , village leaders and WUAs/WUGs
- Semi-structured questionnaire was used as a guide for FGD, but the approach was the PRA technique.
- FGDs were held in the EPA/ NWRA offices as well as in the villages
- 

- **11.5.2 Focus Group Discussion Topics**

The following topics were discussed in the FGD:

- Availability of water services in the village and in its neighborhood.
- Water supply and sanitation / irrigation systems adopted in the project area
- Effective improvement of issues relating to rural/ urban water supply, sanitation and irrigation by:
  - Government Agencies
  - Service Providers
  - WUAs/WUGs
  - Water users themselves (farmers and others)

- Willingness and preparedness of the participants to become active members of WUG/ WUA, in case they had not yet joined such bodies.

### • 11.5.3 Summary of Focus Group Discussions

Issues discussed with the selected primary stakeholders in nine FGDs in five Governorates are summarised below:

| Issues Discussed | Participants' Concerns/Suggestions |
|---|---|
| Groundwater depletion | ▪ The participants expressed their concern over groundwater depletion and suggested that care must be taken so that groundwater flow does not stop completely. |
| Drinking Water Supply | ▪ Lack of appropriate scheme / projects<br>▪ Women are greatly stressed because of water transportation physically from distant locations<br>▪ Quality of drinking water is very poor; it is salty and polluted<br>▪ Participants were willing to pay water charges if regular supply of good quality of water is assured |
| Health and Sanitation | ▪ Inadequate water and sanitation facilities<br>▪ Open drainage, broken water pipelines and lack of maintenance lead to harmful effects<br>▪ Increase in number of water-borne disease like Diarrhea and Bilharzias<br>▪ Lack of IEC programs regarding health and hygiene information<br>▪ Lack of provision for free medicines in the health centers<br>▪ Health centers are either located very far off or closed most of the time |

| Issues Discussed | Participants' Concerns/Suggestions |
|---|---|
| Water Scarcity and Irrigation Problems | ▪ Lack of knowledge of new irrigation methods / improper use of water causes over abstraction of ground water<br>▪ Inadequate water sources and poverty force farmers to use wastewater for irrigation<br>▪ Use of wastewater results in degradation of agricultural land<br>▪ Lack of marketing opportunities encourage farmers to change cropping pattern in favor of cash crops utilizing more water i.e. Qat<br>▪ High cost of diesel and other agricultural inputs are matters of concern.<br>▪ Farmers expressed their willingness to share costs and participate in the labor force<br>▪ Water consumption for Qat plantation should be controlled<br>▪ Lack of spare parts and inadequate maintenance of water pipes |
| Gender Issues | ▪ High illiteracy rates and low primary school enrolment rates for females compared to those for men.<br>▪ A large number of female students leave school after the fourth year (the primary stage) after reaching 10 years of age. This is because of:<br>- Additional burden of bringing water from distant places<br>- Few schools and female teachers<br>- Girls work at home especially in rural areas<br>- Early marriage of girls at 13 to 16 years of age<br>- School curriculum not linked to vocational skills/ educations for girls<br>▪ Limited or no knowledge of Family Planning Methods<br>▪ Lack of opportunity to take part in decision making both at the household level and in public affairs.<br>▪ Insufficient facilities and equipment at maternal health care centers.<br>▪ Inadequate health services for women |
| WUAs/WUGs | ▪ Lack of operational and managerial capacity to discharge WUG/WUGs functions<br>▪ Need for training programs to upgrade skills in irrigation scheduling / water saving techniques<br>▪ Need for "training for trainers" |

| Issues Discussed | Participants' Concerns/Suggestions |
|---|---|
| | ▪ Limited participation of women in WUA/WUGs |
| NGOs/Private Organizations | ▪ Need for more NGOs to deal with social issues like health, education, women empowerment, skill up-gradation and income generating activities for women.<br>▪ NGOs lack funds in operating and running various programs |
| Land Acquisition and Compensation | ▪ No compensation has been given to PAPs for land acquisition<br>▪ In general, a committee consists of the concerned authority and the legal advisor decides the compensation amount for the land acquired on individual basis. |

- **11.5.4 Details of Focus Group Discussion**

Details of Focus Group Discussion are in **Annex – 11.1.**

## ▪ 11.6 Public Consultation Meetings

Public Consultation Meetings were conducted at two stages:

1. Scoping stage
2. Draft SwESA

### • 11.6.1 Holding of the First Public Consultation Meeting

In this meeting, held on 26th May 2008 in Sheraton Hotel Conference room at Sana'a, 58 invested stakeholders in the water sector attended the meeting and expressed their views. Media persons were also invited to acquaint themselves with the SWESA study and the WSSP.

#### • 11.6.1.1 Summary of Issues Discussed During First Public Consultation Meeting

| Issues Discussed | Outcome |
|---|---|
| • Project scope / Objectives / Measures to check environmental and social problems | • WSSP will, among others, improve existing water supply and sanitation problems |
| • Resettlement and Rehabilitation Policies. | • The Project Affected People (PAP) should be made aware of the Government Resettlement and Rehabilitation Policies |
| • Resettlement and land acquisition | • A resettlement plan should be formulated taking into account the needs of the project affected people |

| Issues Discussed | Outcome |
|---|---|
| • Duration of the study | • Participants were informed that the study period is reduced to three months from four and half months |
| | |
| • Study Methodology | • Study Methodology was explained in detail |
| • Water distribution and water resource management | • These issues will be addressed properly through SWESA study and the WSSP interventions |
| • Water and Health issues | • Health issues are an important component of the study |
| • Irrigation water insufficiency for poor farmers | • A proper strategy needs to be developed to address this issue |
| • Request for interaction with poor farmers , women during field study | • Focus Group Discussion with women and marginalized farmers will be a key element of the field study |
| • Support for poor farmers engaged in Qat irrigation | • Qat irrigation will be studied and reviewed during the study |
| • Problems faced in accessing water | • Proper allocation of water would be considered in rural and urban areas |
| • Irrigation water Watershed management | • Irrigation improvement and water shed management issue be examined in this study |
| • Support to traditional methods of irrigation | • WSSP projects will introduce new low cost technologies affordable by the poor |
| • Integration of environmental and social concerns into water policy and regulation | • Environmental and social concerns would be addressed in dealing with water issues |
| • Distribution of ground / surface water and integration of lower and upper watersheds management | • Alternative of solution to combat the issue of water distribution would be suggested |
| • Institutional performance improvement and capacity building at different levels | • Capacity building at various Government levels / Implementation Agencies is a part of study |

- **11.6.1.2 Details of the First Public Consultation Meeting**

Details of the First Public Consultation Meeting are presented in **Annex 11.2**.

- **11.6.2 Holding of the Second Public Consultation Meeting**

In the Second Public Consultation Meeting, held on 3rd August 2008 in the Sheraton Hotel Conference Room at Sana'a, 80 stakeholders working in various water sector areas attended. The outcome from the FGDs was discussed with the stakeholders and their views, registered.

- **11.6.2.1 Summary of Issues discussed during the Second Public Consultation Meeting**

| Issues Discussed | Outcome |
|---|---|
| • Study results confirming depletion of Sana'a Basin and likely drying up in the next 15 years. | • The SWESA study and the WSSP interventions focused on preventive measures would address the relevant issue |
| • Compensation should be decided as per the Yemeni Laws and not by World Bank O.P 4.12 | • RPF is being developed in compliance with the Yemeni Laws and also keeping in view World Bank O.P. 4.12. Compensation would be given as per the Yemeni laws; at the same time O.P. guidelines will be followed to minimize adverse impacts of WSSP intervention |
| • One of the participants asked as to why various components of the World Bank OP 4.12 and the Yemeni Policies are being presented in this study when there are other donors supporting this program? | • As per TOR, for the RFP, the Consultants are to examine:<br>- Country Laws and Institutional Framework<br>- Bank rules and regulations<br>- Identify gaps between the two systems<br>- Suggest appropriate measures<br>The presentation is as per the requirement. |
| • There is no need for the Environmental Management Officers.<br>• Existing Capacity Building Measures shall be used.<br>• The Netherlands funded training program for EPA is underway. | • Environmental and social screening is recommended for WSSP interventions. Subprojects will be categorized as "A", "B", or "C" according to the intensity of their impacts on the existing environment. This need was also felt when some members of the Consultants team visited a few project sites. An EMO at sub-sector / project level is required.<br>• Existing capacity measures have been taken into consideration while devising the Environmental and Social Management Framework. However, there is need to train the WUAs, WUGs, Basin Committees on ESMF and related issues as they would monitor day to day project activities.<br>• The Consultants have considered the ongoing training program for EPA funded by the Government of Netherlands. Under the proposed institutional measures, the roles of |

| | |
|---|---|
| | WEC and EPA have been acknowledged for imparting training to water sector stakeholders at various levels. |
| • Suggestions regarding compensation<br>- For small scale projects, community stakeholders should pay the compensation<br>- For large scale projects, compensation should be paid by State government<br>- The Courts shall pay special attention for paying fair compensation | • It was clarified that compensation for any loss will be paid by the project proponents through the Government. PAPs' grievances could be resolved through local / customary practices. Further, he can approach the Court as spelt out in the RPF. |
| • One of the participants asked as to who will be responsible to pay the compensation amount. | • As explained earlier, the compensation amount will be paid by the project proponents through the government. |
| • EIA should be carried out for Water Projects. | • The purpose of Environmental and Social Screening was explained to the participants |
| • Many of the springs have been depleted at Ghail Ba'wazir District as no Environment Assessment study was carried out | • It was explained that the proposed ESMF would apply to such situations. EMO will carry out Environmental and Social Screening of such Projects after which EPA will approve the proposals. Implementation of mitigation measures will be ensured through the proposed monitoring plan for WSSP project interventions. |
| • The Environment Protection Authority branch in Hadramout lacks capacity building and staff in the field of Environment especially for reviewing of Environment Impact Assessment Reports | • Consultants have suggested necessary measures in the report.<br>• Appropriate budgetary provisions and cost estimates have also been proposed in the report along with training programs. |
| • Water and Irrigation User Associations are sometimes not clear regarding registration of their Associations,<br>- in accordance with National Association and Corporation Law number (1) of 2001<br>- in accordance, with the Cooperative Associations and Unions Law Number (39) of 1998 | • Currently, most of the Users' Associations are registered under the Cooperative Association and Unions Law (number 39 of 1998) the position may be clarified by the Registration Authorities, if required. |
| • Relationship between Sana'a Basin Water Management Project and the study | • It was clarified that the study is being conducted by Sana'a Basin Water Management Project. |
| • Compensation for environmental pollution and damage caused by factories | • This is a genuine problem which has to be solved through appropriate EIA studies. |
| • One of the participants asked:<br>- Currently, surface and groundwater in Abyan are being polluted by sanitation discharge. How can this problem be avoided?<br>- Most of the surface water flows to the sea; how can it be solved? | • WSSP interventions will improve sanitation facilities and provide wastewater treatment plans. Public awareness campaigns are also needed.<br>• Water harvesting structures, suitably designed after necessary geo-hydrological investigations would be recommended. |
| • Existing dams are suffering from negative Environmental Impacts as no EIA studies for such dams were carried out. | • WSSP interventions would require Environmental and Social Screening immediately after registration of such |

| | |
|---|---|
| | proposals.<br>• Projects will be categorized as “A”, “B”, or “C”.<br>• EIA study will be carried out for sub-projects in “A” or “B” category.<br>• Necessary approval from EPA shall be obtained for such projects before commencing any construction activity.<br>• A list of Dam safety measures and a checklist for routine inspection of dams are provided in the report. |

- **11.6.2.2 Details of the Second Public Consultation Meeting**

Details of the Second Public Consultation Meeting are presented in **Annex 11.3**.

## ▪ 11.7 Key Informant Interviews

Relevant information was obtained from ‘Key Informants’ through face to face qualitative interviews with various project proponents and government officials working in the water sector projects.

Key informants for this purpose included the chairman, Head of the department / wing, Coordinators, Chiefs, Team Leaders and others depending upon their availability. Most of the informants were very knowledgeable and cooperative.

- **11.7.1 Over view of the Issues discussed with key informants**

- Low public investment hampers efficient and effective program execution
- Lack of proper coordination amongst various agencies working in a particular area
- Number of programs implemented not sufficient to meet needs of the people
- Short term programs are often taken up; what is required is sustainability of program interventions
- Poor coverage and low sustainability of safe water and sanitation schemes in rural areas
- Professional staff inadequate. Increase of qualified staff essential for effective program implementation
- Total water loss in water supply programs is 40%, out of which 20% is transportation loss and the balance because of unauthorized connections
- Treatment of brackish water not available in the hilly terrains
- Service delivery system needs improvement
- Water tariff structure requires revision
- Emphasis on involvement of local consultants in EIA studies
- Lack of proper statistical data and analysis
- Incomplete and low quality data collection
- Weak law enforcement

- Migration from rural to urban areas affecting water stressed urban areas
- A fully equipped Central Laboratory should be set up for environmental monitoring
- Appropriate monitoring indicators essential to review progress and target achievements
- Separate EIAs should be required for large scale dams
- Capacity building at various levels is essential
- Land Acquisition issues:

- emphasis to be on acquisition of public land
- In case private land is acquired, a special committee to decide compensation amount on individual request

### • 11.7.2 Details of Key Informants Interviews

Views expressed by various stakeholders are in **Annex 11.4**.

## ▪ 11.8 Recommendations

- A countrywide NWRA information network to be established
- Guidelines for predictions, estimations and indicators in Yemen water resources information need to be developed / updated / monitored
- Specific need based training programs would be more effective
- Decentralized approach to be adopted in water management:
- Management of water distribution networks (except primary canals) should be gradually handed over to farmers after proper training
- Poor farmers to be included as members of Water Users' Associations.
- Changes in behavioral and social patterns need to be fostered to conserve water (public awareness).
- RPF to be developed to deal with land acquisition and compensation problems in compliance with World Bank OP 4.12 and the Yemeni laws

## Annex 11.1 Details of Focus Group Discussions

**Focus Group Discussion with Stakeholders: Al-Mahajan, Sana'a Governorate**

**Place: Sana'a**
Venue: Al Mahagal village
Date: 21st June, 2008

**Participants:**
- *Representatives of WUAs*
- *Representatives of WUGs*
- *Representatives from Sana'a Basin Water Management Project*
- *Villagers/Farmers*
- *Representative from Women Association/NGO*

**Issues Discussed:**
- Groundwater depletion scarcity
- Willingness to pay
- Gender Issues
- Health and Sanitation condition
- Water and Health
- Water and Education
- Water and Irrigation
- Role of WUA/WUGs
- Role of NGOs

**Findings of the Discussion :**

**Groundwater depletion scarcity**

- The participants expressed their concern over depletion of groundwater and stated that there is a significant drop in water level and water is contaminated

- Representative of the Women's Association stated that there was no project for drinking water supply, and being women , they are the ones who are suffering most"

**Willingness to Pay**

- There are three categories of farmers

i. Who can pay any amount for the share
ii. Who can pay reasonably
iii. Who can not pay very poor farmers

- The Head of the WUA indicated that the population of the area is 1500 and each household is ready to pay 300-1000 Riyal per month for better accessibility to drinking water supply and 1500-1700 Riyal per month for irrigation and other purposes"

**Gender Concern**

- Representative of the Women's Association mentioned that their children spend 3-4 hours daily to fetch water from far off places. Numbers of dropout cases in school is higher especially as a number of girls' drop out. Such numbers are comparatively higher.

**Health and Sanitation condition**

- Water borne disease like Malaria and Bilharzias are very common because of water pollution

- One Primary Health Centre with provision for free medicine is there, however, most of the time it is closed and is sometimes open only for 2-3 hours
- The participants felt that sanitation conditions of the area are very bad , they have their personal drainage system like soak pits in their houses
- There are no projects for sanitation and drinking water supply

**Role of WUA/WUG**

- The participants informed that with the help of Sana Basin project, members of WUAs got trained in financial management and better operation of WUA .At one stage, 36 farmers attended training courses in Jordan.
- The farmers suggested that there should be more training programs to build their capacities. Some of them were of the view that other farmers who were not given chance to attend the earlier training programs should be imparted training by the group who are already trained.
- There are 54 wells in the area and one WUG for each well; therefore 54 WUGs are working in the area
- Each well cost 100,000 Riyals and each shareholder can use it in their turn, sometimes, one person has more than one shares
- A poor farmer takes one share in the group and each one of them use waters for six hours

**Role of NGOs**

- One NGO was found working in the area; the NGO representative stated that they were looking for funds to implement their ideas
- The participants requested for more awareness programs for promoting efficient use of water

**Focus Group Discussion with Stakeholders: Bani Matar, Sana'a Governorate**

**Place: Sana'a**
Venue: Bani Matar
Date: 22nd June, 2008

**Participants:**
- *Head of Multipurpose Agricultural Organization*
- *Reresenttaion from WUAs/WUGs*
- *Farmers /Villagers*
- *Representatives from Sana'a Basin Water Management Project*

**Issues Discussed:**
- Drinking water supply
- Health and Sanitation
- Gender Issues
- Water and Irrigation
- Role of WUA/WUGs

**Findings of the meeting :**

**Drinking water supply**

- The quality of drinking water is not good, sometime it is salty or contaminated Heath and Sanitation
- Water borne disease are very common and increasing like Malaria, Diarrhea, Bilharzia due to low quality of drinking water
- The Health Centre is very far off and most of the time it is closed.
- There is no sanitation project, the participants said that 30% of the houses have personal sanitation while70% throw their garbage in the open street

**Gender Issues**
- The participants accepted that the women play multiple roles e.g taking care of household chores and also contributing to agriculture work. At the same time they requested for skill improvement/ training programs viz poultry, livestock or any other income generating activity. This will help in improving their economic condition.
- As girls fetch drinking water from far off places, the numbers of girl dropouts from the school are increasing

**Water and Irrigation**
- The farmers in the area are very poor and agriculture is the main source of earning, average land holding is 300 to 5000 libna
- The farmers are very satisfied with the drip irrigation project. However, they said that it covers a limited number of villages. They found the drip irrigation system to be much better in saving water; consumption of fuel is less and there is more productivity.
- Though various projects are under implementation for irrigation e.g. Drip Irrigation Project, Pilot farm Project, Project at Bukaliya for transmitting and distribution of water, Project at Alhasf well for distribution of water, they want projects for drinking water and sanitation

**Role of WUAs/WUGs**
- There are 16 WUGs and these groups faced problems in collecting shares from the farmers in time.
- Head of Multipurpose Agricultural Organization expressed their organizational limitation in operation , financial management and administration, and wanted to improve their skills in these aspects,

**Public Consultation and Meetings with Women: Kharaba Al-Myhob, Sana'a Governorate**

**Place: Sana'a**
Venue: Kharaba Al- Myhob
Date: 22nd June, 2008

**Participants:**
- *Women and Girls*

**Issues Discussed:**
- Water situation and women
- Health
- Education
- Gender disparity
- Role of women in the family
- Cultural constraints
- Empowerment of women

**Findings of the meeting and consultations:**
- Average size of the family is 6-10 members
- The women have no idea about family planning; usually they do not usually practice any method to plan family size
- Heath situation is bad

- Malaria, , diarrhea , bilharzias are very common
  - Most of the women work in the field besides household work and help in:
- Irrigation
- Weeding
- Harvesting and post harvesting operation
  - Irregular attendance and large number of drop out cases for girl child in school because
- They are mainly responsible to fetch water from far off places , it takes 2-3 hours or sometime more
- There is no separate school for girls
- They help their mothers and family in different activities of household including animal care etc.
- Early marriage at the age of 14-16
  - High illiteracy rate among women
  - Women expressed their interest to join adult literacy class, if any such project start by any NGOs

**Focus Group Discussion with Stakeholders: Ibb Governorate**

**Place: Ibb**
Venue: Office of Local Corporation, Ibb
Date: 25th June, 2008

**Participants:**
- *Representatives of WUAs*
- *Representatives of WUGs*
- *Representatives from Sana'a Basin Water Management Project*
- *Villagers/Farmers*

**Issues Discussed:**
- Drinking water supply
- Health and Sanitation
- Gender Issues
- Water and Irrigation
- Role of WUA/WUGs

**Findings of the Discussion:**

**Drinking Water Supply**
- Groundwater is the main source of water supply.
- Participant from Almusshannah and Abdahar district complained that groundwater is highly contaminated and causes adverse impact on their health.
- One of the participant mentioned that the drinking water quality is not good , because of the presence of nitrate in the water ; it affects bones ; causes kidney disease, amebia, and other health problems"
- In Al-Barah, Holagan , Gibla district , water is not available even at the distance of minimum three km.
- Some of the participants came out with problems like:

- Al Audain district "there is too much scarcity of water" ;
- In Gibla District " they dig well and private piped water are also there, but the project is not working",
- In Sahban district "all springs are dried and they dig wells ,they have pumping machines, however, they not operating till now"
- In Al-Makhadir district "They have private projects and WUAs working to distribute water for irrigation purpose ; they are dependent on spring water and they are now connecting it to water pipes"

**Health and Sanitation Condition:**
- The health centers are very far off and there is no provision of free medicines for the poor. For poor villagers, it becomes difficult to bear the cost of medicines
- In Sayyani District, there is no project for sanitation. 30% of the households have their personal sanitation system and 70% throw garbage in open places resulting in various diseases
- In Dar-Alsharq area in Almashannah district, the farmers are irrigating their fields with drain water without treatment that leading to degradation of land.

**Gender Issues**
- 70% of girls dropped out of the school because they used to go to fetch water from far off places.

Water and Irrigation

- Financial advisor of Almarfaden Water Association in Al-Sayyani District said "Water Problem is severe from 1991, because of growing Qat production.

They have scarcity of water. Even after digging up to 500 mtr, water is not available." He further added that the farmers are dependent on rain water that is not sufficient for agriculture.

- In Warraf District, Irrigation is possible only in rainy seasons. They are using traditional methods of irrigation. Only 5% of the population of the district have access to drip irrigation system

**Role of WUAs/WUGs**

- WUA/WUGs found working in some of the districts like Al -sayyani District, Al-Makhadir district and in Yerin District. Their main objective is to provide best services to the needy ones. WUAs/WUGs function as follows:

- Each WUG consists of 10-25 members.
- WUGs are mainly responsible for distribution of water for irrigation.
- They are selling water to the farmers on hourly basis to poor farmers , so that they could meet their needs for irrigation purpose
- They are charging 800-1000 Riyal per hour for irrigation for vegetables and pulses
- For Qat irrigation , the charge is 2000-3000 Riyal per hour

- In Al-Makhadir district, four groups participate in the management of wells, each group comprises between 15-20 persons. Each share is 700,000 Riyals.
- Within this group, some have more than one share each and some share one share with more than one person.
- Every shareholder is given one day to use it for irrigation. The poor farmers take shares in group, use water on hourly basis.
- The shareholder who has one day to use water uses it for a few hours, and sells water for the remaining hours of the day to the poor farmers who could not afford a full share.
- The charge per hour for irrigation given by the shareholder to others is 1000-1500 Riyal for vegetables, pulses and other crops except Qat
- For Qat the rate is between 2000-3000 riyal per hour.
- In the Al-Makhadir district, there is a multipurpose agricultural society with representation of women
    - In Ibb governorate, there is a branch for women with nine representatives. They have a special Directorate for Social and Health Affairs headed by Ms.Leena-amica.

**Focus Group Discussion with Stakeholders: Taiz Governorate**

**Place: Taiz**
Venue: NWRA office, Taiz
Date: 28st June, 2008

**Participants:**
- *Representatives of WUAs*
- *Representatives of WUGs*
- *Representatives from Sana'a*
- *Basin Water Management Project*
- *Villagers/Farmers*
- *Representative from Women*
- *Association/NGO*

**Issues Discussed:**
- Existing water supply condition
- Drinking water supply, quality , willingness to pay
- Water and Sanitation
- Gender Issues
- Water and Irrigation
- Role of Associations and other Groups
- Water Tariff structure
- Compensation for Degradation of land

**Findings of the Discussion:**

**Existing Water Supply Condition**
- Head of the WUA in Al-Haima mentioned that they are facing serious scarcity of water. Wells have now dried up. The people are migrating to other places to search for alternative livelihood.

- Six water projects running are running in AL-Haima district; however, maintenance is poor because of lack of spare parts and other functional problems. Two other projects namely "Khames Issa and Shaqaba" are not functioning now because of technical, operational and maintenance limitations.
- Head of Irrigation Association, Haidran area mentioned that there is no government drinking water project ; however, one charitable project named" Hail Anam Company" dug 4 wells for drinking water. He added that the Local Corporation dug 11 wells for irrigation. Another source of getting water is mobile vendors and it costs 2000 Riyal per month.
- Head of Women Union and Head of the National Women Committee in Taiz Governorate stated that 60% of water available in Taiz Governorate is drinkable and it was tested by the Authority for Agriculture Research.
- Industrial waste water impact on poor farmers :
- In Kharawa Al-Mudrik and Al-Tibsha districts, release of untreated waste water from factories like rubber manufacturing factories, Food Oil units causes many diseases and also leads to degradation of agricultural land of the poor famers.
- In Hoban –Haidran district, poor farmers are irrigating their fields with untreated water coming from the factories.
  - Head of Women Union and the Head of the National Women Committee in Taiz Governorate reported :
  - In new areas , people are using their personal drainage systems without adhering to any technical standards
  - Use of untreated waste water for irrigation is resulting in losing its productivity and quality gradually.
  - Requested that local authorities should monitor water treatment stations in the factories.

**Water and Sanitation**

- The participants indicated that there are no sanitation projects. 70% of the houses have their personal drainage system and 30% of them directly throw the garbage on the open places.

**Gender Issues**

- One of the participant from Haima village stated that there is no drinking water project in their village. 30% of the girls drop out every year because they spend their time in bringing water to their houses. It takes three to four hours to fetch water from far off places"
- Farmers' want to improve their efficiency and are looking for new techniques and projects. At present, farmers are using traditional method for irrigation.
- One of the participant mentioned " "For sanction of project like Water Harvesting, one should have strong relations with the local authorities; we are poor farmers and have no references therefore there is no one to pay attention to our demand"

**Role of Association and other groups**

- regulate water distribution system
- water is being distributed as per prevailing custom and traditions in the area
- water distribution is either on hourly basis or day wise system
  - Participants reported that they have received training organized by NWRA in Taiz to improve their managerial capacity, operation and leadership.

**Water Tariff Structure:**

- In general , water tariff is 40 riyal per cubic meter
- In lower Hemma area, tariff is fixed as per existing customs and traditions. Members contribute 200 riyals and diesel cost as membership fee. The members are mainly responsible for operation and receive net profit every quarter.

**Compensation for Degradation of land**

- Participants informed that factory owners have not compensated for damage done to their agricultural land due to disposal of waste water of the factory in their farms. They have given small amounts of compensation on individual request.

**Public Consultation and Meetings with Women: Addina Village Taiz**

**Place: Taiz**
Venue: Upstream Mountain, Residence, Addinna village, Taiz
Date: 29th June, 2008

**Participants:**
- *Women and Girls*

**Issues Discussed:**
- Water situation and women
- Impact of project
- Health
- Education
- Gender disparity
- Role of women in the family
- Cultural constraints
- Empowerment of women

**Findings of the meeting and consultations:**
- Earlier, women used to go to very far off places to bring water for the domestic purpose. Now implementation of a project by GARWASP have benefited women as

- Girls are now attending their schools regularly
- Women are eager to join adult literacy classes and want to improve their technical skills
- Personal hygiene is improved and they are now able to maintain clean their houses and surroundings clean

- Illiteracy rate is high among females. The main reasons are :
  - There is no secondary school for girls
  - Girls help their parents in taking care of household chores , agricultural work and domestic animals
  - Most of the girls get married at the age of 14-16
  - Girls are accustomed to follow their culture and customs and do not wish to continue their education further
    - There is no concept of family planning. The average size of the family is 6-10 members
    - The Health Centers are very far off.
    - Lack of awareness programs on health , education and other social issues
    - NGOs working in the area have no funds to run their programs
    - Women provided their suggestions to improve their situation:
  - They expressed their willingness to join adult literacy classes and
  - Income generating activities to upgrade their existing skills
  - Suggested Public awareness programs to deal with social problems
  - Requested free medicines for the poor people, especially women, in health centers.

**Public Consultation and Meetings with Women: Addina Village Taiz**

**Place: Taiz**
Venue: NWRA office, Taiz
Date: 29th June, 2008

**Participants:**
- *Head of NGO*
- *Head of General Union of Women in Taiz*
- *Head mistress of school*
- *Local women*

**Issues Discussed:**
- Water situation and women
- Water and Sanitation
- Education
- Impact of water scarcity on Girl's education /Health
- Role of Private Sector/NGOs

**Findings of the meeting and consultations:**

**Water Situation and Women**
- Most of the women reported poor accessibility to water in their areas. Water provided through Local Corporation is available only once in 30-40 days
- Water tastes salty and is sometime polluted.
- Water supplied is used only for cleaning purposes and for washing clothes. They buy water for drinking purpose costing 1500 -2000 riyal per month
- Another source of water availability is water vendors; they used to spend a long time standing in queues to get water from them.
- Residents living in upstream mountains face more problems. They used to go downstream for bringing water from water vendors. One women stated " We used to make several phone calls to know whether the vendor has arrived in town"

**Water and Sanitation**
- The Participants stated that they have their personal drainage in their houses e.g. small soak pits
- There is no drainage system. One of the women mentioned, " At night during Ramadan month, one women died in the open sewer by stepping down into it unknowingly "
- Because of open drainage, the drain water runs on the street whole day and night and stinks very badly. The number of water borne diseases is increasing day by day e.g. malaria, diarrhea and skin diseases etc.
- The poor farmers are using drain water for irrigation purpose because of non-availability of water

**Impact of water scarcity on Girl's education /Health**
- Girls used to bring water over long distances. This took much of their time and resulted in increased number of dropouts from school.
- Carrying water causes exertion and leads to physical complaints.

Role of Private Sectors/NGOs
- NGOs are running awareness campaigns for proper use of water, health awareness and negative impacts of drain water on irrigation etc.
- They also help in providing free medicines by working in close coordination with other voluntary private agencies , working for the poor people
- NGOs lack sufficient funds to run their activities.

**Focus Group Discussion with Stakeholders: Aden for Lahej Governorate**

**Place: Aden**
Venue: EPA office, Aden
Date: 1st July, 2008

**Participants:**

- *Representatives of Water Association*
- *Representatives from Sana'a Basin Water Management*
- *Local people/ Farmers*

**Issues Discussed:**

- Existing water supply situation
- Drinking water supply
- Impact of scarcity of water on women
- Water and Sanitation
- Health and Hygiene
- Gender Issues
- Water and Irrigation
- Role of Association/Groups
- Land Acquisition and Compensation

**Findings of the Discussion :**

**Existing Water Supply Situation**

- In urban areas, water is available only for two hours during day and two hours at night. Member of Irrigation Council stated "The water is polluted and water pipes must be repaired as they are very old and need maintenance"

**Member of Falg/Ayyad Association stated:**

- No regular programs are run by local authorities/NWRA
- There is no project for conservation of flood water
- Proper systems should be put in place to regulate water supply

**Head of Alfayah Association, suggested:**

- Water pipes need repair
- Awareness programs to address water issues
- Taking initiative by the government to monitor water quality
- Illegal water connections in the area should be checked
- Wells digging must be organized and regulated according to water law
- Illegal transportation of soil to other areas should be banned as per existing laws

**Water and Sanitation**

The participants observed as follows on the sanitation aspect

- Sanitation project are essential keeping in view the increase in population
- 70% of the villagers have their own personal sanitation system
- Before the formation of the Local Corporation , Lahaj, the office of Public Work was responsible for sanitation work; the system has not yet been handed over to the Local Corporation

**Health and Hygiene**

- There is no drainage system. Waste water blocking the streets gives rise to water related diseases like Malaria, Bilharzias etc.

**Gender Issues**

- Dropout rate of girls in the schools is approximately 10%; as they are mostly responsible for

bringing the water to their homes.
- One of the participants stated, “Low income is another reason for not getting regular education for girls”

**Role of Water Association**
- 16 Water Associations are responsible for distributing dam water
- Each Association has several groups and each group consist of three farmers
- The participants requested that the relevant bye laws be issued as early as possible

**Land Acquisitions and Compensation**
- No compensation received for acquisition of private land : The Head of Alfayah Association stated “water corporation for water and sanitation dug three wells in his private land , and when he approached the court for compensation , he was arrested for filing a wrong claim”.

**Focus Group Discussion with Stakeholders: Haidramout Governorate**

**Place: Haidramout**
Venue: EPA office, Mukalla
Date: 5th July, 2008

**Participants:**
- *Representatives of Association, Agriculture Cooperative*
- *Representatives from Sana'a Basin Water Management*
- *Local people /Farmers*
-

**Issues Discussed:**
- Drinking water supply
- Health and Sanitation
- Water and Irrigation
- Role of Association/Groups
- Land Acquisition and Compensation

**Findings of the Discussion:**

**Drinking Water Supply**
- Head of the Agriculture Cooperative from Hin Al–Ashshehar expressed his concerns over drinking water supply and remarked as follows:
  - We have artisan wells in Al-Dukkak , Al –Moga areas
  - Water found salty and non drinkable. They used to spend 1500-2000 riyal per month for the drinking water
  - For domestic and other purposes , they used to pay 1500-2000 riyal per month to the local corporation
- Member of Water Association of Ghail Bawazir stated :
  - Well have now dried up; we are facing scarcity of water because most of the water is being supplied to Mukalla city and surrounding areas
  - Water pipes are very old , and these should be replaced with new ones
- A farmer from Maifa district stated that springs and wells are main source for water supply in this area. It takes two hours to bring water from far off places. Sometimes, they use donkeys for transporting water.

**Health and Sanitation**
- Water borne and water related diseases e.g. Malaria, Diarrhea, Bilharzias, eye diseases, chest problems are prevailing in the area because of bad sanitation and low quality of drinking water.
- In Al-Haami, disposal of waste water from paper glass factory, causes eye and chest diseases. The local residents have registered many complaints to local authorities but no response as yet.
- Head of the Agriculture Cooperative from Hin Al- Ashshehar stated "There is no sanitation project in the area. The people took their own initiative to maintain drainage system.
- Member of Foowah Agriculture Cooperative stated "They have sanitation project in their area; however, it does not cover the whole area. Although people pay sanitation charges along with drinking water charges in their monthly bills, there is no proper sanitation and the streets are stinking "

**Role of Water Association/Group/Agriculture Cooperative**
- In Al-shehar distrct, WUGs consist of six farmers. Each member is allotted one day to avail of water from the well. The farmers could resell the water on the same day .They usually charge 500-1000 riyal for reselling water to the needy farmers.
- In Ghail Bawazir, they have working groups for irrigation under the Agriculture Cooperative. Each group consists of six farmers. The whole system of irrigation is supervised, controlled and monitored by the agriculture cooperative.
- In Al-Nikah, each well is shared by 20-30 farmers in a group. Each farmer pays 6000 Riyal annually to the endowment office.

**Land Acquisition and Compensation**
- For the acquisition of private land, a committee consisting of the concerned authority and the legal advisor who decides the compensation amount.

- **Annex 11.2 Details of First Public Consultation Meeting**

The public consultation is an important tool of information, dissemination and awareness creation during the scoping stage of the project. It provides valuable inputs regarding successful implementation of the project besides ensuring public participation and involvement in the process.

Scoping is the process by which the important environmental and social issues, project alternatives, and important environmental about social components are identified by the different stakeholders. It is an early step of environmental and social assessment which is designed specifically for public involvement. Public consultation, in addition to providing access by the public to the assessment process, is also intended to create the opportunity for a two-way information exchange between the primary and secondary stakeholders.

The first public consultation was conducted during the scoping stage on the terms of reference for this assignment. The meeting was conducted on 26th May 2008, in the conference hall of Sheraton Hotel, Sana'a, Republic of Yemen.

This consultation has provided inputs for finalization of the scope of the study. During the scoping session, the documents i.e. summary of project information and TOR in Arabic were shared with relevant stakeholders.

In order to discuss the social and environmental impacts, including the issue of resettlement and rehabilitation, a public consultation meeting was organized at the Conference Hall, Shereton Hotel. 38 persons including PAPs and other stakeholders attended the meeting. Following is the project summary of the meeting.

### 11.2.1 Summary Sheet

| | |
|---|---|
| Title of the Project | - Consultancy Services for the Technical Assistance for Sector-wide Environmental and Social Assessment |
| Date and Place of Meeting | Venue: Conference Hall, Shereton Hotel |
| | Date: May 26, 2008 |
| Name of Consultant | Consulting Engineering Services (India) Pvt. Ltd. |
| | Address India: 507 , Munjusha Building, 5th floor , Nehru Place, New Delhi-110019<br>Address Sana'a: 2nd Floor, Building no. 173, Airport Road, SAR AL GHAYDAH,Poat Box-948, Sana'a |
| Number of Invitees | 52 |
| Number of Participants | 38 |
| Methods Used for Information Dissemination | Personal contact |
| | Dispatching invitation letters |
| Stationary served to the participants | Concept paper /Leaf let – 1 |
| | Writing Pad-1 |
| | Ball Pen-1 |
| | Plastic Folder -1 |
| Methods adopted for discussion | Slide Presentation |
| | Lecture |
| | Group Discussion |
| | Question/Answer Session |
| | Written suggestion |

| | |
|---|---|
| Methods adopted for Documentation | Still Photography |
| | Audio-Recording |
| | Minutes of meeting |
| Media Coverage | Electronic Media and Press Media |

### 11.2.2 Objectives of Public Consultation Meeting

The purpose of Public Consultation Meeting was to promote public awareness and understanding purpose of the proposed program intervention at sector level. The main objectives of conducting meeting were to disseminate information about the project and to notify stakeholders and provide opportunities to participate in consultation and assessment process. The objectives of the Public consultation meeting were as follows:

• ensure the participation of affected stakeholders in the design, review and implementation of the project through:

- the timely disclosure of frank and comprehensive information about the project and its benefits and disadvantages; and
- providing opportunities to disclose information and maintain communications in a manner that is culturally appropriate and practical;

• determine stakeholder issues and concerns; and

• build trust and address suspicions or fears by documenting consultations and discussions, and by being accountable and transparent in the process.

### 11.2.3 The Process

Public Consultation process helps in eliminating any apprehension regarding the project and gives insight to the problems faced by the lay public and also provides cost effective solution by the participation of the affected population in the implementation stage. The consultation process aligns project polices and strategies with the interests and concerns of stakeholders. The process includes the following steps:

- Identify stakeholders who may have a specific interest or concern in a project.
- Consult with those stakeholders to understand respective interests, concerns and expectations.
- Develop strategies and approaches to address stakeholder interests and concerns.
- Develop plans to address stakeholder interests and concerns.
- Deliver plans to stakeholders for review and possible further revision by stakeholders
- Review and revise plans with stakeholders
- Follow up with ongoing communication with stakeholders over intentions and progress on specific initiatives.

### 11.2.4 The Stakeholders

Stakeholders are individuals and organizations who need to be informed and consulted about the Project and who have an interest in the outcome of the Project. Stakeholders are classified into primary and secondary groups/individuals. Primary and secondary stakeholders in the WSSP are defined as follows:

Primary or project affected stakeholders are those who may be directly affected by the project or have a significant influence over the success of the project.

### 11.2.5 Primary Stakeholders include

• People who live, use or have cultural ties to lands and water resources within the footprint of the Project;
• Local disadvantaged groups such as women, children or the poor; and
• Concerned government and regulatory bodies as well as other government agencies that have jurisdiction over resources potentially affected by the Project.

Secondary stakeholders are identified as groups who have the ability to influence a project either because they have knowledge that can contribute to the design of the project or to the strategies to mitigate environmental and social impacts of the project. Secondary stakeholders also include those who have potential political influence over the authorization of the project, such as Non-Governmental Organizations (N.G.Os) and Water Users Association (WUA) /Water Users Group (WUG) and donors supporting WSSP such as the World Bank, KfW – gtz, DFID, and the Netherlands and media.

The various categories of stakeholders were selected to attend the public consultation meeting are as follows:

| KEY STAKEHOLDERS OF THE PROJECT |
|---|
| • Ministry of Water and Environment |
| • Ministry of Agriculture and Irrigation |
| • Ministry of Finance |
| • Ministry of Planning and International Cooperation |
| • Environmental Protection Authority |
| • General Authority for Rural Water Supply Projects |
| • National Water Supply Authority |
| • Local Water Supply Authority |
| • Sana'a Water Basin Management Project |
| • Irrigation Improvement Project |
| • Urban Water Supply and Sanitation Project |
| • Rural Water Supply and Sanitation Project |
| • Water and Environment Centre –Sana'a University |
| • Program Preparation Committee |
| • Sana'a Basin Committee |
| • Sadah Basin Committee |
| • Abyan Basin Committee |
| • Taiz Basin Committee |
| • Water User Associations, Sana'a |
| • Water User Associations, Sadah |
| • Water User Associations, Abyan |
| • Water User Associations, Taiz |
| • World Bank |
| • U.K, Department of International Development(DFID) |
| • Media (Newspaper, T.V.) |

### 11.2.6 Power Point Presentation on the Study

A comprehensive Power Point presentation outlining information about the proposed Project and the environmental and social impact assessment process was prepared. The presentation included:

- Introduction of the project background and sector wide approach of water sector program addressing the following components :
  - Urban Water Supply and Sanitation
  - Rural Water Supply and Sanitation
  - Irrigation Improvements
  - Water Resources Management
  - Capacity Building

- Approach and methodology to carry out proposed study
- An explanation of the environmental and socio-economic impact assessment process, and
- An explanation of the public consultation process and how it relates to the assessment process.
- Outcome of the study in two documents:
  - Environment and Social Management Framework (ESMF)
  - Resettlement Planning Framework (RPF)

### 11.2.7 Proceedings of the Meeting

- Recitation of the verses of Holy Quran
- Inaugural and Introductory speech delivered by His Excellency Dr Mohemmad Al Hamidi, Deputy Minister (Water). Salient points are as follows:
  - General about the Project
  - Problem of Water in Yemen
  - NWSSIP
  - Importance of Environmental Impact Assessment and this Study role
  - Informed the participant that the Sector wide ESA is the first time which will cover the whole sector.
- Welcome speech by Mr. J K Bhattachrya, Institutional Expert, CES
- Presentation on the SwESA and WSSP by Mr Syed A Naqvi, Team Leader
  - Presentation on Social Assessment by Ms Sanobar, Dy. Team Leader and Social Expert
  - Discussion session chaired by His Excellency Dr Hussain Al Gunaid, Deputy Minister of Environment, the salient points of his oration are:
  - Importance of the Environment and need of sustainable development in the water sector.
  - Discussed and elaborated NWSSIP
  - Discussed about the five components of WSSP,
  - Importance of Rain Water Harvesting System to save the Environment
  - Importance of the project.

### 11.2.8 Summary of Issues Discussed During First Public Consultation Meeting

| Issues Discussed | Outcome |
|---|---|
| • Project scope , objectives , Measures to check environmental and social problems | • It is stressed in WSSP , emphasis will be given to improve existing water supply and sanitation problem |
| • Participants' do not have enough knowledge about the Resettlement and Rehabilitation Policies. | • People should be made aware of the Resettlement and Rehabilitation Policies of the Government |
| • Resettlement and land acquisition | • Considering the needs of the people, resettlement plan should be formulated |
| • Participants' commented that duration of the study is very short as per scope of work considered | • It is informed that the study period has been squeezed to three months from four and half month due to short of time |
| • Methodology to carry out study | • Methodology was explained in detail |
| • Distribution of water and water resource management | • In WSSP program , these issue will be addressed properly |
| • Water impact on Health aspects | • Review of health aspect is an important component of the study |
| • Water insufficiency for Irrigation purpose for poor farmers | • Strategy will be developed to addressed this issue |
| • Request to have interaction with poor farmers , women during field study | • Focus group discussion with women and marginalized farmers will be key part of the field study |
| • Role of the concerned authorities in solution of | • The study involves all the stakeholders |

| | |
|---|---|
| water problems | from policy makers to implementation agencies to address the water issues |
| • Does program support poor farmers engaged in qat irrigation | • Qat irrigation will be studied and reviewed during the study |
| • Problems faced by the people in accessing water | • Proper allocation of water would be considered in rural and urban areas |
| • Irrigation and Watershed management of water | • Irrigation improvement is one of the component of the study and approach will be developed to find the solution of watershed management of water |
| • Does program support traditional methods of irrigation | • The program will introduce new low cost technologies that would be affordable for the pro poor section of the society |
| • Embedding of environmental and social concerns into water policy and regulation | • Environment and social concerns would considered in designing of proposed approach to deal with water issues |
| • Water distribution and integration of the management of the lower and upper watersheds, of ground and surface water, | • Alternative of solution to combat the issue of water distribution would be suggested |
| • Institutional performance improvement and capacity building at different levels | • Capacity building to improve the functions and performance at different levels of the government functionaries and implementation agencies is part of proposed study |

### 11.2.9 Summary of the Stakeholder/ Public Consultation Meeting

Through active participation of the stakeholders, the key issues relating to social and environmental impacts, compensation, resettlement and rehabilitation were identified and discussed during the public consultation Following suggestions were given by the participants.

SUMMARY OF PUBLIC CONSULTTAION MEETING

- Emphasis on interventions of environmental protection
- The participants' seek to increase allocation of water resources
- Capability-building for stakeholders has to be addressed. It should take note of the limitations of local capabilities i.e. weak in project implementation.
- Enhancing Environmental Protection Measures to Conserve Water Resources
- Protect the Health of the Poor
- A mechanism to be developed to give priority to the poor, to enable them to have equal access to water resources.
- Timely and transparent disclosure of information regarding social and economic impacts related to the project
- Stakeholders should be given an opportunity to review, comment and offer suggestions or additional information regarding water issues, challenges and opportunities related to the development
- Individual and community concerns regarding the impacts on individuals, communities and infrastructure to be considered: and
- Stakeholders should be consulted and given an opportunity to raise concerns throughout the project
- Introduction of low cost technologies for access to water
- Equal distribution of water resources in rural and urban areas
- Resettlement should be avoided or minimized as much as possible
- Resettlement Framework should be developed to address the issue of land acquisition and its compensation
- Energy Nexus between water and energy to the studies
- Artificial recharge through water harvesting to be examined
- Desalination of water for augmenting the water resources
- Wastewater treatment
- Demand management to be given much stress
- Water to health particularly the problem flurosis
- Need for defloridation

### 11.2.10 Spectrum of the Participants

Representatives of the following organizations attended the public consultation meeting and presented their views.

- Dr Mohammed Al Hamdi, MWE
- Dr Hussain Al Goneid, MWE
- Mr S Chaudhuri, Resident Representative and Project Coordinator of CES, Sana'a
- Mr Syed A Naqvi Team Leader and Environmental Expert – CES
- Dr P K Deb, Environmental Expert – CES
- Dr D N Rao, Environmental Economic Expert – CES
- Mr J K Bhattacharya, Institutional Expert – CES
- Dr Jaffar Shotah, Legal Expert – CES
- Ms Sanobar, Deputy Team Leader and Social Expert – CES
- Representative from SBWMP
- Representative from NWRA and Taiz branch, Aden, and UNDP - NWRA
- Representative from the World Bank
- Representative from GAWRSP
- Representative from SFD
- Representative from IIP
- Representative from GSCP
- Representative from GDI
- Representative from media
- Representative from EPA
- Representative from Abyan
- Representative from MWE
- Representative from SBWMP
- Representative from Basin Committees
- Representative of WUA's and NGOs

- **Annex 11.3 Detail of Second Public Consultation Meeting**

As per the terms of reference, the Second Public Consultation Meeting was organized to discuss the draft SwESA and RPF report on 3rd August 2008, in the conference hall of Sheraton Hotel, Sana'a, Republic of Yemen.

The SwESA report and the Resettlement Policy Framework (RPF) were discussed in detail to make the study meaningful, appropriate and acceptable to the cross-sections of the society.

58 persons including the Minister of Water and Environment and Minister of Agriculture and Irrigation, the Deputy Minister of Environment, Donors, Media, WUAs/WUGs, NGOs and other primary stakeholders attended the meeting. The summary sheet of the meeting is as follows.

### 11.3.1 Summary Sheet

| | |
|---|---|
| Title of the Project | - Consultancy Services for the Technical Assistance for Sector-wide Environmental and Social Assessment |
| Date and Place of Meeting | Venue: Conference Hall, Sheraton Hotel |
| | Date: August 3, 2008 |
| Name of Consultant | Consulting Engineering Services (India) Pvt. Ltd. |
| | Address India: 507 , Manjusha Building, 5th floor , Nehru Place, New Delhi-110019<br>Address Sana'a: 2nd Floor, Building no. 173, Airport Road, SAR AL GHAYDAH, Post Box-948, Sana'a |
| Number of Invitees | 80 |
| Number of Participants | 58 |
| Methods Used for Information Dissemination | Personal contact |
| | Dispatching invitation letters |
| Stationery served to the participants | Concept paper /Leaf let – 1 |
| | Writing Pad-1 |
| | Ball Pen-1 |
| | Plastic Folder -1 |
| Methods adopted for discussion | Slide Presentation |
| | Group Discussion |
| | Question/Answer Session |
| | Written suggestion |
| Methods adopted for Documentation Media Coverage | Still Photography |
| | Audio-Recording |
| | Minutes of meeting |
| | Electronic Media and Press Media |

### 11.3.2 Objectives of Public Consultation Meeting

The main objective of the 2nd round of Public Consultation Meeting was to benefit from the participation of relevant stakeholders in the design, review and implementation of the WSSP through:

- Sharing the views on the proposed Environment and Social Management Framework (ESMF) for WSSP intervention
- Sharing the views on the proposed Resettlement Policy Framework (RPF) for WSSP intervention
- Build trust and remove suspicions or fears by documenting consultations and discussions, and by being accountable and transparent in the process.
- Incorporating their views in the final report

### 11.3.3 The Stakeholders

Water sector stakeholders were invited from various governorates for this public consultation meeting and the spectrum of the invitees is as under:

| KEY STAKEHOLDERS OF WSSP |
|---|
| • Ministry of Water and Environment<br>• Ministry of Agriculture and Irrigation<br>• Ministry of Finance<br>• Ministry of Planning and International Cooperation<br>• Ministry of Local Affairs<br>• Environmental Protection Authority<br>• General Authority for Rural Water Supply Projects<br>• National Water Resource Authority<br>• General Directorate of Irrigation<br>• Local Water Supply Authority<br>• Sana'a Water Basin Management Project<br>• Irrigation Improvement Project<br>• Urban Water Supply and Sanitation Project<br>• Rural Water Supply and Sanitation Project<br>• Water and Environment Centre –Sana'a University<br>• Program Preparation Committee<br>• Sana'a Basin Committee<br>• Water User Associations<br>• Water Users Group<br>• Nongovernmental Organizations<br>• World Bank<br>• the Netherland<br>• KfW<br>• U.K, Department of International Development(DFID)<br>• Media (Newspaper, T.V.) |

### 11.3.4 Power Point Presentation on the Study

A comprehensive Power Point presentation outlined
- the proposed WSSP intervention
- Environmental and Social Management Framework
- Resettlement Policy Framework

The presentation was oriented towards:

- The project background and sector wide approach of water sector program, with the following WSSP components :

- Urban Water Supply and Sanitation
- Rural Water Supply and Sanitation
- Irrigation Improvements
- Water Resources Management
- Capacity Building

- Approach and methodology adopted for carrying out the study
- Analysis of Impacts
- Benefits of the Program,
- With WSSP and Without WSSP Scenarios
- Institutional Capacity Building Program
- Environment and Social Management Framework (ESMF)
- Resettlement Planning Framework (RPF)

### 11.3.5 Proceedings of the Meeting

The programme schedule followed in the public consultation meeting is given below:

| 10.00 AM: Recitation of the verses of the Holy Quran |
|---|
| 10.30 AM: Welcome address |
| Mr. J.K. Bhattacharya, Institutional Expert<br>• Welcomed all the participants<br>• Gave an overview of the objective of WSSP, SwESA, and the Importance of this meeting in the study. |
| 10.40 AM: Inaugural Speech |

His Excellency, Dr. Mansoor Al-Hawshabi, Minister of Agriculture and Irrigation, reviewed the following issues:

- Water scarcity,
- Institutional Performance
- Need to develop better coordination among the water sector agencies
- Importance of good water management techniques

His Excellency also briefly mentioned the objectives/outcome of the SwESA study namely,

- Analysis of Policies, programs and execution of the projects.
- Study of the negative and positive impacts,
- Avoiding the negative impacts by taking suitable precautions enhancing the positive impacts and community awareness about the water issues.
- Importance of the water harvesting systems, maintenance of the terracing system, and construction of dams and reservoirs.
- Enforcement of laws, good traditional customs and the applications which are related to the water rights.
- Conservation of water for sustainable and efficient agricultural development
- Utilization of treated wastewater.
- Need for the public awareness programs among the farmers and water user groups covering modern irrigation systems, groundwater conservation, etc.

His Excellency concluded by stating that this study will assist the Ministry of Agriculture and Irrigation and Ministry of Water and Environment in designing/executing sustainable program programs and activities.

In his remark, Dr. Hussein Al Junaid, Deputy Minister of MWE stressed the importance of EIA as under:

- EIA is the most important tool for sustainable development as it covers
- potential environment and social impacts.
- suggests mitigation measures to reduce for adverse effects of project activity.
- assists the decision makers in deciding issues
- the environment law makes it mandatory for any project.
- He hoped that the meeting would lead to a fruitful interaction and consultant an opportunity for incorporating various views in the environmental management plan.
- Appreciated and thanks to the study team for the efforts.

| 11.00 AM: Presentation Session |
|---|
| Power point presentation covering major issues of the SwESA, ESMF and the RPF by Mr Syed A Naqvi (Team Leader) and Ms. Sanobar, (Deputy Team Leader and Social Scientist) |
| 12.45 PM: Question\Answer session |
| 2.00 PM: Concluding Session |

The meeting concluded with the speech of His Excellency, Dr. Adbul Rehman Fadhel Al Eryani, Minister of Water and Environment. He thanks and appreciated the work done by the CES in carrying out the SwESA study and mentioned, inter alia, that

- water scarcity problems result from over-exploitation
- Agriculture is using 91% of the available water resources for Irrigation.
- There is an urgent need to establish sustainable system for various water uses and improvement of the watersheds.

3.00PM Lunch

### 11.3.6 Summary of Issues Discussed During Second Public Consultation Meeting

| Issues Discussed | Outcome |
|---|---|
| • Separate study results confirm that Sana'a Basin is suffering from depletion of water and is likely to dry up in the next 15 years. | • WSSP intervention focused on preventive measures to deal with and improve the water situation |
| • Compensation should be decided by following Yemeni Laws and not by World Bank O.P 4.12 | • RPF is developed in compliance with Yemeni Laws and keeping in view World Bank O.P. 4.12. Compensation would be given as per Yemeni laws; at the same time O.P. guidelines will be followed to minimize adverse impacts of the project/sub project of WSSP |
| • One of the participants raised the question "why various components of the World Bank OP 4.12 and comparison with Yemeni Policies have been presented in this study while because besides World Bank , there are other donors supporting this programs | • As per TOR given to the Consultants the study for RPF is to examine:<br>- Country Laws and Institutional Framework<br>- Bank rules and regulation<br>- Identifying gaps between the two systems<br>- Suggesting appropriate measure<br>The presentation is as per the requirement. |

| Issues Discussed | Outcome |
|---|---|
| • There is no need for the Environmental Management Officers.<br>• Existing Capacity Building Measures shall be used.<br>• The Netherlands funded training program for EPA is underway. | • Environmental and social screening of the subprojects is recommended for WSSP interventions. The subproject will be categorized as "A", "B", or "C" according to the intensity of their impacts on the existing environment. The need for the same was also felt when some team members of the Consultants visited some of the project sites. An EMO at sub-sector or project level is required.<br>• Existing capacity measures have been taken into considerations while devising the Environmental and Social Management Framework. However, there is need to give training on ESMF and related issues to the WUAs, WUGs, Basin Committees as they will be monitoring day to day project activities.<br>• Consultants have considered the ongoing training program funded by the Netherlands for EPA. Under the proposed, institutional measures, the roles of WEC and EPA have been acknowledged for imparting training to water sector stakeholders at various levels. |
| • Suggestions regarding compensation<br>- For small scale projects, community stakeholders should pay the compensation<br>- For large scale projects, compensation should be paid by State government<br>- The court shall pay special attention for paying fair compensation | • It was certified that compensation amount for any loss will be paid by the project proponents through the government. And if PAPs have any grievances, they could appeal to the Court as spelt out in the RPF. |
| • One of the participants asked "who will be responsible to pay the compensation amount." | • As explained earlier, the compensation amount will be paid by project proponents through the government. |
| • EIA should be carried out for Water Project | • The purpose of Environmental and Social Screening was explained to the participant. |
| • Many of the springs have been depleted at Ghail Ba'wazir District as no Environment Assessment study was carried out | • The participant was assured that the proposed ESMF would apply to such type of situations. EMO will carry out Environmental and Social Screening of such Projects after which EPA will approve the proposals. Implementation of mitigation measures will be ensured through the proposed monitoring plan for WSSP project interventions. |
| • The Environment Protection Authority branch in Hadramaut lacks capacity building and staff in the field of Environment especially for reviewing of Environment Impact Assessment Reports | • Consultants' have suggested necessary measures in the report.<br>• Appropriate budgetary cost estimates are also proposed in the report along with training programs. |
| • Water and Irrigation User Associations are sometimes not clear regarding registration of their | • Currently, most of the Users Association are registered under the Cooperation |

| Issues Discussed | Outcome |
|---|---|
| Associations, namely,<br>- Registering the Association in accordance with National Association and Corporation Law number (1) for Year 2001<br>- Registering the Association in accordance, with the Cooperative Associations and Union Law Number (39) for the year 1998 | Association and Union Law number 39 of 1998. the position may be clarified by the Registration Authorities, if required. |
| • One of the participants raised the question "What is the relationship between Sana'a Basin Water Management Project and the study" | • The study is being conducted by Sana'a Basin Water Management Project. |
| • Activities of factories activities are causing environmental pollution and damage; the question is "Will the compensation be given for this environmental damage" | • This is genuine problem which has to be solved by suitable EIA studies. |
| • One of the participants asked:<br>- Currently the surface and groundwater in Abyan are suffering from pollution as a result of sanitation discharge, how could this problem be avoided?<br>- Most of the surface water flows to sea, what is the solution for this? | • Under WSSP, there are proposals that sanitation facilities will also be improved and wastewater treatment plant shall be provided. Public awareness campaigns are also proposed in the Institutional capacity building measures.<br>• Water harvesting structures with proper design and after necessary geo-hydrological investigation shall be planned. |
| • Existing dams are suffering from negative Environmental Impacts as no EIA studies for dams were carried out. | • For WSSP interventions, Environmental and Social Screening of the projects will be conducted immediately after registration of such proposals.<br>• Projects will be categorized as "A", "B", or "C".<br>• If the subproject falls under "A" or "B" category, EIA study will be carried out.<br>• Necessary approval from EPA shall be obtained for such project before commencing any construction activity.<br>• A list Dam safety measures and a checklist for routine inspection of dams are provided in the report. |

### 11.3.7 Summary of the Stakeholder/ Public Consultation Meeting

Active participation of and interaction with a large number of the varied stakeholders was very helpful in identifying the key issues relating to social and environmental impacts, compensation clauses, resettlement and rehabilitation process etc. and the suggestions given by the participants are broadly as under:

SUMMARY OF PUBLIC CONSULTATION MEETING

- Participants expressed concern over water depletion and desired that this issue be addressed in the study to improve the water situation
- Emphasis on interventions for environmental protection and check on pollution level
- Compensation amount should be assured at fair market price in compliance with Yemeni Laws
- Need to develop Resettlement Policy Framework to mitigate the genuine problems of the people affected.
- Enhancing Environmental Protection Measures to Conserve Water Resources
- Environment Impact Assessment should be taken care of at the project preparation/construction/operation stage of the projects
- A proper registration system bye-law should be developed in order to run smooth functions of the WUAs/other associations.
- Urgent need for capacity building of staff at various levels to improve their work efficiency and service delivery.
- Resettlement should be avoided/minimized as much as possible
- Resettlement Framework should be developed to address the issues of land acquisition and its compensation
- Urgent need for appropriate and prompt enforcement of water laws
- EIA studies before commissioning of the projects.
- Mitigation measures must be implemented.
- EIA studies shall be carried out especially for dam and reservoir projects
- A Committee in the EPA branch offices shall be formed to review the EIA studies.
- Funds shall be allocated to EPA to carryout Environmental and Social Screening Process
- Need to protect seawater intrusion

### 11.3.8 List of NGOs that were consulted during the Implementation of Sector-wide Environmental and Social Impact Assessment

**WUAs**

1. Kharabat Bani Mahiab – Bani Al-Hareth – Sana'a Governorate
2. Al-Mahjel – Bani Mater- Sana'a Governorate
3. Hethran – Taiz Governorate
4. Al-Haimah - Taiz Governorate
5. Al-Araies–Lahej Governorate
6. Al-Karathah - Lahej Governorate

**Other NGOs**

1. Family Social Association for Development – Sana'a Governorate
2. Future Generations Association – Ibb Governorate
3. Environment and Social Development Association- Ibb Governorate
4. Irrigation Association in Maleh –Lahej Governorate
5. Maif'a Agriculture Cooperative Association – Hadramout Governorate
6. Fouah Agriculture Association– Hadramout Governorate
7. Al-Hami Agriculture Association– Hadramout Governorate
8. Ghail Bawazeer Agriculture Association– Hadramout Governorate
9. Al-Shehr Agriculture Association - Hadramout Governorate

**أسماء المنظمات والجمعيات الغير حكومية التي تم إستشارتها عند إجراء دراسة تقييم الأثر البيئي والإجتماعي لبرنامج دعم قطاع المياه**

**جمعيات مستخدمي المياه**

١. جمعية خرابة محيب لمستخدمي المياه – بني الحارث – محافظة صنعاء
٢. جمعية المحجل لمستخدمي المياه– بني مطر – محافظة صنعاء
٣. جمعية حذران لمستخدمي المياه – محافظة تعز
٤. جمعية الحيمه لمستخدمي المياه – محافظة تعز
٥. جمعية سد العرائس لمستخدمي المياه - محافظة لحج
٦. جمعية القرضه لمستخدمي المياه - محافظة لحج

**منظمات غير حكومية أخرى**

١. جمعية الأسرة الإجتماعية للتنمية - صنعاء
٢. جمعية أحفاد المستقبل – محافظة إب
٣. جمعية البيئة والتنمية الإجتماعية - محافظة إب
٤. جمعية الري في الملح- محافظة لحج
٥. جمعية ميفع التعاونية الزراعية – محافظة حضرموت
٦. جمعية فوه الزراعية – محافظة حضرموت
٧. جمعية الحامي الزراعية – محافظة حضرموت
٨. جمعية غيل باوزير الزراعية – محافظة حضرموت
٩. جمعية الشحر الزراعية – محافظة حضرموت

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- **Annex 11.4 Details of Key Informants Interviews**

| **Minute of Meeting as Recorded** | |
|---|---|
| Place: Sana'a<br>Venue: EPA office<br>Date: 04.05.2008 | Participants<br>EPA, Chairman,<br>Mr. Amer Ghorbani, Coordinator,<br>Mr. S A Naqvi<br>Dr PK Deb<br>Ms. Sanobar<br>Dr Jaffar Shoatah |
| ISSUES:<br>– WSSP, NWSSIP, SWESA, ESMF, Role of EPA, Capacity of EPA for water quality monitoring and Assessing the sub-interventions of the WSSP | OUT COME:<br>• Shortage of Funds with EPA.<br>• Responsibility of enforcement of law is not clear.<br>• Institutional capacity building program is in process with the help of the Netherlands.<br>• Qat production consumes more water.<br>• There is a proposal to set-up a central lab for environmental monitoring. |
| Place: Sana'a<br>Venue: GAWRSP office<br>Date: 11.05.2008 | Participants<br>GARWSP Representatives<br>Mr. Ali Mohammed Al Suremi, Chairman<br>Ms. Sahar Abdulaziz Al-Nader GAWRSP<br>Consultant :<br>Mr. S.A Naqvi<br>Mr. P.K. Deb<br>Ms. Sanobar<br>Mr. Jafar Shoatah |
| ISSUES:<br>• WSSP objectives,<br>– rapid expansion of services in rural areas<br>– help enhance the pro-poor focus and MDGS<br>– support to GARWSP and local governorate in design and implementation<br>– improved institutional set – up<br>• SWAP, and SwESA<br>• Demand Responsive Approach<br>• Problem faced in implementation of the schemes<br>• Role of beneficiaries<br>• Success achieved by the GARWSP | OUTCOME:<br>• Lack of financial resources to implement the programs<br>• Some stakeholders promised for the financial contribution but they did not contribute in reality.<br>• All beneficiaries of the program could not be covered as population of the program area is very high.<br>• Fluoride problem is noticed in Sana'a, Dhamar, and Al dalih<br>• Rural Sanitation problem is another area of concern<br>• Lack of sustainability of the program<br>• Lack of statistical data and analysis<br>• There is no specific approach applied for implementation of the program<br>• Rural program should be covered in one umbrella approach.<br>– Presently, there are three type system are prevailing in rural water supply schemes, depending on the size of city, house connections are provided, Stand posts are also provided in small populated areas, and in some rural areas, water is being supplied through tankers. |

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| Place: Sana'a<br>Venue: MWE<br>Date: 14.05.2008 | Participants<br>Mr. Jean François Barres,<br>Consultant:<br>SA Naqvi,<br>Dr P K Deb<br>Mr JK Bhattacharjee |
| ISSUES:<br>• WSSP, Rural coverage with water supply and sanitation, Proposals for large dams, Water Quality Monitoring, Private Water Supply sources, Basin Water Plan, Tariff and Subsidies, Role of Local consultant in EIA | OUTCOME<br>• Before commencement of the work, by (GAWRSP), no tests are conducted for checking the availability of water. Some of the bore wells failed and they have to dig wells at other places.<br>• For large scale dams, separate EIA's are to be conducted.<br>• Proper monitoring system for checking the quality of the water being sold through private parties in cities or towns or rural areas.<br>• Service delivery system needs to be improved.<br>• Hadramawt has charitable organizations for supplying the potable water.<br>• Social Fund is doing a lot of work in rural water sector.<br>• 3P's system could not be adopted.<br>• GAWRSP is not supposed to do all work. They (GAWRSP) need to be more cooperative with SFD.<br>• District water plan/Basin water plan on pilot basis are being prepared.<br>• Prices of water are ridiculously low.<br>• Expressed the need of technical audits.<br>• Safe sustainable, reliable, and equitable projects.<br>• Implementation of small water treatment plants<br>• SFD is implementing the specific projects.<br>• Local consultant shall be involved for carrying out the EIA studies. |
| Place: Sana'a<br>Venue: Office of the Chairman<br>Date: 17.05.2008 | Participants<br>Chairman, EPA<br>SA Naqvi<br>Dr PK Deb<br>Mr JK Bhattacharya |
| ISSUES:<br>• Institutional requirement of EPA in conjunction with SWESA and ESMF, Environmental Law, Protected Zones, Training Needs for capacity building measures, Staffing pattern, Budgets | OUTCOME:<br>• By-laws are under preparation.<br>• Each governorate has EPA office.<br>• New amendments to environmental law are under preparation.<br>• Enforcement of law is not effective. Responsibilities are not clear with regard to enforcement of law.<br>• There are five (5) declared protected areas. (Sana'a, Hawf, Aden wetlands, Hodeidah – Bura'a, and Dhamar - Othma protected areas.)<br>• Dutch program for EIA strengthening is in progress. It is bilateral program. (for 3 years staff will be deployed there for training from EPA and other ministries)<br>• The EPA has 200 staff (Environment, Chemist, biologists etc.) in |

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| | total.<br>• Annual budget 350 million YR. For O&M, 50 million YR. |
| Place: Sana'a<br>Venue: office of the Climate Change, EPA<br>Date: 18.05.2008 | Participants<br><br>Anwar Abdul Aziz Noaman, Climate change, EPA<br>anwar.noaman@gmail.com<br>www.cdm-yemen.org<br>www.yemenenvironment.org<br>SA Naqvi,<br>Dr P K Deb,<br>Mr. JK Bhattacharya,<br>Dr Jaffar Abdullah Shotah,<br>Ms Sanobar |
| ISSUES:<br>• WSSP, SWAp, SwESA, ESMF, Dam policy and its environmental particularly with Climate, Climate change issues in Yemen | OUTCOME:<br>• Pilot projects for water sector. -12 small dams project identified.<br>• Large dams are not appropriate from environmental angle.<br>Draft policies being formulated for 3 most vulnerable areas:<br>– Water Resources<br>– Agricultural areas<br>– Coastal areas<br>▪ Climate change will surely affect people due to more draughts, more heating, change cropping pattern, and wells drying up. |
| Place: Sana'a<br>Venue: Social Fund for Development<br>Date: 18.05.2008 | Participants<br>Eng. Abdulwahab Almujahed, Head of Water and Environment Unit, Social fund for Development<br>SA Naqvi,<br>Dr P K Deb,<br>Mr. JK Bhattacharya,<br>Dr Jaffar Abdullah Shotah<br>Ms. Sanobar |

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| Place: Sana'a<br>Venue: NWRA<br>Date: 20.05.2008 | Participants<br>Chairman, NWRA<br>ENG Qahtan Y Al Abashi, National Integrated Water Resources Management Program<br>SBWMP:<br>Mr. Farooq Jawwad<br>Mr. Amer Ghorbani, Coordinator (MWE)<br>Consultant:<br>SA Naqvi,<br>Dr P K Deb,<br>Mr. JK Bhattacharya,<br>Dr Jaffar Abdullah Shotah,<br>Ms Sanobar |
| ISSUES<br>• WSSP,NWSSIP, SWAp, SwESA, ESMF, RPF, Basin Plans and Water Plans, Role of Basin Committees, Enforcement of water law #33, Water Quality Monitoring of approved wells, Capacity building measures, WUA's and WUG's, Coordination between MAI and MWE over water allocation, Role of NGOs or CBOs in water resources management, Land acquisition system in the country, Land tenure system | OUTCOME<br>• Responsible for Water Resources Management and preparation of policies.<br>• Basin committee prepares Water Management Plan.<br>• Bulk of the water is being utilized in Agriculture.<br>• Basin Committee are responsible for implementing the schemes<br>• MAI and MWE are responsible for coordination of the water resources in Irrigation.<br>• Enforcement of legislation is a problem; Coordination from Ministry of Interior is required.<br>• Strategy for Awareness is essential.<br>• Professional staff is lacking. There is need to increase qualified staff for strengthening of the authority.<br>• Authorities issuing licenses for drilling of wells should also check the water quality.<br>• NWSA conducts monitoring of water quality and have labs.<br>• Now there is plan to establish a central lab.<br>• Integrated Water Resource Management – Professional group – meets quarterly which is very useful.<br>• Control over location of canals/distributaries water availability etc. under discussion with MAI. |
| Place: Sana'a<br>Venue: UWSS<br>Date: 31.05.2008 | Participants<br>Mr. Ali Qumairi, UWSSP<br>Consultant:<br>SA Naqvi<br>Mr JK Bhattachrya,<br>Dr DN Rao |
| ISSUES:<br>• WSSP, SwESA and SWAp Aim of WSSP in Urban Water supply and Sanitation<br>– Increase coverage along | OUTCOME:<br>• In water supply, total water losses are 40%. Out of which 20% is system losses in conveyance and 20% is illegal connections.<br>• Water supply schemes are being implemented in Taiz, Mukalla, Hodeidah, Ibb , Sana'a, and Aden. Almost 95% of projects have been completed. |

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| with sustainable water supply and sanitation<br>– Support to urban local corporations in urban and town area<br>– Capacity building<br>• Existing water Tariff<br>• Staffing pattern<br>• List of completed projects<br>• Future planned projects<br>• Annual budgets | • PIU is mainly involved in implementation of the projects.<br>• Key staff, 40% Technical being funded by the World Bank, and remaining non technical, Support staff through local funding.<br>• Pilot project on rain water harvesting in Ibb city is in progress. |
| Place: Sana'a<br>Venue: MWE<br>Date: 01.06.2008 | Participants<br>Mr. Anwar Sahooly, Team Leader PPC,<br>Mr. Amer Ghorbani, Coordinator,<br>Consultants<br>SA Naqvi<br>Mr. JK Bhattachrya,<br>Dr DN Rao |
| ISSUES:<br>• NWSSIP Updates<br>• Tariff blocks<br>• Capacity of local corporations<br>• Coverage with water supply and sanitation services in urban areas<br>• Decentralization of NWSA<br>• Public, Private, Partnership issues<br>• Political acceptability for Cost Recovery<br>• Rural to urban transfer of water<br>• Brackish water treatment. | OUTCOME:<br>• NWSSIP may be extended up to June 2012.<br>• Tariff blocks have been reduced to three from six.<br>• 1st block is 5m$^3$ to 10m$^3$. It is subsidized. It is within 5% of household expenditure.<br>• 2nd block – Mosques etc.<br>• 3rd block – Commercial users.<br>• Local Corporations are responsible for implementing their own tariff.<br>• Majority of Local Corporations cover maintenance and short term investment+ inflation.<br>• There are 15 Local Corporations covering 90% of population<br>• Inflation – 5% (International), and 20% (Local)<br>• Political acceptability for Cost Recovery: There is some opposition at local level but it can be managed. No problem on this issue.<br>• Attempts to transfer water from rural to urban areas are not found encouraging and fruitful.<br>• Treatment of brackish water is not found encouraging especially in hilly terrain in Yemen.<br>• Capacity building for Top Managers of LC's is undertaken regularly.<br>• Decentralization of six more Branches of NWSA is in progress. |
| Place: Haidramouth<br>Venue: Office, governor<br>Date: 6.07.2008 | Participants<br>Mr. Amer Ghorbani, Coordinator,<br>Consultants<br>SA Naqvi<br>Mr. JK Bhattachrya,<br>Ms. Sanobar<br>Mrs. Swad<br>Mr. Shota |

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| ISSUES:<br>• Water situation and problems in the governorate<br>• Land acquisition and Compensation | OUTCOME:<br>• Coordination between water authorities is being strengthened<br>• Enforcement of law needs improvement<br>• Lack of qualified staff<br>• Migration from rural to urban areas affecting water stressed urban areas<br>• Inefficient management of water resources leads to social and environmental problems<br>• Emphasis on acquiring public land<br>• In case private land is acquired, a special committee is set up to decide upon compensation amount on individual request |
| Place: Haidramout<br>Venue: Ministry of Agriculture and Irrigation<br>Date: 07.07.2008 | Participants<br>Dy. General Manager, MAI<br>Mr. Amer Ghorbani, Coordinator,<br>Consultants<br>SA Naqvi<br>Mr. JK Bhattachrya,<br>Ms. Sanobar<br>Mrs. Swad<br>Mr. Shota |
| ISSUES:<br>• Definition of Large dam<br>• Feasibility study for large dams<br>• Status of Irrigation Improvement Projects<br>• Benefits for poor and vulnerable from the project<br>• Land acquisition and compensation procedures | OUTCOME:<br>• Large dams more than 15 m in height<br>• Feasibility study usually conducted for large dams<br>• Shortage of technical staff-geological engineers<br>• Need to conduct geo-physical studies<br>• Shortage of funds; capacity building of the technical staff is required<br>• Need drip irrigation project in the area.<br>• For land acquisition and compensation :<br>- PAPs suffer delay in getting compensation, going to court is expensive and time taking<br>- Local District Council and tribal leader are involved to resolve land and compensation issues |

# Table of Contents

# *SECTION-12.0: SwESA INDICATIVE BUDGET*

## 12.1 SwESA Indicative Budget

| SwESA Activity | Units | Unit Rate US$ | Cost US$ |
|---|---|---|---|
| **Personnel:** | | | |
| Environmental/social management officers | | | |
| - Sector level (1 E/SMO for 5 years) | 60 mo. | 2,000/mo. | 120,000 |
| - Subsector level (2 E/SMOs for 5 years) | 120 mo. | 1,500/mo. | 180,000 |
| Consultants (national/international, part-time) | | | |
| - national consultants (environment, social, RPF) | 100 mo. | 2,000/mo | 200,000 |
| - international consultants | 15 mo. | 10,000/mo. | 150,000 |
| **Subtotal:** | | | **600,000** |
| | | | |
| **ESMF Environmental Mitigation Measures:** | | | |
| - Measures for urban water supply and sanitation interventions (yet to be identified) | n/a | lump sum | 100,000 |
| - Measures for rural water supply and sanitation interventions (yet to be identified) | n/a | lump sum | 300,000 |
| - Measures for irrigation improvement interventions, including IPM (yet to be identified) | n/a | lump sum | 400,000 |
| **Subtotal:** | | | **700,000** |
| | | | |
| **Environmental and Social Monitoring Program:** | | | |
| - Support to EPA for monitoring and inspection functions (compliance monitoring, site visits, etc) | n/a | lump sum | 362,000 |
| - Support to NWRA for water monitoring and inputs to basin planning | n/a | lump sum | 300,000 |
| - Monitoring of NWSSIP/WSSP indicators and any additional ecological and social indicators | n/a | lump sum | 300,000 |
| **Subtotal:** | | | **962,000** |
| | | | |

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| **Institutional Capacity-Building Program:** | | | |
| Training in environmental management[1]: | | | |
| - HQ staff of MWE, MAI, EPA, NWRA, LWSSC, GARWSP, GDI | 10[2] | 15,000 | 150,000 |
| - EMOs, branch offices of MWE, MAI, EPA, NWRA, GARWSP, LWSSC, basin committees | 22[3] | 20,000 | 440,000 |
| - Representatives of WUAs, WUGs, local committees, and NGOs | | | |
| -- train the trainers | 2[4] | 88,000 | 176,000 |
| -- extension to WUAs, WUGs, farmers, etc. | 44[5] | 19,200 | 844,800 |
| External training in environmental management: - Study tours, study abroad, etc. | 5[6] | 10,000 | 50,000 |
| Equipment/goods to support training function | n/a | lump sum | 100,000 |
| Public awareness campaign[7]: | n/a | lump sum | 1,250,000 |
| **Subtotal:** | | | **3,010,800** |
| **TOTAL** | | | **5,272,800** |

[1] Training costs are included in Component 5 – Institutional Strengthening and Capacity Development
[2] 10 workshops at US$ 15,000 apiece held in Sana'a
[3] 1 workshop per governorate at US$ 20,000 held in Sana'a
[4] 2 workshops for 44 trainers at US$ 88,000 apiece
[5] 2 trainers per governorate at US$ 19,200 (4,800/yr x 4 yrs) apiece
[6] 5 study tours at US$ 10,000 apiece
[7] Public awareness campaign costs are included in Component 5 – Strategic Communication Program

## 12.2 Budget Summary

| SwESA Activity | Cost US$ |
|---|---|
| Environmental/Social Management Personnel | 600,000 |
| ESMF Environmental Mitigation Measures | 700,000 |
| Environmental/Social Monitoring Program | 962,000 |
| Institutional Capacity-Building Program | 3,010,800 |
| **TOTAL** | **5,272,800** |

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