REPUBLIC OF YEMEN

Ministry of Water and Environment

National Water Sector Strategy and Investment Program (NWSSIP)

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List of Abbreviations

A21A	Aden agenda 21 for Agriculture (reform agenda)
AFPPF	Agricultural and Fisheries Production Promotion Fund
AREA	Agriculture Research and Extension Agency
CBOs	Community Based Organizations
DRA	Demand Responsive Approach
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
GARWSP	General Authority for Water Supply and Sanitation Projects
LCs	Local Corporations for Water Supply and Sanitation
MAI	Ministry of Agriculture and Irrigation
MCM	Million Cubic Meter
MDGs	Millennium Development Goals
MOF	Ministry of Finance
MOPIC	Ministry of Planning and International Cooperation
MWE	Ministry of Water and Environment
NGOs	Non Governmental Organizations
NWRA	National Water Resources Authority
NWSA	National Water and Sanitation Authority
NWSSIP	National Water Sector Strategy and Investment Program
PRS	Poverty Reduction Strategy
PWP	Public Works Project
RWSS	Rural Water Supply and Sanitation
SFD	Social Fund for Development
UWSS	Urban Water Supply and Sanitation
WSS	Water Supply and Sanitation
WUAs	Water Users Associations
WUE	Water Use Efficiency

Foreword by H.E. The Prime Minister

Foreword by H.E. The Minister of Water and Environment

Executive Summary

1) The Purpose of NWSSIP

Following reorganization of the water sector in 2003, the MWE initiated a multi-stakeholder process of preparing a consolidated strategy, action plan and investment program for the water sector as a whole – the National Water Sector Strategy and Investment Program (NWSSIP).

The MAI actively participated in the preparation of NWSSIP. Five working groups were formed, four for the four sub-sectors (water resources, urban WSS, rural WSS and irrigation) and a fifth to address the environmental aspects of water, with a total membership of more than 100 professionals, parliamentarians and representatives of civil society and donors. The working groups drafted the proposed strategy and investment program, which were then discussed with a broad base of government, civil society and donors; through a national workshop that was held in June 2004.

2) The Problems of the Water Sector

Yemen is facing one of the most complex development problems and its most serious challenge, namely: the problem of water resources scarcity and over-exploited aquifers. As a result, the water shortage is worsening one year after another, exasperated by the continued imbalance between annual recharge and the growing water demand. This has led to the alarming depletion of groundwater in a number of basins (Sana'a, Amran, Sa'adah, Rada'a, Rasyan, Tihama, Abyan and Tuban), wiping out agricultural production and investments in some of these areas.

This water reality imposes on the country the challenge of reducing the existing unsustainable use of water resources through improved management and better planning for its rational utilization, and the challenge of providing safe drinking water and sanitation service to the great majority of urban and rural populations who still lack such services (it is estimated that 32% of the population have access to public drinking water systems and 21% have access to public sanitation networks).

The importance of water, not only for drinking and food production, but also as a basis for sustainable development is well known, particularly in view of the strong linkages between water availability on the one hand and public health, unemployment, poverty, girls' education, and socio-economic development in general on the other.

3) The Objectives of this Strategy

This strategy proposes a set of institutional, financial and other measures, which are aimed at addressing discrepancies in the five sub-sectors in order to protect the interests of all stakeholders in the resources. Obviously, if the situation continues as it is without regulation of groundwater extraction and use, without reduction of the current unsustainable level of water resources use, and without putting an end to the ongoing resource capture, then this will eventually harm everyone, including farmers, who will be the first victims of water exhaustion.

At the same time, (water) regulation is needed to safe guard or secure the economic and social growth of the cities. Growth will not happen unless the cities get their water needs. Hence, an equitable mechanism for rural-to-urban transfer of water from the rural peripheral areas surrounding cities needs to be developed, as well as strict measures to protect the water fields, which supply the cities, against illegal drilling.

4) Reforms to Date

Since the mid-1990s, Yemen has embarked on courageous reforms, including the creation of NWRA and MWE; a successful reform program in the urban water and sanitation sub-sector and

establishing the AFPPF to increase rural productivity, to fund various water structures to provide farmers with more water, and to improve water use productivity (or return from water). However, the deteriorating condition of groundwater aquifers, as a result of overdraft, is still continuing, and population growth is faster than the rate of building new water supply schemes. This highlights the importance of concentrating efforts on water demand management to rationalize water use.

5) Proposed Objectives, Policies and Approaches in Sector Management and Coordination

NWSSIP sets four objectives for sector management, namely: a) to ensure coordination among all partners working in urban and rural water supply and sanitation sub-sectors, within and outside the MWE, b) to ascertain that policies in 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, c) to ascertain integration of water policies and national policies of sustainable growth and poverty reduction, d) to ensure that sector financing effectively supports sector goals, and e) to monitor and evaluate performance.

To achieve these objectives NWSSIP proposes three policies, namely: giving immediate priority to defining and implementing the strategy, investment program and action plan; to organize the institutional and administrative setup of sector institutions and to ensure that they are properly functioning and managed; and to ensure that cross-cutting issues are being dealt with in an integrated manner (funding, community contribution, tariffs, training, etc).

The approach proposed for implementing these policies comprised: 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, and follow-up of implementation of the necessary measures to establish control over groundwater 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 use).

6) Proposed Objectives, Policies and Approaches in Water Resources Management

The following five water resources management objectives were set by NWSSIP; namely: to ensure greater degree of sustainability; giving priority to domestic needs of rural and urban populations; improved water allocation, while mindful of equity, social norms, meeting the domestic needs and maximizing economic benefits; creating a realistic and holistic water vision among the general population; and contributing to poverty alleviation by promoting efficient water use and equity in water allocation.

To implement these objectives, NWSSIP adopted a set of policies, bringing into attention that the exhaustion and pollution of aquifers beyond possibility of recovery, will amplify (among an increasing numbers of the population) the feeling of inequity in access to water. This may potentially lead to intensified social tensions. Hence, the government has to provide suitable institutional interventions, particularly through forging of partnerships with local communities for co-management of water basins.

The proposed approaches to implement water resources management policies include consolidating the basin co-management 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, implementing the water law, and creating a conducive macroeconomic environment. The Strategy also adopted the implementation of integrated water management plans for water basins based on this co-management approach with local communities to assist them in solving their water management problems.

7) Proposed Objectives, Policies and Approaches in Urban Water Supply and Sanitation

NWSSIP adopted the same objectives as those of the WSS Sector Reform Program set out in Cabinet resolution (237/ 1999), namely: to increase coverage by WSS services (the goal here is to meet the MDGs, which translates to providing services to more than 4 million inhabitants by 2015); financial sustainability of WSS utilities; separation of sector regulatory and executive functions; decentralization of WSS service provision; knowledge and skills development; and involvement of the private sector.

To achieve these objectives, NWSSIP adopted the policy of progressively decentralizing responsibility for service provision, by continuing the current WSS Sector Reform Program, transforming more of NWSA branches to autonomous local corporations (at the governorate level), consolidating the autonomy of existing local corporations, reformulating the role of NWSA to progressively undertake a regulatory, monitoring, supporting and policy making role, and promoting a wider private sector and community role in sector funding and management.

The proposed approach to implement these urban WSS objectives and policies includes: expanding coverage; continuing and deepening the reform program after evaluating it; developing regulatory, monitoring, support and policy functions; achieving financial sustainability of water utilities, giving due consideration to the low income segment of the population; promoting private investment and public private partnerships; continuing capacity building, and performance improvement; enhancing community participation; securing additional water sources for cities; and formulating a policy for sea water or brackish groundwater desalination.

8) Proposed Objectives, Policies and Approaches in Rural Water Supply and Sanitation

NWSSIP adopted an overall objective for rural WSS sector, namely: the rapid expansion in WSS services in rural areas (a realistic and more modest objective of achieving "half the MDGs" was set). This means providing services to more than 5 million inhabitants by 2015, and facing the main challenge in this sector, namely: how to ensure sustainability of implemented schemes?

A sector review is underway and is expected to produce within 2004 a sector strategy, a restructuring plan, and an investment program. However, the major policy issues of this sector include adoption of decentralized implementation mechanisms, enhancement of beneficiary community role, adopting a demand responsive approach (DRA) to identify targeted communities and making this approach the standard practice, and targeting and cost effectiveness, by identifying means to implement projects that meet the needs at lower cost.

The approach proposed to achieve the general objective of this sector, includes: setting up sector strategy and coordination of its activities; improving project/ scheme implementation; broadening the range of partners; broadening technology choices and adapting appropriate ones; integrating sanitation and hygiene in rural water schemes; ensuring and protecting water resources and their quality; improving targeting and sustainability by adopting bottom-up approaches throughout and mainstreaming gender issues; promoting sustainability through broadening the range of partners so as to include, for instance, more NGOs and community institutions; and directing available finance to the greatest need (targeting).

9) Proposed Objectives, Policies and Approaches in Irrigation and Watershed Management

Within the overall objective of improving the well-being of the rural population, by increasing farmers' income, contributing to poverty alleviation and making the added value in the sector sustainable; the specific objectives for irrigation and watershed management are: sustainability through water resources protection and reduction of groundwater extraction; improving farmer incomes through increased water use efficiency; enhancing water supplies; and improving institutional performance with the aim of supporting the farmers.

The adopted policies include supporting water use efficiency, producing more crop per drop, improving water supplies and giving a wider role for local communities and water user associations (WUAs).

The proposed approach for this sub-sector includes: reducing groundwater mining; securing farmers' water rights; getting incentives right; refocusing agricultural research and extension; cost recovery on public irrigation schemes and developing water user associations (WUAs) as main partner; treating qat as a crop; reviving watershed/water basin management with an integrated approach; reviewing and revising the dams program; repositioning MAI through reviewing and redefining the roles of government and private sector in the agricultural sector; enhancing institutional coordination on agricultural water use; improving the effectiveness of AFPPF; increasing the role of community organizations and civil society; and implementation of the agricultural agenda A21A.

10) Proposed Objectives, Policies and Approaches in Human and Environmental Aspects

Objectives at the human level are to ensure equitable access to water and efficient use. At the environmental level, the objective is to ensure sustainability both in quantity and quality of natural resources in general and water resources in particular.

Policy issues include expanding coverage with WSS services, while giving priority to the poor communities, which is an implicit policy since Yemen has adopted the WSS goals of the MDGs and incorporated them as a major objective of PRS); and preventing environmental degradation to avoid its profound negative impact on poverty.

The following approach has been adopted by NWSSIP to achieve the objectives and policies in this sub-sector; namely: strengthening EPA work in the field of water so as to reduce poverty through improved environmental management; act on water quality through a broad front; protect water sources; and operationalize environmental monitoring and regulation.

11) Existing Investments in the Sector

NWSSIP has clearly revealed the inadequacies in investment financing in the five water and environment sub-sectors as well as the imbalances among them. Per capita share of available funds for the next five years (2005-2009) is $129.00 for urban WSS projects, $13.00 for rural WSS projects, $8.00 for irrigation projects, approximately $1.33 for water resources management, and $0.10 for environmental aspects. What is needed is to raise the per capita share during the five years (2005-09) in these five sub-sectors to $ 160.00, $32.00, $13.00, $2.35.00, and $1.00; respectively.

Unless there is an improvement in sector investments, urban and rural WSS situations will deteriorate, and, at the fast annual population growth rate of 3.5%, the country will not be able to maintain the current percentage of population covered with drinking water supplies and sanitation services, let alone increasing this percentage or halving the percentage of those not covered, as called for in the MDGs. This deterioration will also extend to water resources, irrigation, and

environment sub-sectors, which also requires additional funds as shown in the table below (Sector Investment Indicators).

12) Implementation of NWSSIP[1]

The NWSSIP investment program (2005-9) totals about $ 1.5 billion, of which almost $1 billion is already committed/pipelined by government and donor funding. The estimated financing gap at present is about $ 560 million (see table below).

NWSSIP will be a rolling program, updated periodically and with provision for monitoring, benchmarking and donor coordination. NWSSIP is intended to be a comprehensive agreement between all stakeholders in the water and environment sector.

Sector Investment Indicators ($ millions) –(see NWSSIP 2005-2009)

Sub-sector		Total required 2005-9	Donor funds committed/ pipelined	Local financing Expected	Net financing require-ment	Share of total sector investment
Water resources management		47	20	7	20	3%
UWSS	Hard ware	750	355	265	130	49%
	Soft ware	48	25	0	23	3%
RWSS	Hard ware	454	78	101	275	30%
	Soft ware	28	6	0	22	2%
Irrigation		190	64	56	70	12%
Environment		21	2	0	19	1%
Sector Funds 2005-9	Total	1,538	550	429	559	100%
	%	100%	36%	28%	36%	

13) Action Plan

NWSSIP included an action plan for the priorities in each of the five sub-sectors, as shown in Chapter 12.

[1] See details of the estimation for each sub sector in Annex (2). Annual funding from the local investment budget is estimated at $ 50-55 millions for urban WSS and $ 18-22 millions for rural WSS (see Annex 2).

INTRODUCTION

1) Background

The Ministry of Water and Environment (MWE) was established in May 2003 to reorganize the water sector, with the aim of creating an institutional structure for integrated water management and to prepare the necessary institutional and investment conditions to face the exacerbating water problem in Yemen. The MWE was charged with one of the most complex development problems in Yemen and its most challenging tasks, namely: the water scarcity problem and the challenges of providing drinking water to the urban and rural population, treating wastewater, water resources management and planning its use in light of the water law. The importance of water is well known, not only for drinking and food production, but also as a basis for sustainable development, especially given the strong interrelationships between the availability of water on the one hand and public health, unemployment, poverty, female education, and development in general on the other.

Another challenging task of the MWE is abating environmental degradation manifested in exhausting, depleting and polluting (to various degrees) precious natural resources: vegetation, air, soil and water and taking appropriate measures to protect and conserve such vital resources as a basis for sustaining economic activity, upon which the development and population stability depends (particularly in the rural areas). In addition, the MWE is charged with protecting and conserving biodiversity, marine environment, nature reserves and protected zones; and with the follow-up of Yemen's commitments as party to 12 regional and international environmental agreements[2].

As a new ministry, it was natural for the MWE to start by initiating a participatory process which involved all stakeholders and which aimed at elaborating a clear and shared vision of its priorities and the needed approaches to address water and environmental issues in view of an objective evaluation of the conditions of the five sub-sectors (water resources, urban water, rural water, irrigation and environment), to arrive at an accurate determination of the needed actions or measures and institutional, legislative and investment requirements. This evaluation and determination of the main actions and requirements was carried out through a participatory process that involved all stakeholders.

To insure that this strategy does not end up shelved, without implementation, it was agreed right from the start that it should include a 5-year (2005-2009) investment program, targeted at achieving the Millennium Development Goals[3]. However, for the rural population the aim was to achieve half the target set out in the MDGs. The reason for this exception is the huge investment

[2] These agreements are: ozone protection, climate change, biodiversity, hazardous wastes, persistent organic pollutants, endangered species, Red Sea environment and others.

[3] Millennium Development Goals were declared in 2000. With regard to water and sanitation the target is to “half by 2015 the number of people in urban and rural areas lacking access to clean water and adequate sanitation services”. Another water-related MDG is to establish by 2005 a strategy to improve irrigation efficiency.

required to achieve the MDGs in full, and the recognition by the rural WSS working group (which prepared the investment program for the rural sub-sector) of the difficulty of overcoming the capacity constraints in implementation of water and sanitation schemes in rural areas, even if the additional funds were available, due to the large number of such schemes and the problems associated with their implementation. It is hoped that the experience of the next five years would help accumulate and strengthen sufficient institutional and administrative expertise and capacity to attract more funds for this sub-sector as well as to ease the capacity constraints so that the full MDG target for rural areas can still be achieved during the remaining period (2010-2015).

Therefore, NWSSIP for the period 2005-2009 is a result of an intensive participatory process which took place over 8 months (November 03- June 04) and involved more than 100 experts and stakeholders concerned with water and environment. Hence, it represents an integrated sector vision and a program for the next five years, agreed upon by all parties concerned. This clarity in what is sought for the sector, and the agreement reached among all parties on what is needed, helps to create a conducive environment to achieve the MDGs by 2015, as reflected in the Poverty Reduction Strategy (PRS). On the other hand, NWSSIP clearly defines for Yemen's development partners in this sector, the country's needs and priorities, and the role they are expected to play, especially after Yemen was recently selected to be one of 8 states participating in the global millennium project[4].

In this participatory process of preparing NWSSIP, 5 working groups were formed, one for each of the following five themes/subs-sectors:

- Water resources management
- Urban water supply and sanitation
- Rural water supply and sanitation
- Irrigation
- Environment and human issues

In preparing this strategy, the working groups were guided by a number of considerations, namely:

- The need for an action plan, that defines the practical steps to end the state of imbalance between annual replenishment by rainfall and annual pumping from groundwater, so as to achieve water resources sustainability;
- The importance of water for stability of the society and its economic security;
- The States'/Government's obligation to regulate the exploitation of water, being a natural resource and given the Constitutional clauses which clearly obligate the Government with this role.

[4] Donor states and organizations have adopted the millennium declaration and goals as a basis or framework for development assistance, especially given the strong linkages between water availability on the one hand and health, unemployment, poverty, female education and development in general, on the other. Yemen can (on this basis) get substantial assistance to achieve these goals. It is well known that unclean drinking water is responsible for 80% of diseases and that the availability of more water (for agriculture for example) creates more job opportunities, and consequently helps to fight poverty. Moreover, the lack of drinking water in rural areas hinders girls' education and contributes to poverty.

- That access to water is a basic and recognized human right. It is a basic right necessary for humans to live a healthy life or enjoy human dignity. It is also a basic pre-requisite for attaining all other human rights, such as the right for development, health, and others;
- That exhausting and wasting or polluting water is considered a criminal act, contravening all religions and can almost be considered an act of terror against the rights of present and future generations.

It should be noted that this strategy should not be understood as an attempt to re-establish centralization in the sector. Instead, the decentralization is a well-established principle of sector development throughout this document and a common denominator in all proposed strategy approaches, as will be seen.

2) The purpose of the National Water Strategy

The purpose of the strategy can be summarized as follows:

- To formulate a shared vision for sector development, which is agreeable to all parties concerned, based on an objective assessment of sector (and sub-sector) conditions and taking into consideration previous experience in the development and implementation of sector policies and strategies;
- To set clear quantitative and qualitative targets for the institutional, legislative and investment actions, which the MWE and its corporations and agencies are required to achieve during the next 10 years, with a precise definition of the roles of other concerned parties in achieving these targets;
- To contribute to the creation of a conducive environment and conditions to achieve the MDGs by 2015, as reflected in the PRS, by clearly defining the required and nationally agreed approaches;
- To mobilize support from concerned government bodies and donors for a clear set of objectives, measures and a 5-year investment program and action plan aimed at achieving these objectives.

3) The NWSSIP process

The NWSSIP preparation process began by joint government/donor consultations in October 2003, which defined the objectives and the process to be followed in its preparation. In December 2003, five thematic working-groups were set up, bringing together over 100 sector professionals, parliamentarians, representatives of civil society and donors (see Annex 1 for names of participants).

The reports of the working groups were presented and discussed in a series of workshops held during February 2004. The revised reports were consolidated and put into a coherent document that was discussed and further elaborated by a group of 20 sector professionals and donor representatives, which retreated for 3 days in the city of Taiz during the month of April 2004. Subsequently, the action plan and investment proposals were consolidated and the NWSSIP document was prepared for presentation to a national workshop, which was held in June 2004. About 150 participants representing various stakeholders attended this one-day workshop. The document on hand incorporated the additional comments that were received

4) The NWSSIP Orientation: Basis and concept taken into consideration during NWSSIP preparation

The preparation of NWSSIP was guided by five broad principles:

- First, emphasis should be on "implementation": over the years, many valuable strategies have been prepared. Inspired by these strategies, NWSSIP focuses on moving from vision to action, by presenting an investment program for strategy implementation.
- Second, NWSSIP is based on success: successful reforms in recent years in the urban sub-sector have taught lessons that need to be scaled up and used for other sub-sectors. The urban water reform has benefited from clear objectives and plans, which were debated and agreed at all levels, from a focus on implementation and donor mobilization, and from extensive technical assistance, monitoring and follow up. NWSSIP allows other sub-sectors, notably the rural water supply and sanitation, to develop similar programs, driven by targets with benchmarking.
- Third, strong links between water supply and sanitation on the one hand and poverty reduction, health and employment generation on the other hand, and to achievement of the MDGs on the third hand, must be exploited to mobilize adequate investment and reform in the sector. The MDGs help set targets with a strong poverty-reduction orientation. In its poverty orientation, NWSSIP is essentially an implementation plan of the water aspects of Yemen's Poverty Reduction Strategy (PRS).
- Fourthly, NWSSIP takes a long term and integrated approach: it is a five-year investment program (2005-2009, to be updated periodically) designed to bring all partners into a coherent framework for action.
- Finally, prioritization is essential: NWSSIP focuses on what will have an impact on reaching major objectives and is realistic about implementation.

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PART ONE: STRATEGIC CHALLENGES FACING THE WATER SECTOR IN YEMEN

Foreword

Yemen is a water-scarce country, situated in an arid region with no permanent rivers. Historically, the population depended upon rainfall, springs, hand-dug wells and water harvesting in ponds, and behind dikes and dams of various sizes. Maximum well depths didn't exceed few tens of meters and their water was lifted, in small quantities, by muscular, animal or human effort. No mechanical drilling rigs or pumps were used until the 1960s.

Because Yemen is situated in an arid region, the annual per capita share of renewable water resources does not exceed 125 cubic meters (the international figure is 7500 cubic meters). This water scarcity gave water a prominent role in shaping Yemeni consciousness and civilization throughout history. The Mareb dam is one symbolic example of this vital role of water, another example being the agricultural mountain terraces. These terraces, which cover most Yemeni mountains, are in fact water-harvesting structures innovated by Yemeni farmers to retain scarce rainwater along with the precious fertile soil that sweep down the barren mountain-sides. These terraces may have been a testimony to Yemeni ingenuity.

The opening of Yemen to modern well-drilling technology in the early seventies, coupled with the large cash inflow that followed during the oil boom, led to an extensive expansion of irrigated farming and a rush to drill water wells and buy pumps. In the absence of any regulatory controls on drilling, these developments led to the mining of groundwater aquifers in most water basins in the highland plateaus and in the coastal plains. This mining is still going on.

Although the symptoms, causes and even the required remedies for the water crisis in Yemen have been diagnosed and became well known since the mid 80s, as a result of numerous studies that mapped the water basins and estimated the rainfall replenishment and quantity of water-use, however, this did not stop the problem from continuing and worsening, unabated, to reach an all-time serious level today. That is why the prevailing impression in informed circles about this problem is that the failure lies in implementing the solution measures rather than in diagnosing the causes of the problem and prescribing measures to solve it.

It should be noted that establishing the MWE in the Cabinet of 2003 reflects a political awareness of these problems and an orientation to tackle them, especially that the water shortage problem is worsening, day after day, and its impact is being felt not only on the drinking water but also on development in general, and agricultural activity in particular, which is threatened in a number of regions (Sana'a, Sa'dah, Rada' and other areas). However, the mere existence of the MWE is not sufficient by itself to solve water and environment problems, which have accumulated over long years of fragmented responsibility scattered among numerous bodies, coupled with the lack of sufficient funds to address these problems. Here lies the importance of this strategy and investment program: in formulating a vision for the required measures and necessary investments to implement the policies and laws that exist only on paper.

Chapter 1

Strategic Water Sector Issues

Water security is undoubtedly a key component of the national security of any country, especially in a country as water-scarce as Yemen. Water, in addition to its necessity for human life, enters into the core of agricultural production and economic activity in general. Therefore, its scarcity and the growing competition to access it, can become a source of economic and social disturbance affecting social peace and consequently national security, particularly that 50% of the country's workforce is in the agriculture sector.

NWSSIP is, in fact, only a part of a national effort to address the water problem. A number of difficult strategic decisions will have to be made to face this problem, whose essence is the imbalance between the scarce water supply and a growing demand, or between the annual recharge from scarce rainfall and a growing consumption. In this regard, it is important to keep in mind that decisions that may be considered difficult to make today could become impossible to make tomorrow; or they may come too late then to have the desired effect. Indeed, arriving at an effective investment strategy entails addressing effectively the following strategic issues facing the water sector:

1.1 Rapid modernization has outpaced evolution of social adaptive capacity

For centuries, Yemen remained a society based on agriculture, which is almost entirely supported by rain and surface water resources (floods, spring and seasonal streams). An elaborate system of formal and informal norms and laws slowly evolved to govern the use of surface water in a sustainable and fairly equitable manner. This began to change, however, in the early 60's, with the advent of modernization characterized by population increase, rising food demand, rapid urbanization, initial industrialization, and availability of modern technology such as pumps and drilling rigs.

Today, the share of groundwater in irrigation is increasing rapidly. The quest for greater control over surface water (flood water) to prevent its flow to the sea or desert, has led to technocratic solutions (concrete dams and diversion structures) replacing disturbing traditional rules for the allocation of this surface water. At the same time, the urban and industrial sectors demand greater amounts of freshwater and generate ever-increasing quantities of wastewater.

These changes took place in just two to three decades, too rapidly for the society to define an appropriate response. At present there is inadequate capacity at community and central levels to regulate water resource development, or improve water use patterns and environmental practices. To make matters worse, the water-use efficiency in the irrigation sector is very low, essentially because most Yemeni farmers are traditionally experienced in rain-fed rather than irrigated farming.

1.2 Water use based on resource capture is unsustainable

In a situation of natural water scarcity[5] and due to the absence of adequate mechanisms to regulate groundwater extraction[6], capturing this valuable resource became acceptable, especially that traditional customs (and even Yemeni Civil Law) grant a land owner the right to exploit whatever water that may exist underground. This has led to the depletion of groundwater and its use has become unsustainable.

In 2000, the annual water use has been estimated at 3.4 billion cubic meters exceeding by more than one third the annual renewable freshwater resource (estimated between 2.1-2.4 billion cubic meters). This means that there is an annual water deficit of about one billion cubic meters (20% of which is in Sana'a basin). This water deficit will increase year after year due to population growth, water demand growth and growing competition for water resources, as long as irrigation efficiency remains low.

Notwithstanding the skepticism about the accuracy of the above figures or estimates of annual recharge rate, water use and extraction rates, the overall picture is clear: Yemen is facing an exacerbating the imbalance between water supply and water demand, especially affecting groundwater. The water crisis is starting to take a catastrophic nature in a number of basins where aquifers are depleting very fast, as reflected by rapidly falling groundwater levels at rates reaching 6 meters annually in some basins. Water conflicts resulting from growing competition are also becoming frequent in many basins (see Annex 3).

It is evident that unless measures are taken to reduce excessive use of water resources, this crisis will become widespread, jeopardizing the whole nation.

Low water use efficiency (especially in irrigation) and excessive pumping of groundwater are the result of direct and indirect incentives that make water cheap and do not encourage its conservation (see 1.14). Other factors, such as weak organizational capacity and lack of a water rights definition and registration system, also contribute to this problem. Hence, water savings that can be made from investments in water use efficiency improvements may become allocated to horizontal expansion of irrigated areas instead of reducing excessive pumping of groundwater. At the same time water demand for domestic use is continuously increasing, especially in cities, due to rapid growth of population and of rural to urban migration. It is estimated that an extra 100 million cubic meters per year are needed for urban water supply and sanitation sector by 2015. Therefore, the re-allocation of water resources from agricultural to domestic use and from rural to urban is inevitable. However, no institutional mechanisms exist at present to implement such a scheme, as water markets, despite their widespread proliferation, remain small and ineffective.

[5] The average per capita share of renewable water resources in Yemen is approximately 125 cubic meters per year. This makes Yemen one of the ten poorest countries in the world in water. Notice that this quantity is only 10% of the per capita share in the Middle East and North Africa region (1250 m3 per year) and only 2% of the international average of 7500 m3 per year.

[6] Well-drilling licensing did not become obligatory by law until 2002, when the Water Law was issued. The implementation of this licensing system, however, is still facing difficulties.

1.3 Equity concerns over surface water allocation

In recent years, the traditional mud-and-tree-made surface water diversion structures (locally called *oqms*) have given way in the major wadis to concrete spate diversion structures. In many cases, greater control over surface water flows has come at the expense of water equity, favoring upstream over downstream users[7].

In some cases reservoir dams have adverse impacts on distribution equity similar to diversion dams. This is either a direct impact on the distribution of spate water, which is retained rather than allowed to flow downstream as before the dam, or an indirect impact by limiting the recharge of underground water to the immediate area adjacent to the dam, rather than the entire wadi reach/bed.

1.4 Unsustainable environmental practices: groundwater pollution by wastewater

Capacities for environmental regulation are quite modest at present. Cities and industries discharge untreated domestic and industrial wastewater into aquifers in peri-urban areas. While dangers of urban wastewater pollution are more visible, there is also a potential pollution hazard to aquifers from untreated wastewater from rural settlements. Hence, rural and small town sanitation requires higher priority. In addition to environmental impacts, uncontrolled disposal of raw wastewater poses a direct health hazard to urban and rural populations.

1.5 Water use in all sectors is inefficient

Low irrigation efficiencies in the largest water-consuming sector, agriculture (consuming around 90%), have often been cited as the main reason for unsustainable water use patterns and resource depletion. The irrigation efficiency in agriculture is indeed low – in some cases only around 35%. However, the case for potential water saving in irrigation is rather over stated. Return flows to the aquifer are usually not taken into account and focus is on water use efficiency at the farm level instead of the basin level. Irrigation efficiency improvement efforts have targeted conveyance efficiency rather than the adoption of a comprehensive on-farm water management approach, which would have been more effective at preventing unproductive non-consumptive losses such as excessive evaporation.

While agriculture has received most attention (and criticism) for low water use efficiency, the situation is far from satisfactory in other water consuming sectors. The proportion of unaccounted for water (losses) of urban water supply utilities is very high, sometimes approaching 45-50 % of water production. A significant part of these losses is system losses due to poor maintenance.

[7] The mud and tree diversion dikes would be washed away if the flood flow exceeds a certain rate. Hence, the downstream farmers would still have a chance to get some water to irrigate their crops, at least when the floods are large. With the concrete diversion structures, however, the upstream farmers became capable of seizing all the flow, large or small. This deprives the downstream farmers from any water but also encourages the upstream farmers to over-irrigate, which led to reduction in the irrigated area in some wadis.

Similarly, water recycling is not a general practice in the industrial sector, which in many cases chooses to acquire additional water supplies instead of recycling. Notably, however, it is generally accepted that the cost per cubic meter of loss reduction in the urban sector is much higher than that in the irrigation sector. Besides, the fact that only 10% of the total annual water consumption is used in domestic sector makes it very obvious where to direct use-efficiency and loss-reduction investments.

1.6 Inter-sectoral allocation of water

Agriculture consumes roughly 90% of the annual water consumption but returns on agricultural water use are generally quite low, except for some high value crops such as *qat* and some fruits and vegetables. On the other hand, the willingness to pay for water by municipal, commercial and industrial consumers is several times higher than typical returns on irrigation.

In the absence of a system of generally accepted and legally protected water rights, sectoral water shares are determined by resource capture. Administrative reallocations involving forcible appropriation of water resources by urban water utilities have not worked in the past and have only served to delay water availability to cities, leading in some cases (such as Taiz) to a water crisis. It is clear that any future institutional arrangements for meeting the growing water needs of municipal and industrial sectors, would have to be based on agreement between concerned parties, especially inhabitants of rural areas neighboring and providing water to cities.

Another point regarding the use of valuable groundwater for the production of high value crops is that the revenues that farmers often make are usually invested in fixed assets (new houses, real-estate, and the like). The large capital that is generated by transforming groundwater into qat or similar high-value cash crops needs to be directed in local sustainable economic activities that are not dependant on intensive water use and that can generate income in these regions when the aquifers are exhausted.

1.7 Poverty and access to water

Much attention has focused on subsidizing water supply schemes to make water affordable for the poor. Some poor families are certainly unable to pay for expensive water services. There are also more complex links between poverty and access to water. The poor living in areas not adequately served by public water supply are forced to use lower quality water or buy expensive water supplied by tankers or private networks. Diseases resulting from use of poor quality water reduce the employment opportunities of the already poor families. Often, the adverse impact of these constraints on the welfare of the poor is neglected.

1.8 Markets in water services are not based on a recognized system of water rights

Both in the rural and urban/industrial sectors, there are thriving markets in water services: irrigation water services, urban privately owned bulk-water outlets which sell water to tankers and also private sector water supply networks, tanker delivery services for water, and supply of *dabba* (jerry can) and bottled water. These markets are essentially based on resource capture because the sellers of these services have neither a restriction on access to water or quantity to pump nor a recognized right over the water they access.

Essentially, it is the lack of clear water rights that is the cause of unsustainability because higher demand for water services drives a 'race to the bottom of the aquifers' in the absence of prices which reflect the scarcity value of water and which could induce conservation (common resource or pool dilemma)[8].

1.9 Legislative framework and decentralization process

After a prolonged process of consensus building, Yemen has enacted in 2002 a water legislation. The Water Law provides a legal basis for controlling groundwater abstractions. It includes measures like licensing and registration requirements for wells and rigs, and more strict control regimes in water stressed catchments. The Water Law also supports decentralization in the form of encouraging the formation of basin committees and requires working closely with Local Councils in implementation of water management measures. But for all of this to translate into effective water management, more than just the legal framework is needed. Communities have to be mobilized in support of the water resources management plans because without their consent, water plans and policies cannot be implemented, since implementation mechanisms work through a bottom-to-top approach.

1.10 Basin co-management approach is still on the drawing board

It has been realized and acknowledged that the appropriate paradigm for water management in Yemen is "basin co-management" whereby stakeholders and state institutions forge a partnership for managing water resources at catchment level. Concerted efforts need to be made for translating this from a management model into reality. To date, only a Basin Committee in Sana'a has been formed, as well as an interim Basin Committee in Sa'adah that will be formalized soon.

Efforts to create community-based organizations concerned with water issues on a wider scale are constrained by the fact that NWRA at present has only a few regional branches, a limited regional and local presence and weak links with local authorities, to which some of its water resources management responsibilities could possibly be delegated. A cost-effective initial solution has recently been agreed to expend the presence of NWRA in various regions of the country; by nesting NWRA hydrogeologists within the offices of MWE-affiliate institutions in various governorates.

1.11 National water plan does not yet exist; regional plans cover few catchments

For the co-management approach to work, the first step is to create a shared vision of what water management entails. This is usually translated as an integrated plan for the management of basin or catchment's water. Regional water management plans have been prepared by NWRA for some areas such as Taiz, and Hadramawt and are nearing completion for Tuban-Abyan and Sa'adah basins. The pace of plan preparation is slow in part because technical capacities for integrated water resources management are still weak and the infrastructure to collect information such as

[8] The common resource or pool dilemma is a well-known economic problem that arises when a resource is shared in common among a community. In this case individuals seek to maximize their benefits from the resource, believing that what they leave may not remain till tomorrow and could be taken by others. Hence, the resource is abused/depleted and a regulator is needed to maximize the common benefit.

hydro-meteorological monitoring network and reliable water quality labs is either non-existent or has only very limited coverage.

National level water management planning requires information on a countrywide scale but that is even more inadequate and very sketchy. The Dutch government has lately committed funds for implementation of the Taiz plan. The German government will fund the Sa'adah Plan, while WB urban water credit will provide partial funding for the Tuban-Abyan Plan, through the Aden Water and Sanitation Master Plan.

1.12 Water Governance

Since unification of the country in 1990, notable progress has been achieved towards improving water sector governance. This includes consolidation of water management functions under NWRA (1995), and formation of the MWE (2003) with most water sector agencies administratively linked to it. This resulted in the water sector as a whole, and water management in particular, gaining representation at the cabinet level. The responsibility for irrigation, however, remains with the MAI, which has been, and is still, engaged in much water infrastructure development.

There is need for the MWE and the MAI to reach an understanding regarding jurisdiction over surface (spate) water infrastructure. It is very important that decisions regarding design and location of water infrastructure are made from an integrated water management perspective at the water basin level. Furthermore, with urban water supply reforms having gone into effect, there is a need for institutionalizing the regulation responsibility over the newly formed autonomous water corporations and for monitoring and reporting on MDGs achievement and the progress made in achieving millennium development goals. Whether NWSA headquarters can do this or whether a new body is needed remains to be decided.

The same applies to rural water supply and sanitation sector where a number of agencies are active in service provision with increasing urgency for regulation. The decisions regarding provision of RWSS services and associated technological packages have to be more demand driven and transparent but also due consideration must be given to environmental health aspects (i.e. need for achieving better balance between water supply and sanitation components). A viable mechanism for coordination among various institutions, within and outside the MWE, which build rural water supply schemes, needs to be developed. The local water supply and sanitation entities in both the rural and urban areas need to develop linkages with NWRA to be able to coordinate efforts in two areas: (a) water resource re-allocation, and (b) wastewater disposal that presents both potential environmental and health hazards (if left untreated) and an opportunity (if properly treated and re-used). Finally, linkages have to be strengthened between MWE / NWRA and local authorities, and particularly with Local Councils for decentralized implementation of water management plans and policies.

1.13 Is *qat* the culprit?

Although qat contributed to rural stability by transforming water resources to financial wealth[9], however, the qat crop has earned quite a lot of notoriety as being responsible for water resource depletion. Expansion of qat-cultivated area is often considered as evidence of its major role in groundwater overdraft. Qat now occupies at least half of the irrigated area in Yemen, growing at an annual rate of 9 % (double the growth rate of other crops). This crop has even invaded virgin land never cultivated before, in addition to expansion in regions known for its cultivation.

The reality is that between 1970 and 2000 the area under other crops, particularly grapes and coffee, has also expanded annually at nearly 3% and 5%, respectively. However, the area under qat expanded at a much faster rate at 9% per year because it is more profitable. Even if increase in qat area levels off, other crops will take up some of the slack and reduction in total area would be smaller. Therefore it is prudent to target expansion in total well-irrigated area, which expanded about ten folds (from 37 thousand to 368 thousand hectares) between 1970 and 1996 (this expansion is equivalent to about 9% per year). By the same logic, most effective agriculture policy instruments would be those that target the entire agricultural sector (such as agricultural trade policy liberalization and removing input price distortions, especially the under-pricing of water) rather than single crops.

If the existing situation continues as it is, without intervention, then qat farming will in the end deplete rural water and consequently wipe out the rural economy, unless qat savings are used to create alternative rural income-generating activities that are not dependent on intensive water use; activities that will create new job opportunities for the young generation instead of drilling wells and cultivating qat. It is suspected that a large percent of the cash revenues from qat cultivation is invested in treasury bonds, which give a lucrative income of about 13% annually

Nevertheless, serious consideration should be given to freeing qat importation. Indeed, the hard-currency expenditures on developing qat farms in neighboring water-rich countries, which would permit qat growing and export to Yemen, will be much less than the hard-currency which Yemen currently spends on qat irrigation (subsidized diesel fuel; maintenance and depreciation of drilling rigs; cost of well casings, pumps and spare parts; well deepening and drilling) as well as the cost of pesticides for spraying qat shrubs and the cost of the medical bill for treatment of the pesticides-caused diseases (since Qat shrubs growing in a humid environment like Ethiopia will not need an intensive use of pesticides). This is in addition to the value of the water which will be saved as a result of reducing qat farming in Yemen.

This switch to qat importation could be arranged in such a way that the chain of qat retailers and other marketing beneficiaries, which constitute the bulk of qat labor force in Yemen, will not be affected. The interest of current qat growers can be protected by encouraging them to form qat farmers' cooperatives, bringing together targeted qat farmers in critical basins to participate with shares proportional to their current cultivated areas in these basins. Each cooperative can get a permit to import a specified quantity of qat to Yemen or to a specified destination, in the coastal areas for instance. This process could be accompanied by a gradual substitution of qat shrubs in the water-scarce basins with alternative trees, with lower water consumption. This type of arrangements is already applied, for example, for banana farming by Saudi and American firms

[9] However, this wealth is not invested in productive economic activities, but is mostly spent extravagantly in building lavish houses in the countryside.

operating in some Latin American countries. An economic analysis to demonstrate the incentives and disincentives for qat importation remains to be done.

1.14 Macro economic and resource policies need to be better integrated

The role of diesel prices in groundwater conservation has traditionally generated much debate in Yemen. Fuel accounts for a relatively small part of pumping costs if one considers the total cost of pumped groundwater, which includes not only amortized capital costs (drilling, pump and engine etc) but also the cost of prospecting for water, i.e. the cost of dry wells.

Discussion of other macroeconomic policies, particularly policies affecting agriculture and water, is completely missing from the discourse on economic incentives for water conservation. Therefore, there is a need for compatibility between water development and management policies and plans, on the one hand, and other sectors' development policies and plans, on the other (particularly agriculture, energy and urban development policies).

Moreover, it is necessary to make water or the water dimension, a key (if not the prime) criterion in development decisions. For it is impossible to confront the water scarcity issue in isolation of the development process, as it is inconceivable to deal with development issues in isolation of water scarcity. In other words, the water dimension should rationally guide development decisions. What is meant here by development decisions, are those decisions and projects which deal with essential issues, such as agriculture, population, urban development, qat, etc.

Yemen's external balance of payment and inflation (both linked to government finances), exert a much more significant influence. High inflation encourages investment in land and wells that are likely to maintain real value compared to monetary assets. Moreover, deficits in external balance tend to weaken the Yemeni Rial, which in turn makes imports of cereals more expensive for domestic consumers and exports of fruits and livestock from Yemen cheaper for foreign buyers. The result is that domestic production of cereals increases (virtual water imports fall) and exports of certain fruits and livestock products increase (virtual water exports rise)[10].

In Yemen, where oil exports are very modest, the energy policy, particularly energy pricing, should aim to maximize exportable energy surplus so that the external balance of payment and government finances may improve and the currency is stabilized. This in turn would also ensure that the effects of macro-economic policies on domestic production are conducive and would encourage resource conserving.

1.15 Economic policy and financial investment

Yemen has a free market in agricultural products (except for the importation of *qat).* The country profits from its comparative advantage by importing much of its cereals requirements and using the scarce water thereby saved to produce higher value crops. The profitability of agricultural

[10] "Virtual Water" is a modern concept based on the premise that importing (or exporting) agricultural crops, is in fact equivalent to importing (or exporting) the water that is used in their production, particularly that most of the countries which import the produce are not short of soil or good climate for producing such crops but are instead short of water.

production and the consequent good performance of the agricultural economy in recent years has been driven by policies that have promoted the development and use of water resources. These policies, particularly energy policies, have contributed greatly to the recent strong growth of agriculture (5.5% average annual growth rate 1996-2000) and of agricultural employment (growing at 4% a year). However, these policies, coupled with the poor extension service to increase water-use efficiency in irrigation, have also encouraged over-abstraction of groundwater.

The critical water situation, however, calls for a review of agricultural policy and a reconsideration of some old concepts about self-sufficiency and food security, especially in the light of new developments in world trade. Furthermore, export-crop farming should be planned with a water-sense, considering that what is being exported is in fact water. Agricultural extension should be given a wider role to improve irrigation efficiency; small agricultural industries should be introduced, at least to substitute imported manufactured products such as juices and similar agricultural-based commodities. Also, higher yield crops that use less water should be encouraged and efforts should be made so that the added value from agricultural production is increased in order to enable the farmers to buy modern water-saving irrigation networks and to encourage the transfer of some crop farming to areas with more water availability.

Investment in the agricultural sector has been predominantly private, with the public sector intervening largely through the financing agency, AFPPF. Investment in piped water supply and sanitation has been almost entirely made by the public sector, as the economic and regulatory framework is not yet favorable to attract large-scale private investment.

1.16 Institutional resources and constraints

Yemen is moving towards an integrated sector governance structure. This was consolidated by the establishment of the MWE in 2003. For the first time, all agencies dealing with water and environment, except for irrigation, are within the fold of the new ministry (NWRA, NWSA, LCs, GARWSP and EPA).

In water supply and sanitation, the government is gradually moving away from the role of sole investor and service provider towards that of facilitator and regulator. In urban water supply, a reform program is underway to decentralize responsibility to locally accountable utilities that will ultimately become self-financing. In rural water supply, the government still retains a stronger involvement because of the poverty reduction mandate, but is increasingly promoting decentralized approaches, and involving beneficiaries in funding.

At present, responsibility for irrigation, dams and water harvesting lies with MAI, and substantial financing is provided by AFPPF, particularly for dams.

Institutionalized coordination mechanisms for the MWE and the MAI are needed, especially in the field of watershed management, water infrastructure (planning of small dams and water structures), improving irrigation water-use efficiency, implementing integrated water resources management, and expanding the re-use of treated domestic wastewater.

1.17 Dams policy

Quite early, the government adopted many programs and invested substantial funds in dam construction. It is estimated that there are today about 1000 water structures, with about 80 million cubic meters of storage capacity, costing about 16 billion Rials (200 Rials per cubic meter). Although Yemen receives an annual average of 50 to 60 billion cubic meters of rainfall, however, the nature of rain bursts, which fall during the summer, cause most rain water to be retained in upper (surface) soil layers to be used directly by vegetation, or to evaporate thereafter. Hence, it is practically impossible for runoff water to exceed 10% of rainfall water on average (3-6 billion cubic meters). Therefore, in spite of the tremendous efforts in dam construction, the 1000 water structures can only hold less than 80 million cubic meters (equivalent to less than 20% of Mareb dam capacity, or approximately one third of the annual extraction from the Sana'a basin).

Therefore, big dams are needed, which is what prompted MAI to start a project for big dam construction. Here, again, the importance of integrated water planning on basin level is further emphasized. However, it should be noted that to continue to focus only on increasing the quantities of available water without due consideration to demand management and conservation, is not a sustainable policy on the long run. The policy of supply management cannot alone meet the growing demand on the medium and long term and cannot constitute a sole and sufficient solution. This is evident from the fact that the dams that have been built have not stopped the continuously declining water tables or recovered the depleting aquifers. Hence, the dams policy should be accompanied by measures and actions to control and rationalize water demand.

1.18 Population and urban development policies: the need to take difficult decisions

It is important to realize the impossibility on the long term of meeting the growing water needs of the increasing population of the highland plateau. Hence, it is necessary to develop coastal cities and to contain the fast urban growth in mountainous cities, by moving certain industries and government institutions and services to coastal regions. It is only there that the desalination option can be meaningful, as an economically feasible option for meeting domestic and drinking water demand.

1.19 Human resources development in the sector

Professional and competent human resources to carry out the huge management and development tasks in the water sector are very scarce in Yemen, to such an extent that the shortage of qualified human resources constitutes the biggest constraint to building the capacities necessary for sound water management.

Within governmental agencies, competent professionals are even scarcer, due to the “brain-drain” towards the private sector and donor-funded projects. The reasons for this are well known: low-paying government jobs, poor incentives, and limited opportunities for career development through scholarships/fellowships abroad.

Indeed, the training opportunities that helped develop the generation of engineers and water resources professionals during the late seventies and eighties are no longer available, at least not

at the same scale. Civil service reform is progressing slowly and it will probably be long before it can tackle this constraint in the water sector. The limited availability of human resources is constraining the capacity of government agencies to implement reforms. This constraint poses a real risk on the ability to successfully implement NWSSIP.

Human resources are limited not only in the relevant social sciences, water resources economics and public and business administration but also in technical fields such as sanitary engineering. Competent professionals with experience to manage water projects or utilities are extremely scarce. Post-graduate level professionals are increasingly needed to deal with the complexity of issues in the water sector. Another constraint is the lack of support for the few existing training and capacity-building programs that are run by some Yemeni universities in water related subjects.

It is evident that this gap in qualified professionals cannot be filled through short-term training, as is often proposed in the many donor-supported capacity building projects. There is a genuine need for a long-term human resource development program, including intensive degree-oriented training, (post graduate diploma and masters degrees) but adequate financing is difficult to obtain. Ideally the Government should finance such programs from its own budgetary resources to ensure its sustainability. However, donor support is needed to initiate such programs.

Chapter 2

Previous Efforts in Defining Sector Objectives and Progress Made in Reforms

2.1 Water sector objectives

The social and economic objectives for the water sector in Yemen have been defined in several legal, policy and strategy documents. They can be summarized as follows:

a) Meeting the basic domestic water needs.
b) Facilitating water-use by higher return sectors of the economy (e.g. industry and tourism).
c) Maximizing income per m3 water used in agriculture.
d) Protection of the environment and sustainability of the resource (protection against pollution and depletion).

2.2 Guiding principles for water policy

Yemen has adopted guiding principles for water policy; covering natural resource management, social and economic objectives, institutional and sector governance aspects. These principles, which conform to international best practice, have guided sector reform to date, and are the basis of the proposals made in NWSSIP. Box 1 summarizes these principles.

2.3 Progress on sector reform to date

There is a growing public awareness of water scarcity challenges (see Chapter 1). This has prompted the reform of the water sector in the 1990s. Progress has been made, lessons have been learned, and some new initiatives are underway. The achievements to date are testament to the determination of Yemenis at all levels to act to prevent crisis. Donors have endorsed Yemen's progress on sector reform and have made long term commitments to the sector.

2.4 Institutional, legal and governance reforms

Yemen has been moving towards an institutional structure that will allow integrated management of water resources. This began in 1996 with the consolidation of water resource management functions under one entity (NWRA) and the start of basin planning.

The institutional reform process has received powerful new impetus from the creation of the MWE, reflecting an orientation towards establishing a consolidated sector management structure. For the first time, all agencies dealing with water and environment (NWRA, NWSA, LCs, GARWSP, EPA), except for irrigation, came under the auspices of the new ministry.

On the legal front, the water law was passed in 2002 after extensive national and international consultations. Following the establishment of the MWE, few amendments were introduced into the law and they await parliamentary approval (expected to enter the parliament in the fourth quarter of 2004). The by-laws have been prepared and await the passage by the parliament of the

amended law. Meanwhile, several measures to initiate implementation of the water law have been undertaken (see footnote 12).

In agriculture (irrigation, water harvesting and dams), the MAI has drawn up a reform program (Agenda 21 for Agriculture, A21A) to improve the efficiency of its services, aiming at increasing agricultural productivity. Implementation was delayed but is now starting on pilot basis.

Box 1: Guiding principles for Yemen's water policy

Principles of good natural resource management

- Integrated water resource management and the basin management approach.
- Management of the resource for achieving efficiency and sustainability.

Social and economic principles

- Priority to domestic uses, with due consideration to equity and poverty aspects.
- Allocative efficiency, so that water can flow to the use that pays the highest return, respecting basic domestic water needs for the poor.
- Water supply concerns are to be balanced by demand management measures, including the use of economic incentives to reduce the demand.
- Enhancing national and household food security through market-driven growth rather than self-sufficiency.
- Fiscal, agricultural and trade policies to be factored into water sector policy.

Institutional principles

- Water sector governance and capacity building are considered a priority.
- Decentralization, participation and user organization are key policy principles.
- Role of the private sector is emphasized.
- Role of the public sector in financing is clearly defined.
- Regulatory function is separated from service delivery.

2.5 Water resources management reform

NWRA has made a start on integrated resource management, with several basin plans prepared. Innovative water resource management approaches are being tested, including basin management approaches and self-regulation by groundwater users. Technical support is needed from countries, which have successfully implemented such approaches.

2.6 Water supply reforms

In water supply and sanitation, major efforts have been made to expand the coverage and quality of service. Reform efforts in urban water and sanitation are well underway, and a reform policy for rural water and sanitation is currently under preparation. The major challenge is that service coverage has not kept up with the population growth.

The general orientation of reform in this respect is the gradual departure of the government from its traditional role as an exclusive investor and service provider to a role of sector facilitator and regulator. In urban water sub-sector, there is a reform program currently being implemented to enhance decentralization and transfer responsibility to autonomous local corporations, designed to be self-financing in the end. In rural water sub-sector, the government preserves a strong participation in view of the commitment to poverty alleviation, however it increasingly encourages decentralization and cost sharing with the beneficiaries, who are also made responsible for scheme operation and maintenance.

2.7 Agriculture and irrigation reforms

The MAI is currently responsible for irrigation, dams and water harvesting. AFPPF provides substantial funds, particularly to dams. At the field level, MAI programs have demonstrated the technical and economic feasibility of better agricultural water management in groundwater irrigation, watershed management and spate irrigation improvement.

Participatory approaches are being followed, especially in irrigation through water user associations (WUAs). Sector economic policies have been developed that favor water use efficiency, including withdrawal of credit facilities for drilling and pumping equipment, and reforms in the price of diesel to remove part of the subsidy. There has been an increase in public finances allocated to the water sector. The balance and conduct of AFPPF programs are currently being reviewed to see how best this Fund can improve water (use) productivity and groundwater conservation. Despite these reforms, the groundwater overdraft is continuing and water use efficiency in irrigation remains very low.

There is a need to develop and operationalize coordination mechanisms between the MWE and the MAI, particularly in the fields of water catchments and water infrastructure (small dams and surface water structure), irrigation water use efficiency, integrated water resources management and recycling of domestic treated wastewater.

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PART TWO
PROPOSED OBJECTIVES, POLICIES AND APPROACHES

Chapter 3

Proposed Objectives, Policies and Approaches in Sector Management and Coordination

3.1 Objectives

The objectives of sector management are:

a) To ensure coordination between all sector agencies in pursuit of policy goals, to ensure accomplishment of water strategy and policies.
b) To ensure integration of water policies and national policies of sustainable growth and poverty reduction.
c) To ensure that sector financing effectively supports sector goals.
d) To monitor and evaluate performance, and report on progress towards goals.

3.2 Policy issues

The immediate priorities are:

a) To define the strategy and investment program.
b) To organize the institutional setup of sector agencies and to ensure that sector institutions are properly functioning and managed.
c) To ensure that cross-cutting issues are being dealt with in an integrated manner (funding, community contribution, tariffs, training, etc).

3.3 The approach

3.3.1 Consolidating MWE institutional structure

Noting that the Cabinet has approved the by-law and organizational chart of the MWE in June 2004, priority is to be given to complete the setting up, organization and competent staffing of the MWE, and to clarifying its mandate, internal horizontal and vertical relations, and relations with the various authorities, as well as with the water supply and sanitation corporations, . The MWE will put in place an incentive scheme (for government approval) to attract and retain competent staff. MWE will also promote outsourcing from international agencies and organizations, to the extent possible. In addition, institutionalized coordination mechanisms on management of irrigation water and structures between MWE and MAI will be pursued.

3.3.2 Improving the quality of sector investment and of AFPPF financing

MWE will be responsible for investment planning for the entire water sector, excluding irrigation. Investments for improving water use efficiency in irrigation have been far below the needs. In

particular, the bulk of AFPPF financing has been directed to the construction of dams, and very little is allocated to promoting lower cost recharge schemes like terrace rehabilitation or to promoting on-farm irrigation efficiency. The MWE has joined the board of the AFPPF. It is likely that in the future, the AFPPF, will allocate more finance to water resources management investments such as basin plans and public awareness, and to improve water use efficiency programs at farm level.[11] Donors, who currently finance dams (as well as irrigation development in general) are encouraged to channel their contributions through the AFPPF so as to influence reform of the AFPPF in order to increase transparency, to engage it more in water management and water use-efficiency projects, and to better use the AFPPF resources.

3.3.3 Managing water quality

The formulation of a clear policy is required on institutional responsibility of each concerned entity for water quality and its suitability for various uses, and for the assessment and control measures of such quality. MWE will adopt and follow-up establishing awater quality coordination group, to engage various institutions, and to agree on the role of each institution.

3.3.4 Recovering control over groundwater

The biggest challenge threatening 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 this common pool resource as possible.

The current incentive structure (particularly lack of limitations on extraction quantities, and the incentive of subsidized diesel) promotes rather than discourages groundwater overdraft. The nation recognizes the need to deal with the problem, which a number of initiatives have tried to tackle.

Few communities have imposed self-regulation rules, either on new drilling or on transfer and sale of water outside the extraction area.

The MAI has piloted a range of technical efficiency and watershed management innovations, and is currently adding water user organizations and technical advisory services to its approach.

On the other hand, NWRA has carried out water-well inventories in a number of basins, and the new water law has introduced all the regulatory instruments required. Three critical basins as well as the well fields in the major and some secondary cities have been declared protected. Projects are underway in the Sana'a and Sa'ada basins to test integrated packages of incentives

[11] AFPPF Board approved recently the funding of the preparation of a master plan for dams in 6 critical basins, in the framework of implementing integrated management programs. A joint unit from MWE and MAI will be formed to prepare this plan, with an allocated budget of approximately 70 million Rials. However, progress is very slow.

and measures to reduce overdraft of aquifers. Ultimately, the overdraft problem will have to be dealt with by a comprehensive "package" of measures, including:

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

MWE and MAI propose to progressively develop and test the elements of this package. National policy will essentially decentralize these key water resources management issues to the water basin committees, within basin plans. The preparation of basin plans is therefore top priority.

NWRA will coordinate information, education, public awareness, licensing,[12] monitoring and enforcement. NWRA will work closely with other concerned agencies, open more decentralized branches at governorate level, and cooperate at the field level with local authorities, especially regarding water law enforcement. NWRA will also closely work with farmers through its community mobilization teams and will coordinate its programs with the groundwater-related actions of MAI. The programs in Sana'a and Sa'adah Basins are piloting integrated packages based on water use efficiency investments and practices, identifying enhanced supply options, and defining farmer responsibility and encouraging self-regulation. These programs will be closely monitored through regular workshop, and lessons will be drawn and applied in other basins.

A study on options for changing the economic incentive structure, particularly for groundwater management, will be carried out. This study will cover both positive incentives like investment cost sharing as well as negative ones like pricing. It will also cover the overall incentive regime for irrigated agriculture that results from macroeconomic and agricultural policy, fiscal policy regarding taxation, water charges and subsidy on water-related equipment, and the role of public investment, including that of the AFPPF.

Furthermore, pilot projects will be undertaken, including a pilot project to test a system of tradable water rights in Taiz. Other actions will be identified through a stakeholder symposium that will review the results of the study on incentive structure. As sustainability is no longer attainable in the overexploited areas, and as some mining is unavoidable, NWRA will also propose a "rational groundwater policy" to set out expectations and benchmarks regarding the use of the groundwater resources.

[12] Cabinet Resolution 141/2004 was recently issued concerning regulating drilling rig traffic within and between governorates. The Resolution prohibited unauthorized institutions (Local Councils) from issuing well drilling permits, and mobilized the support of local authorities and security apparatus to control and check violations. MWE started to convene meetings at governorates' level and signing minutes of meeting with local authorities to enforce this resolution and clearly define the role of each party.

Chapter 4

Proposed Objectives, Policies and Approaches in Water Resources Management

4.1 Objectives

Water resources management objectives are:

a) Ensure maximum possible degree of sustainability.
b) Give priority to domestic needs of rural and urban populations.
c) Thereafter, maximize economic benefits through improved allocation, while mindful of equity and social norms.
d) Create a realistic and holistic vision among the general population regarding water resources availability/scarcity.
e) Contribute to poverty alleviation by promoting efficient use and equity in water allocation, so as to enhance socio-economic development

4.2 Policy issues

Yemen cannot depend solely on the spontaneous evolution of social institutions for dealing with water and associated environmental issues. Modernization has spawned economic and social activities and processes that in a short period of time can deplete aquifers and pollute them beyond possibility of recovery. In the meanwhile, increasing numbers of the population will acquire feelings of inequities in access to water, which would become worse and may potentially lead to growing social tensions.

In such a situation, the government has to play a leading role. It has, for example, to provide the now missing institutional interventions that would allow society to better cope with extreme water scarcity and environmental degradation. This is especially important in today's economy of globalization where the effects of macro economic policies and international trade flow (virtual water imports/exports) are often more pronounced on production systems and on patterns of resource use than the effects of sector or commodity-specific, targeted, economic measures.

The state, however, cannot adopt (especially for groundwater extractions) a top-down command-and-control approach that would replace indigenous institutions and substitute a formal legal code for customary water laws. Historically, these institution and norms have been proven effective in regulating water use and ensuring sustainability. A more pragmatic approach is for government institutions to forge a partnership with decentralized community based organizations for co-management of water resources.

4.3 The approach

A co-management partnership requires that the stakeholders be engaged in diagnosis of their water situation, and contribute their knowledge of the local situations for formulating practical water resources management plans and policies. After the plans are finalized, community-based

organizations play an active part in their implementation, especially in monitoring and ensuring compliance. The government for its part assumes the following responsibilities:

a) Creating an enabling institutional framework.
b) Providing information on water resources, raise awareness and create a shared water management vision among the beneficiaries regarding optimal management of the resources.
c) Supplying water related public goods (infrastructure).
d) Protecting water rights, implementing the water law, and creating conducive macroeconomic environment.

4.3.1 Creating an enabling institutional framework

The legislative framework for the water sector is already in place, with the Water Law becoming effective in 2002, and considerable progress has been made in consolidating water management functions and building implementation capacity as noted in the previous chapter. Capacities to regulate water use need to be further strengthened. This would require rationalization of mandates of agencies performing regulatory and implementation functions.

The technical capacities of key water sector agencies also need to be enhanced, especially regarding water resources. This would require substantial investments in human resources development for filling what is at present a large gap in availability of technically qualified personnel for the regulatory and service providing agencies. There is also the need to establish better linkages between water sector agencies. It is particularly important that decentralization is pursued and extended as a policy priority and authority is devolved at the lowest appropriate level. Furthermore, it is important to enable community based organizations to play their due role in co-management with local communities and to build their capacity for joint management of groundwater resources. The government has to assume the role of a catalyst for creation of such organizations and for building their capacities.

4.3.2 Information provision, awareness raising and creation of water management vision

Despite the increasing importance of groundwater in meeting the overall water demand, the updating of information about the resource is generally not done on a regular basis and remains inadequate. This is partly because the assessment and monitoring of groundwater, being a hidden resource beneath the surface, is more difficult technically and is more costly. The MWE will take steps to create an adequate national water resource information base, and strengthen the hydro-meteorological monitoring network to keep track of evolving resources use and resource quality situation. The ministry will also ensure that the information systems mentioned above are capable of processing and analyzing the regularly collected data and making it available as an input for water policy formulation and for disseminating it to the public as another means for increasing awareness. This will entail strengthening the National Water Resources Information Center at NWRA and establishing water quality laboratories.

The final component is the creation of a shared vision among stakeholders that would guide water resource management efforts. This can be accomplished through formulation of water resources

management plans that would be prepared through a participatory approach. The plans would heavily rely on the technical information obtained through systems mentioned above as well as on the input from professionals and their participation in the preparation process. The water resource information and technical solutions generated by water professionals would be disseminated among stakeholders who would be involved in the selection of water management strategies to be implemented. This approach was successfully piloted in the formulation of Taiz water resources management plan (Wadi Rasyan Basin).

4.3.3 Provision of water related public goods

The institutional framework, information system and strategic water vision mentioned above must be supplemented with hardware in the form of infrastructure for water resources management. Investments in infrastructure such as terrace rehabilitation or water structures for recharge enhancement, surface water diversion or flood control, generate public benefits. However, these structures tend to be under funded, unless the state shares responsibility for building them. This is essentially because the benefits, which are accrued from them, such as recharge enhancement and flood protection, are shared by all landowners, whereas the costs are borne by the terrace owners alone. Government can enhance supply of such public goods by direct subsidies or by mobilizing the benefiting communities to share some of the costs (through contribution of labor, for example).

Infrastructures for urban water supply, including desalination plants and brackish water treatment plants, involve large investments requiring the intervention of the government. However, these infrastructures need not be financed exclusively from public funds, as there is considerable scope for partnership with the private sector.

Investments in water harvesting schemes and in re-use of treated wastewater require linking technologies and public health issues. Therefore, government involvement in providing public funding, even on a pilot scale, is desirable.

All in all, the government has to create an enabling environment for:

a) Encouraging private sector, which already plays an important role in financing a significant part of water sector investment needs (e.g. tanker delivery services, private water networks and supply of potable bottled, or *dabba,* water),
b) Rationalizing investments financed through international financial assistance, to ensure maximum utilization of such resources and to ensure that, over time, a progressively larger share of this assistance is utilized for meeting infrastructure investment priorities that are part of regional water resources management plans.

4.3.4 Protection of water rights, implementation of the water law, and creation of an enabling environment at the macro-economic level.

Yemen needs a system of water and environmental rights in order to control groundwater overdraft, reverse the growing trend towards inequity in access to (or allocation of) surface water, and to protect water and land resources from quality degradation.

In collaboration with stakeholders, the government would help put in place a system of water rights, and enforce contracts involving voluntary transfers of such rights between consenting parties. Subject to the results of a pilot project on rights-based water transfers, the MWE would work (long term) on defining and gaining social and political acceptance of a system of water rights that would allow recognition of formalized water markets and trade in water rights.

Moreover, the MWE would enforce the water law, particularly the provisions relating to licensing and registration of wells and drilling rigs, and will endeavor to build control regimes for the protection of water stressed catchments.

Finally, as macroeconomic policy has an important bearing on resource use, the government would endeavor to a better integration of water resource management issues and concerns on the one hand, and macroeconomic and trade policies on the other. This, however, requires strengthening national capacities in the field of economic development within the sector, as well as in other relevant ministries, through human resources development and by mobilizing more investments for improving information on linkages between macroeconomic policy and water resources, and developing the needed analytical tools to support decision-making during formulation of development policy.

Chapter 5

Proposed Objectives, Policies and Approaches in Urban Water Supply and Sanitation

5.1 Objectives

The objectives for urban water supply and sanitation were set out in the Cabinet Resolution 237 of 1997, which adopted the reform program. Those objectives remain valid:

a) Increase coverage by WSS services
b) Financial sustainability of WSS utilities
c) Separation of sector regulatory and service-provision functions
d) Decentralization
e) Knowledge and skills development
f) Community and private sector involvement

With Yemen's adoption of the Millennium Development Goals (MDGs), quantitative targets for water supply and sanitation coverage were set[13] (see Table 1).

Table 1: Reaching the water supply and sanitation MDGs in urban areas

	2002	2009	2015
Percent of urban population covered with water supply services	47%	71%	75%
Percent of urban population covered with sanitation services	25%	52%	63%
Population covered with urban water supply services (million)	2.4	4.9	6.7
Population covered with urban sanitation services (million)	1.3	3.6	5.6
Total urban population (million)	5.2	6.9	8.9
Annual investment needed (million USD)	120	150	150
Urban water demand (million cubic meters)	129	175	224

5.2 Policy issues

NWSSIP's goal for urban water supply and sanitation is to expand coverage and quality of service of both water and sanitation services with the objective of reaching the MDGs by 2015, with due priority to the poor. In line with international best practice, responsibility for provision of such services is being progressively decentralized, and government's role is shifting towards that of policy making, regulation, monitoring and providing support. The role of the private sector and of the community in financing and running the sector is to increase. In due course, the Local Water Supply and Sanitation Corporations are expected to become fully independent, financially and administratively.

5.3 The approach

[13] MDGs aim at halving, by 2015, the percentage of population who lacked access (in 2000) to these services, taking into consideration annual population growth.

5.3.1 Expand coverage

To reach the MDGs in urban water, an annual investment rate of $150 million is required. Furthermore, additional quantities of groundwater will be needed each year such that an additional 100 million m3 per year will be needed by 2015[14]. As much as possible coverage will be expanded to poorer sections of the society. At the same time additional financing has to be absorbed. Measures such as staff and contractor training will be introduced to increase absorptive capacity of investment financing[15], and criteria will be set to ascertain that priority will be accorded to pro-poor investments.

5.3.2 Continue and expand the reform program after its evaluation

The reform program, which was launched in the beginning of 2000 with the corporatization of NWSA's Sana'a Branch, is generally recognized as successful. Its essence is the decentralization and corporatization of NWSA's branches and transforming them into autonomous local WSS corporations at governorate level[16].

As implementation of this program has proceeded rapidly, there is a need to ensure that the needed support measures and management controls, like corporate business plans, are in place. Therefore, an independent evaluation will be carried out during 2005, and needed corrective measures taken. In addition, by-laws will be introduced to clarify institutional relations with the MWE and local authorities. Actions will also be taken to continue the decentralization process, by establishing more LCs.

5.3.3 Develop regulation, monitoring, support and policy-formulation functions

Critical to the reform program is the establishment of a regulatory entity to ensure compatibility between water and service quality on the one side and tariffs on the other. This is essential to protect the public and to attract the private sector. A study will be carried out in 2005 to define these regulatory functions and the entity, which will undertake them. A performance benchmarking and monitoring system will also be set up.

Although in theory one regulator could cover both urban and rural sectors, at first sight this is unlikely, as rural water supply is of a very different scale and nature, and is generally self-regulated at the local level by the population served.

5.3.4 Financial sustainability and poverty orientation

[14] In 2003, the total pumped groundwater for urban water use was about 75 million m^3.

[15] Lengthy disbursement routines and double review and approval of disbursement requests at both the MoF and the MoPIC, in addition to poor working conditions of technical and administrative staff in the sector, constitute serious obstacles to increase absorption capacity of investments.

[16] There are 7 local WSS corporations (Sana'a, Aden, Ta'iz, Hodiedah, Ibb, Mukalla, and Seiyun). Each LC undertakes the responsibility for WSS services in its governorate.

The financial viability of a service utility/provider is vital (i.e. its ability to cover the operation, maintenance and depreciation costs from its own revenues). Therefore, full recovery of service cost remains the over-riding objective of the tariff policy.

At present, cost recovery practice by each LC varies according to local situation. The accepted norm is for the tariff to be set such that at least the cost of operation, maintenance and depreciation of electro-mechanical equipment are recovered. The government pays for new schemes, replacements and expansions, with these costs added to the assets. The tariff is expected to move to full cost recovery over time.

Regarding, the poor, the most pro-poor policy is expansion of coverage, especially as many poor people currently rely on expensive tanker-delivered water. At present, there is a degree of pro-poor cross subsidy in the block-tariff structure, where an affordable "lifeline" rate is charged on the first block to benefit the poor. However, the better-off currently also benefit from the lifeline rate and the tariff-system needs to be evaluated to be more pro-poor, based on experiences in the region.

However, the financial health of the water and sanitation utility must remain as the over-riding objective of the tariff. In smaller towns, lower cost technologies will be proposed and adopted, if the population wishes to keep tariffs down. The poorest of the poor will continue to be dealt with by charity and through social safety nets.

5.3.5 Promoting private investment and public private partnerships

Current policy is to encourage gradual phase-in of public-private-partnerships, through management contracts and "utility support programs", and by developing outsourcing. In addition, the MWE will review the possibility of improving the enabling environment for the local private sector to consolidate and expand their urban water supply and sanitation investments, which are currently constrained by an uncertain investment environment.

5.3.6 Building capacity and improving performance

Performance indicators in the decentralized utilities are improving, but are still well short of international norms. Capacity building programs are underway to improve performance. Topics include loss reduction, improved operation and maintenance, improved financial management, senior management programs, project management and project implementation.

5.3.7 Enhancing community participation

Community participation in the choice of technology and in selecting the level of service it can afford, is a possible means to reduce costs and, hence, to expand coverage to a larger population. This approach is being adopted systematically in the rural water sector. However, other community participation measures, which apply to both urban and rural communities, include public awareness campaigns on such issues as water conservation and the basis and importance of tariff setting in sustaining the utility/service.

5.3.8 Sourcing the required quantities of water

Reaching the MDGs will require additional quantities of water, which will increase annually to reach 100 MCM by 2015. Recent water supply projects (e.g. Taiz project) have faced extraordinary problems in sourcing water. Furthermore, as virtually all known water sources are harnessed and the scope for water supply augmentation by reducing distribution system losses is modest, securing these additional quantities of water will have to be through transfer from agricultural use in the rural areas to the towns.

On the other hand, large quantities of water could be saved by irrigation efficiency improvements. However, institutional mechanisms for water rights trading that facilitate inter-sectoral transfers are missing. Pilot programs in water transfer and water markets are proposed (see Chapter 4). These programs will succeed if properly designed, as higher urban prices of water already encourage well owners in rural areas around many towns to supply water to the city instead of using it for irrigation.

An innovation being piloted currently in the Sana'a basin is swapping deep groundwater with surface water or shallow groundwater from additional dams. In addition, innovations are proposed to pilot the desalination of brackish water (Taiz) and swapping treated sewage effluent for fresh water. These market based systems, which implicitly recognize farmers' water rights and reward them at scarcity prices, should be complemented with regulatory programs to stop further drilling in critical basins and to control abstractions.

5.3.9 Desalination

Desalination technology has made considerable advances during the last few decades, which have added to its importance as a source for meeting drinking water needs in rural and urban (arid or semi arid) regions. Such advantages have also led to a substantial reduction in desalination costs, largely due to savings achieved in energy consumed in the desalination process and to the reduction of environmental impacts of desalinization, which previously required high mitigation costs[17].

Desalination is often looked at by some magical solution to water scarcity, while others consider it an expensive technology, especially when water needs to be transported over long distances or pumped to high altitudes. In such cases, the energy cost for transport, rather than desalination cost becomes the determining or constraining factor. The following paragraphs will shed some light on desalination, and the MWE policy in this respect:

a) Discourse about desalination should be limited at the present time to coastal towns or highland towns with sustainable quantities of brackish groundwater that can economically be desalinated as a supplementary source for fresh groundwater. The reason for this being the prohibitive cost of transporting and pumping desalinated water over long distances or to high altitudes.

[17] These are the cost of environmentally acceptable disposal of brine water resulting from desalinization.

b) It will be a mistake to delay the introduction of desalination until all groundwater resources are depleted. Then, it would be difficult for the population to afford the sudden large increase in the water-tariff, which would be brought about by the high cost of desalinated water compared with the relatively cheap groundwater.

c) Desalinated water should be gradually introduced as a supplementary source to supply coastal towns', so as to allow gradual increase of tariff[18]. This will also maintain the implementation of the national policy on water tarrif which stipulates that the tariff should allow recovery of the operation and maintenance cost in addition to part of the depreciation cost; a policy, which has been achieved in most water utilities. In other words, it is important that the introduction of desalination should not lead to a large and sudden increase in the production cost, that cannot be recovered except by big changes in the tariff, which cannot be afforded, given the economic conditions and low per capita income[19].

d) Institutionally, desalination constitutes a unique opportunity for the private sector to enter into investment partnership with the public sector, particularly that the water produced can be sold in bulk to service utilities which in turn will pump it into its networks and bill it to its consumers.

e) For desalinization to be economical, the losses in the water distribution networks should be very small (not exceeding 15%). This entails considerable investment to rehabilitate large segments of the water distribution networks in several Yemeni cities.

[18] That is why it is important to introduce desalination gradually over a number of years to replace depleting groundwater aquifers. At the same time, the water-tariff can be gradually raised at small affordable increments. That means that if desalination is introduced today at 10-15% of the produced quantity, this will not lead to a big rise in tariff. After one year the percentage can be increased to 25% and the tariff can be increased accordingly by another small increment. Thus gradual replacement and gradual tariff adjustment can be achieved, and groundwater sustainability can be extended for a longer period. It is important here to emphasize that this mechanism can be applied in coastal regions only. In highland regions, the cost of pumping desalinated water from the cost is so high that small gradual increments in the water tariff are not feasible.

[19] Average production cost of groundwater in Aden, for example, excluding distribution cost is approximately 35 Rials per cubic meter (about 20 dollar cents), while desalinated water production cost is estimated at 65-100 Rials per cubic meter (about 35-55 dollar cents)

Chapter 6

Proposed Objectives, Policies and Approaches in Rural Water Supply and Sanitation

6.1 Objectives

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, this goal should be given top priority. The sector needs more efforts to establish new approaches to implement rural schemes through involving and organizing local communities, adopting the demand responsive approach (DRA), improving field implementation of the schemes, supporting the establishment of NGOs which are active in this field and also by developing low-cost, appropriate technologies.

Considering that achieving the MDGs for the rural population represents an ambitious high target, that can be difficult to achieve (it would entail serving ten million more rural residents by 2015, which equals three times the current population served), and given the current rate of implementation and the need for sector reorganization, NWSSIP has retained a lower target of delivering water services to 47% of the rural population by 2009 and to 65% by 2015 and sanitation services to 37% by 2009 and to 52% by 2015 (see table 2.)

Table 2: Reaching the water supply and sanitation MDGs for rural areas

	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	10.9
Total rural population (million)	13.8	17.5	20.9
Total annual investment required (million USD/year)	50	130	130

Check also financing in the annex!

6.2 Policy issues

Like urban water, the goal for rural water is to achieve rapid expansion of water and sanitation services. However, the challenges in the rural sector are quite different. The lead agency for rural water, GARWSP, and other agencies and projects are in a process of decentralization, and are testing approaches to sustainable rural water supply and sanitation, based on the principles of decentralization, community participation and "demand responsive approach". A sector review is underway which is expected to result by the end of 2004 in a sector strategy, institutional restructuring plan and investment program.

The major issues of this sector are implementation mechanisms, the role of local communities, targeting of beneficiaries and cost effectiveness (i.e.; how to implement projects that meet needs at low cost. The approaches and actions discussed in this Chapter have to be reviewed and confirmed by the results of the sector review, which is currently underway through a Dutch grant.

6.3 The approach

6.3.1 Increasing coverage and implementation capacity

6.3.1.1 Setting up sector strategy and coordination

Expanding rural water supply and sanitation coverage is a national priority. Forceful new departures are underway with decentralized approaches, participation and demand responsive approach (DRA), low cost appropriate technology, and the involvement of efficient and flexible field partners like SFD, PWP and NGOs.

However, in order to achieve the desired rapid expansion of coverage, the reform program will have to address a number of issues, the most important of which are: restructuring, decentralization, role of GAWRSP, agreed methodology of rural water implementation (DRA) to be followed by all stakeholders, involvement of non-governmental partners, and uniform approach and criteria to prioritize rural water investments (selection and eligibility criteria) etc. The modality of the implementation of the rural sector reform will be similar to the urban sector.

As the RWSS strategy is still under preparation through a sector-wide consultative process, the proposals in the rest of this section are not yet firm. However, it is expected that they will be incorporated into the final strategy.

6.3.1.2 Improve project implementation

Absorptive capacity of institutions to utilize available investment financing (the ability to implement projects or schemes expeditiously so as to make full use of available financing) is a major issue for the rural water supply sector.

Current project implementation is expected to produce “success stories” that can serve as a model to solve this problem of absorptive capacity. In addition to the current innovations produced by the approaches described above, other measures will be introduced, such as:

a) Measures to develop and adopt a common methodology or approach for project implementation, through pooling of experiences of different agencies,
b) Measures to intensify training and social and environmental awareness raising,
c) Building capacities at branches, especially “soft skills” (non-technical skills) for DRA, and
d) Making greater use of (and reliance on) local knowledge and skills, including community contracting.

6.3.1.3 Broadening the range of partners

Absorptive capacity for investment financing can be increased by decentralization of GARWSP and through partnerships with non-governmental entities (NGOs, CBOs, private sector) for

project implementation using participatory implementation methods, and by enhanced implementation through greater coordination and integration with SFD and PWP.

6.3.2 Improving technology choices

6.3.2.1 Broadening and adapting technology choices

Current rural water project programs offer a very limited choice of technologies (the most common choice being mechanical systems consisting of a well and a pump). In order to increase coverage and promote sustainability, research and experience will be used to develop technical advice material, and field programs will offer a broad range of technological options, explaining to communities the capital and operation and maintenance cost and sustainability implications of each. This approach will give priority to simple low cost solutions.

6.3.2.2 Factoring in sanitation and hygiene

Too often sanitation is neglected. In future projects, sanitation will be obligatory on the beneficiaries, and hygiene education that targets women will be an integral part of each project/scheme.

6.3.3 Ensuring water resources and their quality

As Yemen's water resources are fully developed, rural water projects are increasingly encountering problems obtaining a viable water source. NWRA branches, EPA and the local authorities need to play a role, within the basin plans, in ensuring the quantity of water required, and in ensuring source protection from depletion and quality from pollution.

6.3.4 Improving targeting of the communities and sustainability of the schemes

6.3.4.1 Adopt bottom up approaches throughout and ensures that gender is mainstreamed

The demand responsive approach is currently being tested in several forms. However, most investments, allocated for governorates or specific areas, continue to be administratively determined. It is proposed that the demand responsive approach and work through community-based organizations be adopted as standard practice for identifying projects to implement.

In addition, although women are recognized as key managers of household water and the guardians of family health and education, they are not yet systematically involved in decision-making or project management. Thus, gender inclusiveness is to be mainstreamed.

6.3.4.2 Promote sustainability through strengthening the role of community institutions:

Global experience in rural water supply has shown that sustainability needs to be built into projects from the beginning (i.e. at the project planning and design stage). This early participation of beneficiaries is a major thrust of the DRA. It helps in choosing the right technology for community needs and affordability in terms of capital as well as operation and maintenance, It also helps in identification of training and capacity building needs of the community. Early involvement of the beneficiaries also ensures that the chosen committee to operate and maintain the scheme is capable of running a self-sustaining financially independent

scheme. Future rural water programs will allocate more investment for the needed "social mobilization" and for community capacity building.

6.3.4.3 Target finance to the greatest need

A final issue is targeting. Past experience shows that rural water projects are clustered in certain parts of the country. Currently, GARWSP has set up a criteria-based system for investment allocation among governorates. As part of the upcoming rural reform strategy, eligibility criteria that favor poorer communities, a transparent bottom up application process and a decentralized approval system will be established.

Chapter 7

Proposed Objectives, Policies and Approaches in Irrigation and Watershed Management

7.1 Objectives

Within the global objective of improving rural livelihoods and sectoral value added in a sustainable manner, the specific objectives for irrigation and watershed management are:

a) Enhancing sustainability through water resources protection;
b) Improving farmer incomes through increasing water use efficiency;
c) Enhancing supply; and
d) Improving institutional performance in support of farmers.

7.2 Policy issues

The fundamental policy issue for agriculture is how to increase farmers' incomes and contribute in reducing poverty, whilst cutting the over-abstraction of groundwater. This is an area in which the MAI has a very active program both in promoting water use efficiency and in enhancing supply. Increasingly MAI and MWE/NWRA will work together on community-based solutions, in collaboration with user associations.

7.3 The approach

7.3.1 Sustainability through water resources protection

7.3.1.1 Reducing groundwater mining

The approach to control groundwater mining has been described above (see paragraph 3.3.4). 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 those local communities that have demonstrated water use adaptive capacity, to help them recover control of groundwater.

7.3.1.2 Securing farmers' water rights

Recognition of farmers' use rights to water, acquired under the water law, and registration of these rights, is key to responsible management of such resources (see paragraph 3.3.4). The MAI will therefore work with MWE/NWRA to recognize and register farmers' use rights over water.

7.3.1.3 Getting incentives right

The importance of incentives and the measures proposed to correct them are described above (see paragraph 3.3.4). The MAI will support the proposed study, in light of which changes in the incentive structure will be proposed, discussed and adopted.

7.3.2 Increasing farmer incomes through increasing the efficiency of water use in irrigation

For the irrigated agriculture sector, a range of measures will be continued (and expanded to more areas) to increase water productivity within agriculture (more income per drop). The key goal is to help farmers use water resources efficiently and sustainably, whilst increasing their incomes. This will include measures to improve institutional capacity; to increase participation and strengthen farmer institutions; and to optimize use of non-conventional water sources (such as treated wastewater).

7.3.2.1 Refocus research and extension

In order to develop water efficient technology packages, MAI intends to further develop research at AREA, building on recent successes like the Rapid Impact Program. Emphasis will be on improving incomes through water use efficiency in irrigated agriculture, on integrated basin/watershed linkages, on conjunctive use of conventional and non-conventional water resources, and also on enhancing returns in rainfed agriculture. The research will use participatory techniques and integrate socio-economic factors. Extension will be reoriented to focus on water use efficiency at farm level, with national coordination provided by MAI/AREA.

7.3.2.2 Cost recovery on public irrigation schemes and developing water user associations

Under MAI's reform program, *Agenda 21 for Agriculture* (A21A), the MAI intends to gradually implement full cost recovery on publicly managed irrigation schemes. On the large spate schemes, MAI has already embarked on a process of developing water user associations (WUAs). The objective is to arrive at viable federations of water user associations that may in the long run be able to take over responsibility for scheme management.

7.3.2.3 Treat *qat* as a crop

Qat, which is not illegal, has to be treated largely like any other crop (see paragraph 1.13). There will continue to be a research effort on qat, and in due course it should become the subject of extension, particularly on water use efficiency. However, no direct public investment should support qat, and any agreements involving public subsidy (e.g. an investment project) should continue to require farmers not to expand their qat area.

7.3.3 Enhancing sustainability and quality through improved watershed management

7.3.3.1 Watershed management with an integrated approach

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

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 like terrace rehabilitation, check-flow structures, dams and spate improvement will become a priority for AFPPF financing and will be coordinated by MAI and NWRA within the basin framework

7.3.3.2 Review and revise the dams program

On the question of dams, a review and evaluation of past experience will be undertaken. Within a basin-wide master plan, guidelines will be developed for site selection criteria, economic, social and water resources management assessments, and EIAs. A participatory approach will be adopted, involving both beneficiaries and local councils.

7.3.4 Institutions for efficient agricultural water use

7.3.4.1 Repositioning Ministry of Agriculture and Irrigation

Since 1999, MAI has been working to redefine the role of government, the private sector and farmers in the agriculture sector. A21A was developed and adopted by the government in 2000 as a blueprint for change, for repositioning the MAI. The agenda targeted efficiency, decentralization, incentives and participation. After long delays, the MAI now intends to implement this agenda. In the first phase, a review and update will be made of the proposals to reflect the new focus on water resources management, the ongoing decentralization process in the country, and the role of local authorities and communities. Following the first phase, further support to implementation of A21A will be included in subsequent projects.

7.3.4.2 Enhancing institutional coordination on agricultural water use

Government has for the time being decided that dams and irrigation should remain under the aegis of MAI, rather than being transferred to MWE. However, MAI and MWE are setting up coordination mechanisms, and all plans affecting water resources (including dams) should be screened by MWE/NWRA (see paragraph 3.3.2), based on the water planning mechanism set in the Water Law.

In addition, and in conjunction with MAI decentralization and its integrated approach, NWRA will build its program on agricultural water use utilizing this decentralization policy as well as NWRA's community mobilization teams (see paragraph 4.3.4 above), and its awareness and education programs.

7.3.4.3 Improving the effectiveness of AFPPF

As discussed above (see paragraph 3.3.2), AFPPF should play a growing role in promoting water use efficiency and conservation. MWE has joined the AFPPF board, which will help to improve coordination with the MAI.

7.3.4.4 Increasing the role of community organizations and civil society:

For several years, MAI has worked with community-based organizations, like water user associations. It will expand its program to form more WUAs in spate and rainfed areas. The current pilots will be monitored, so that lessons may be learned and scaled up. MAI will also work with NGOs, including the Agriculture Cooperatives Association, to improve agricultural water management.

Chapter 8

Proposed Objectives, Policies and Approaches in Human and Environmental Aspects

8.1 Objectives

Objectives at the human level are to ensure equitable access to water and efficient use. At the environmental level, the objectives are to ensure resource sustainability both in quantity and quality.

8.2 Policy issues

Lack of access to clean potable water and adequate sanitation is a prime indicator of poverty. Hence, expanding coverage with priority to poor communities is a government policy and is implicit in Yemen's adoption of the water supply and sanitation MDGs as a major objective of the PRS.

In addition, the poverty impacts of environmental degradation are profound. Groundwater depletion affects poor farmers most, as the rich are financially capable of tapping deeper groundwater, thereby drying up shallow wells and springs and increasing the difficulties, which the poor farmers face. Water pollution also affects the poor most, as they are typically downstream in the catchment (an example is in the Tihama, where seawater intrusion is common). Scarcity, desertification, and drought affect the poor, who depend more on rainwater, whilst the poor in towns have far less access to public and piped water supply (because they live in the perimeters of towns) , and typically pay far more for tankered supplies. In rural areas, women and children have to spend up to six hours daily fetching water for domestic use.

8.3 The approach

8.3.1 Reduce poverty through improved environmental management

During 2004, Yemen will formulate a pro-poor environmental target and adopt it as part of its national strategy for sustainable development, and within the MDG targets. Specifically, the target will be to "reverse by 2015 the trend of environmental degradation and its impacts on poverty".

8.3.2 Act on water quality through a broad coalition

Regarding water quality, there is often duplication and some overlap of responsibilities among various stakeholders or institutions. According to the water law, NWRA is responsible for monitoring and regulating water resource quality (natural water resources), while potable water quality (in the networks) is monitored and controlled by the water utilities and the public health authorities. Currently water quality monitoring mandates are fragmented among many entities. Therefore, as mentioned above (see paragraph 3.3.3), MWE will set up a working group to

prepare a proposal for mandates and coordination. Water quality laboratories will be strengthened and the private sector will be encouraged to invest in this field.

8.3.3 Protect water sources

In addition to data collection and watershed management activities, which have been covered above, the government will look into the possibilities to establish an early flood-warning system.

8.3.4 Get environmental monitoring and regulation fully operational

Monitoring and regulation of water quality and environmental impacts is the responsibility of the EPA, which needs to have its legal status formalized, as a successor of the EPC. EPA is not an executing agency, but works through other concerned agencies, notably the "environmental units" in line ministries and institutions concerned. EPA will ensure the systematic implementation of EIAs for all projects with a potential impact on water. It will also monitor and supervise the preparation of EIAs and evaluate the results before advising government on whether they meet environmental standards.

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PART THREE
INVESTMENT PROGRAM

Chapter 9

Investment Program for (2005-2009)

Table (3) summarizes the Investment Program for the 5 year-period (2005-2009) associated with the national strategy for the water sector.

Table 3: NWSSIP investment program (2005-2009)[20]

Sub-sector	Total Required Investment (M USD)	Donor funds Committed/ Pipelined (M USD)	Local Financing Expected (M USD)	Net Financing Requirement (M USD)	Share of Total Investment (M USD)
Water resources management	47	20	7	20	3%
UWSS hardware	750	355	265	130	49%
UWSS software	48	25	0	23	3%
RWSS hardware	454	78	101	275	30%
RWSS software	28	6	0	22	2%
Irrigation	190	64	56	70	12%
Environment	21	2	0	19	1%
Total water sector investment (2005 – 2009)	1,538	550	429	559	100%
As percentage	100%	36%	28%	36%	

[20] Detailed investment programs for the five sub-sectors are included in Annex 2. The expected local financing is assumed to continue at the current level of about of USD 50-55 million annually for UWSS and a USD 18-22 million annually for RWSS (see Annex 2.B and 2.C). These numbers do not include funding through other entities like the SFD, the PWP, rural development projects, specialized international organizations (e.g. UNICEF), etc.

Chapter 10

Guidelines Adopted in Defining NWSSIP

10.1 Scope: volume of investments

NWSSIP has been designed to include all investments made in the water sector, including these made through public organizations (including PWP, SFD, and AFPPF). It includes government, beneficiary and donor funding of projects or schemes.

10.2 Rationale for choosing investments

NWSSIP is designed as a coherent strategy, action plan and investment program. Therefore, investment proposals are linked, through policies and actions, to the objectives of the water policy, and vice versa.

10.3 Links to quantitative targets

Where quantitative targets can be defined, especially the MDGs, the investments proposed are tailored to meeting that target. However, some investments have been phased - notably those for rural water - with lower investment requirements in the early years to allow adequate time needed to finalize the sector strategy and mobilize the institutional capacities needed to implement it.

10.4 Programmatic approach

As far as possible, NWSSIP proposes that a programmatic approach should be followed whenever possible (i.e. implementation based on programs), as is already being done in urban water and to some extent in water resource management (support program to NWRA), in order to reduce inefficiencies and implementation problems when many fragmented projects exist.

Ideally, a "sector wide approach" (SWAP) would be proposed to the donors under which donors agree to finance a time slice of the investment program, subject to monitoring and annual review/auditing. However, indications are that Yemen's water sector does not yet have the performance record and implementation capacity that would give confidence in this approach.

10.5 Improving the efficiency of existing investment resources

A number of measures need to be undertaken to ensure that existing programs give better returns. These include the preparation of a rural water supply and sanitation strategy, and the measures outlined in Chapter 3 for increasing the impact of AFPPF in the water sector.

10.6 Striking a balance between investments in hardware (infrastructure) and software (institutional capacity building)

Experience shows that financing is more readily available for physical investment than for capacity building. One reason is that capacity building programs are often not well prepared, and

their result/impact is variable and depends on persistence of the concerned institution and its effort/seriousness in implementing these programs. Given the desperate need for good planning and management, and for human resources development, NWSSIP has placed large emphasis on institution building and capacity building, with a target of investing for this purpose at least 5% of total investment of NWSSIP.

10.7 Absorptive capacity

The absorptive capacity is the capacity to implement projects and disbursements proportionately with program available funds. The investment numbers are high in relation to past spending, and a question mark over absorptive capacity is evident. To mitigate the risk, NWSSIP has given emphasis to investments that are backed by viable investment strategies. In addition, actions to improve implementation capacity are programmed e.g. outsourcing, working with non-governmental partners, contractor training etc.

10.8 Integrated programs and crosscutting investment areas between 5 sub-sectors

Even more difficult than integrated planning is the design and implementation of crosscutting or fully integrated programs. Coordination and inter-agency cooperation is required, inter-alia, for (a) basin programs; (b) watershed management investments (terraces, dams, water harvesting); (c) wastewater treatment and reuse; and (d) desalination and brackish water treatment.

NWSSIP proposes a series of institutional measures to handle this challenge, including: (1) the integrated planning approach at basin level and in cooperation with the basin committees and aided by NWRA; (2) MAI/MWE coordination on agricultural and irrigation water resource management programs; and (3) coordination within MWE, where most entities of water management and use are now located. Coordination with EPA is required for environment related programs.

10.9 Basin approach for allocation of resources

Yemen has adopted a policy on basin planning, and is preparing for implementation of two basin management programs (Taiz and Sa'ada). As far as possible, NWSSIP investment proposals have been conceived within basin plans.

10.10 Focus on equity, MDGs and poverty

The poor tend to lose out in resource allocation, although they are a "priority". NWSSIP and the basin plans give priority to domestic use, an inclusive and pro-poor strategy. Investment for poorer areas will be increased relative to non-poor areas.

10.11 Rural/urban balance

Typically, investments are biased towards urban areas, which are easier and more visible, and in the case of Yemen have a successful ongoing reform program. This bias will exist in the early years of NWSSIP - with an average $ 310 per capita proposed for urban over the five years 2005-9 (water supply and sanitation), but only $ 110 per capita for rural (water supply and sanitation).

However, this balance will shift in the outer years of NWSSIP, as the rural water strategy takes effect, and measures are introduced to improve absorptive capacity in rural water, adopt low cost technologies, and discuss with donors progressively more funding for rural water.

10.12 Links to private investment

One objective is to increase the synergy between public and private investment, and ultimately to reduce the proportion of public resources invested. Measures are included to enhance private investment in urban water, and to encourage farmers to invest in water conservation and efficiency through the enabling environment, appropriate policies and legal framework.

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PART FOUR
IMPLEMENTATION AND ACTION PLAN

Chapter 11
Implementing NWSSIP

11.1 Priorities for implementing NWSSIP

The action plans and investment program presented above represent the minimum program to achieve Yemen's pressing goals in the water sector. As implementation starts and as sources of finance are identified, selection criteria will be used to prioritize investments.

Box 2: Guidelines for prioritizing NWSSIP investments

1. Fit with MDGs/PRSP
2. Absorptive capacity of the sub-sector
3. Priority to rural water supply and to water resources management, which are currently under-financed
4. Emphasis on capacity building, training etc. (where needed)
5. Fits within an integrated approach (basin level or intra-sectoral)
6. Non-governmental, participatory approach to implementation (user involvement, NGO and private sector outsourcing)
7. Existence of a credible sub-sector strategy
8. Economic and incentive framework conducive to achieving results
9. "Ready-to-go" pilot projects supporting some key innovation
10. Impacts and sustainability likely
11. Local cost sharing agreed (Government and beneficiaries)

NB: Some of these guidelines can be used for ranking; some are pre-conditions. If the pre-condition is not met, then first priority is to get it into place, e.g. a credible sub-sector strategy. Not all the guidelines will have the same weight/importance.

11.2 Risk assessment of NWSSIP

Risk assessment asks "what if" about certain basic assumptions underlying NWSSIP. The largest risks identified are: volatility of external aid; institutional capacity and the chances of improving it; availability of local funds; the feasibility and extent of community mobilization; and policy reform on difficult issues like incentives (for example, diesel fuel).

The principal risk mitigation measure is NWSSIP itself, which by its long term and consensual nature should act as a "compact" that binds partners – government, civil society, donors – into a single common agenda that obligates them all to taking the actions and providing the funding agreed.

The phasing of the investments in the NWSSIP can also help mitigate certain risks (e.g. weak institutional capacity, need for adherence by the beneficiary local community to the agreed contributions and to agreed rules, or for national consensus on policies).

Another implementation risk is the extent of success achieved in integration with development planning. Obviously, NWSSIP cannot be successfully implemented in isolation of the development process in general, and socio-economic development planning in particular. NWSSIP can be superceded if development projects are not conceived within an Integrated Planning Approach, with its dual dimensions: a water planning dimension and a water economics dimension[21].

Other risks include the inadequacy of funding coordination. With the establishment of the MWE and merger of most agencies working in this field, the next step should be investment coordination. There is still multiplicity in agencies undertaking various water schemes, which requires more coordination to avoid project duplicity and to strengthen integrated management. One of the options to be assessed is to form an investment basket, similar to SDF, for the whole sector.

Another NWSSIP implementation risk is the big investment gap caused by the acute shortage of public investment in urban and rural WSS. If Yemen is to obtain the MDG target in WSS, it is necessary that the annual investment allocated to the 5 sub-sectors is increased. The improvement of government capacity to mobilize funding resources, to coordinate the flow of funding from various internal and external sources, and to direct these resources according to priorities, is a basic condition for making a tangible improvement in water and environment conditions. There is also a need for creating a balance in sector investments at the national level, such that water can get a share of investment proportional to its importance, according to clear criteria to remove current distortions both in per capita investment in the water sector relative to other sectors, as well as among various water-sub-sectors. The development of WSS utilities should be given

[21] Water planning dimension entails adopting the water basin as the geo-administrative unit of development planning, such that the management of all development issues and the drafting of integrated plans are based on a basin view, much in the same way that a *mudiriah* (district) or a governorate is considered the administrative unit in the government administrative system. Based on this approach, water availability and demand, water development planning and investment should be done at the basin level. The water economic dimension requires the impact on water to be a basic criterion in establishing the economic feasibility of development projects; that is a basic criterion in prioritizing projects according to their merit. When the economic feasibility of a project is evaluated, its water feasibility should be taken into consideration in terms of water quantity used by the project, economic return of this use and the pollution impact of project waste on the water environment. This water impact should be one, if not the main, criterion in directing basin development investments. In other words the first questions to be considered by a development planning decision maker should be: How much water will a project consume? Where will this water come from? And what measures are taken to prevent adverse impact of the project waste discharge, if any?

priority in government investments, in order to alleviate the daily hardships of the urban and rural poor who fight for daily survival[22].

11.3 Monitoring, evaluation and updating of NWSSIP

NWSSIP is an ambitious program demanding substantial resource allocation. Hence, monitoring and evaluation are essential to show outputs and impacts. The MWE, in collaboration with relevant agencies, will be responsible for monitoring. A monitoring and evaluation system with benchmarks will be designed in the coming months (as an activity within NWSSIP). Regular reports on progress will be issued, based on targets and indicators. It is intended that NWSSIP be a "rolling" document that will be updated, say every two years. A first update would be indicated in 2006, when the results of the December 2004 Population Census become available.

Regular follow-up of progress made towards achieving the MDGs in WSS, is not any less significant than actual implementation. Monitoring and evaluation will also greatly help in orienting and focusing effective international cooperation for the poor. Decisive political commitment on both the national and local levels will be crucial factor in achieving success. This should be stressed by key partners in the government (MoPIC and MAI).

11.4 Coordinating NWSSIP's implementation

The Government will establish a government-donor coordination mechanism, based on best practice worldwide[23] and in Yemen.[24]

[22] To raise available funds, it is proposed to: a) raise government share in donor funded projects from the current 15% to 25% and call upon donors to increase their funding with the same ratio, b) increase coordination in utilizing currently available funds to avoid project duplicity, whereby some locations may, for example, get water harvesting projects in addition to mechanical projects, c) giving due consideration to projects falling behind schedule, in which tens of billions of Rials have been invested and the completion awaits small funding for certain components. A special mechanism should be devised to get them completed, perhaps through special loans, in addition to delegating a greater role for the local councils for their completion.

[23] The WSS Collaborative Council has a good document on "best practices" for donor-recipient coordination in the water sector.

[24] The education sector in Yemen can serve as a "model" for donor-donor and donor-recipient coordination (key-elements are: clear government strategy, ownership and leadership of the Ministry, partnership agreements with donors and commitment to certain parts of the program).

Chapter 12

Action Plans

12.1 Action plan for sector management and coordination

Issues and strategies	Action
Consolidating sector institutions	• MWE by-law and organizational chart in mid-2004 • Outsourcing to private sector and NGOs • Staff incentive scheme
Improving the quality of sector investment and of financing through AFPPF	• Financial planning to improve utilization of available funds • MWE to join the Board of AFPPF • AFPPF to finance some water resources management activities and water use efficiency programs • Encouraging the donors to contribute to the financing of the AFPPF
Managing water quality	• Establish a water quality coordination group
Recovering control over groundwater	• Decentralize to the water basin committees within basin plans • NWRA to make necessary coordination to improve water law enforcement, including local authorities • Implement the water plans of Taiz, and Sa'adah Basins, monitor and scale up lessons • Carry out a study on the economic incentive structure for water use in various sectors • Pilot projects including a test of tradable water rights in Taiz • Stakeholder symposium to identify further actions • Prepare strategy on “policy for rational use of groundwater ”

12.2 Action plan for water resources management

Issues and strategies	Actions
The institutional framework needs to be strengthened to enable NWRA to carry out its mandate	
Institutional strengthening and sector coordination	• Water Forum • Delegation of authority to local authorities / Councils
Strengthening community-based organizations	• Providing support to local communities for basin co-management
Water resources management planning	• Preparation of IWRM plans for selected basins • Monitoring implementation of IWRM plans
Strategic initiative for human resource development	• Degree oriented training program (Diploma and Masters degrees) • Skills development (short term training) • Study tours • Center of Excellence for resource economics
Information, awareness, and vision are needed to improve sector governance	
Strengthening water resources information base	• National water well census • Water resources assessment • Decision support system
Strengthening water resources monitoring system	• National hydro-meteorological monitoring network • National observations wells grid • Strengthening NWRIC • Water quality lab
National and regional information campaigns	• Water education program • Awareness campaigns
Water sector investments and public goods need to be rationalized	
Providing water resources management infrastructure	• Terrace rehabilitation • Recharge structures • Water harvesting pilots • Wastewater re-use pilots
Property rights need to be guaranteed and a conducive macroeconomic environment created	
Monitoring, implementation and enforcement	• Expansion of NWRA branches network • Establishment of more community mobilization teams • Implementation of Taiz IWRM plan • Monitoring implementation of IWRM plans • Implementing licensing, registration & other provisions of water law

Issues and strategies	Actions
	• Pilot project for establishing groundwater rights • Pilot project for rights-based water transfer (rural/urban, inter-basin) • Project for industrial pollution prevention • Project for promotion of water saving devices

12.3 Action plan for urban water supply and sanitation

Issues and strategies	Actions
Need to expand coverage	
Expand the investment program to meet the MDGs.	• Program and finance investment 2005-9 ($750 mn) • Increase absorptive capacity (staff and contractor training) • Criteria given to prioritize investments for the poor etc.
Continuation and deepening of reform program	
Continue reform program after evaluation	• Define relations between LCs and PUs in a by-law • Pilot the idea of a governorate water office in Hudeida • Complete decentralization of remaining NWSA-branches
Develop regulation, monitoring, support and policy functions	• Study, then establish regulatory function for WSS • Redefine and revise NWSA tasks • Set up performance indicator system
Improved orientation of policies towards poverty reduction and financial sustainability	• Cost recovery (only for O&M and depreciation of electro-mechanical equipment) • Government pays for new schemes, replacements, extensions • Lower cost technology to be introduced • Study block tariff system and revise it with a pro-poor view • Poorest of the poor to be dealt with by charity and social safety nets
Promote private investment and public private partnership (PPP)	• Phase in PPP at the operation stage through management contracts and “Utility Support Programs” • Develop outsourcing, to reduce over-staffing
Improve utility performance	
Building capacity and improving performance	• Capacity building to improve performance: loss reduction, O&M, financial management, senior management, project implementation and management • Project management and contractor training to improve absorptive capacity
Enhance community participation	• Choice of methodology in small towns, plus public awareness
Sourcing water	• Pilot projects in desalinization of brackish water and swapping treated effluent for fresh water

12.4 Action plan for rural water supply and sanitation

Issues and strategies	Actions
Increasing coverage and project (scheme) implementation capacity	
Setting up sector strategy and coordination	• Sector strategy and investment program to be further developed and finalized • Central office for sector reform to be set up • Decentralization of GARWSP to governorate branches
Improve implementation	• Develop common approach to be followed by all entities operating in the sector • Capacity building • Community contracting
Broaden (diversify) the range of partners	• Give NGOs access to finance • Establish fast track procedures for small projects • Encourage low-cost technology
Improve technology choices	
Technology choice is limited, and may not be always appropriate	• Develop technical advice material • Priority to simple low-cost solutions
Factor in sanitation and hygiene	• Sanitation to be obligatory • Hygiene education to be systematic in GARWSP work program
Sourcing the water	
Ensure water resources and quality	• Work with NWRA and EPA within basin plans • Local education and awareness also needed
Improve targeting and sustainability	
Adopt bottom-up approaches throughout and mainstream gender	• Demand responsive approach and community based organizations to be standard
Maintain sustainability through closer work with community institutions	• User associations/committees to be self sustaining financially
Target finance to greatest need	• Establish transparent bottom-up application process and decentralized approval system for allocation of investments

12.5 Action plan for irrigation and watershed management

Issues and strategies	Actions
Sustainability through water resources protection and allocation	
Reduce groundwater mining	• Revise incentive structure, support WUE and user self-management • Support water-saving technology • Pilot projects in community groundwater management
Securing farmers' water rights	• Implement water law • Recognize farmers' use rights • Promote awareness regarding water rights
Getting the incentive framework right	• Carry out a study leading to review of the incentive framework
Increasing farmers' incomes through increased water use efficiency	
Refocus agriculture research and extension	• Revitalize research based on economic returns and comparative advantage, with emphasis on water use efficiency and rainfed agriculture, using participatory techniques and integrating socio-economic factors • Reinforce extension, with national coordination and focusing on WUE
Cost recovery on public irrigation schemes	• Implement full cost recovery progressively
Developing water user associations (WUAs)	• Develop WUAs in spate areas and ultimately hand-over schemes to them
Treat qat as a crop	• Implement the program on qat agreed at National Conference on qat
Enhancing resource sustainability and quality through watershed management	
Revive watershed management with an integrated approach	• Implement A21A • Support integrated programs and research on rainfed systems
Review and revise the dams program	• Review and evaluate the experience gained so far, establish guidelines and planning, involve beneficiaries and local councils

Issues and strategies	**Actions**
Strengthening the institutions for a better role in realizing efficient agricultural water use	
Repositioning MAI	• Implement "A21A", starting with pilot
Enhancing institutional coordination on agricultural water use	• MAI/MWE coordination • Dams etc. screened by MWE/NWRA, according to the law • Decentralize NWRA; establish field presence, awareness and education.
Improving effectiveness of AFPPF	• See the action plan on sector management and coordination
Increase community organization and civil society role	• Monitor current WUA pilots, learn and scale up • NGOs to be service delivery partners

12.6 Action plan for human and environmental aspects

Issues and strategies	Actions
Poverty reduction	
Reduce poverty through environmental/ natural resources management	• Formulate a pro-poor environmental MDG in the national strategy for sustainable development • Participation of the local community, with awareness about conservation and financial cost sharing, and "empowerment" in decision making and management • Incentives to private investors • Capacity building for community based organizations • Education in water resource management and environmental protection
Water quality	
Act on water quality on a broad front	• Raise public hygiene awareness • Working group to propose mandates and coordination mechanism for water quality control • Establish quality standards • Regulations for water storage and transport • Facilitate setting up water quality laboratories • Trade-of high and low quality water • Combat waterborne disease • Pay for service, polluter pays and participation
Protect water sources	• Establish water protection zones • Pilot watershed management activities • Establish flood early warning system • Water data collection
Get environmental monitoring and regulation fully operational	• EPA legal status to be formalized • EIAs to be used systematically • Water quality monitoring, groundwater monitoring, and monitoring of surface and groundwater discharge (groundwater abstractions and wadi flows)

PART FIVE
RECOMMENDATIONS OF THE LAUNCHING WORKSHOP OF NWSSIP

Under the auspices of H.E the Prime Minister, the workshop on " **National Water Sector Strategy & Investment Program 2005-2009"** (NWSSIP) was held during the period 26-27 June 2004. NWSSIP was prepared during the period from November 2003 to June 2004 by five working groups from MWE Head Office and affiliated agencies and corporations, MAI Head Office, AREA, MPIC, representatives of relevant committees from the House of Representatives (the Parliament), and the *C*onsultative Council, representatives of line departments in the President's and Prime Minister's offices, experts from SFD and PWP, and representatives of German, Dutch, Japanese donors as well as UNDP and WB.

During the workshop sessions, NWSSIP was discussed so as to reflect a shared vision among the concerned institutions regarding the development, management and investment in the water sector to achieve the Millennium Development Goals as reflected by the Poverty Reduction Strategy, and:

Considering the importance of water as a corner stone in social and economic stability and security and the importance of achieving water resources sustainability,

- Being aware of the growing water scarcity faced by most Yemeni cities and rural areas as a result of continued irrational water use,
- To maximize the benefits gained from the selection of Yemen as one of the 8 participant states in the Millennium Project,

The workshop participants, **have endorsed the following recommendations:**

1) The proposed strategy be approved concerning management and coordination, and continuation of institutional capacity building in accordance with priorities of the parties concerned.
2) The Strategy & Investment Program 2005-2009 be submitted by MWE to the Cabinet for approval and allocation of the needed additional funds. And action be taken to benefit from selecting Yemen as one of the 8 participant states in the Millennium Project.
3) The need to establish a financing mechanism for the water sector, not only to attract more donor funding, grants and loans but also to coordinate and prioritize projects and to remove distortions in sub-sectoral funding.
4) The importance of enforcing the Water Law, especially with respect to licensing of water well drilling**,** water planning and environmental monitoring.
5) MWE is urged to follow-up what been included in H.E. the Prime Minister's address during opening of the workshop regarding:
    - Rationalization of water use in cities through adoption of an awareness campaign by the water utilities through promotion of water saving devices.

- MWE is encouraged to cooperate with the Ministry of Oil and Mineral Resources to update the hydro-geological studies and maps which were prepared before re-unification by the, then, Yemeni Joint project.
- Coordination with the Ministry of Finance (Customs Authority) to control the import of well drilling rigs to the country and cooperation with other parties to control their traffic in accordance with the Water Law and relevant Cabinet resolutions in this respect.

6) MWE should consider carrying out the necessary socio-economic studies on the *qat* issue (in consultation with MPIC and MAI) and present results the Cabinet to take the necessary decisions.
7) Efforts should be continued to improve the work conditions of technical and administrative staff in the sector and give capacity building more attention so as to ensure that appropriate decisions are taken by the Cabinet in this regard.
8) Coordination with the MPIC, for better implementation of environmental impact studies, so as to make water use intensity the key factor in directing economic and social development in general.
9) Continuation of cooperation and coordination with MAI especially with regard to rational water use in irrigation, qat and dams.
10) MWE is encouraged to review and update previous studies on desalination and take the necessary action in this regard.
11) The MWE is to make necessary preparations for implementation of the Parliament's recommendation to declare 2005 a national water year.
12) Any new revenues, which may be allocated to the AFPPF, should be exclusively marked for promotion of irrigation efficiency, including drip, sprinkler and similar technologies.
13) The Government increases its contribution (so called local component) to project financing so as to partially offset the gap in NWSSIP financing. The donors are also called upon to contribute to covering this financing gap.

Annex 1: Names of Participants in the Preparation of NWSSIP

Water resources and Policy Thematic group

	Name	Organization
1	Salem Bashuaib	NWRA-Chairman
2	Abbas Al-Mutawakel	NWRA
3	Zeid Al- Mumalemi	MWE
4	Moh'd Saleh Ali	Parliament
5	Ali Jabr Alawi	YWPS
6	Saleh Bakuhaizel	EPA
7	Antelek Al Mutawakel	GWCC
8	Abdallah Thary	NWRA - deputy
9	Abdullah Saif	NWRA/Taiz
10	Abdulah Aziz Mahyoub	NWRA/Aden
11	Nasser Moh'd Nasser	NWRA
12	Saleh Al- Dubby	NWRA
13	Faisal Sultan Ameen	Shura Council
14	Hans Van Henvel	Netherlands Embassy
15	Marion Jerichow	CIM-advisor NWRA
16	Peer Gatter	UNDP
17	Gudrum Isphording	German Embassy
18	Yori Hattori	Japanese Embassy
19	A. Thabet	Japanese Embassy
20	Ibrahim Thabet	FAO
21	Mohamed S. Harmal	WB-SBWMP
22	Khaled Riaz	Facilitator – CTA UNDESA

Urban Water Supply and Sanitation Thematic group

	Name	Organization
1	Mohammed al Hamdi	Deputy Minister MWE
2	Ali Al Kumairy	MWE
3	Saleh Al Kouni	NWSA
4	Ahmed Sarhan	NWSA
5	Abdullah Al Mutawakel	Sana'a LWSSC
6	Abubaker Ayash	MoPIC
7	Ali Kassim	KfW
8	Gerhard Redecker	KfW
9	Ali Khamis	WB
10	Isam Makki	WB UWSP
11	Abdullah Al Muta	Arab Fund sewerage project
12	Ali Hussein Al Ansi	Parliament
13	Mary Horvers	European Commission
14	Eberhard Wolf	GTZ/NWSA
15	Anwer Sahooly	GTZ/Technical Secretariat
16	Mohammed Fusseil	Yemen Water Protection Society
17	Susanna Smets	GTZ –TS /Facilitator

18	Abdullah Noman	WEC/Facilitator

Rural Water Supply and Sanitation Thematic group

	Name	**Organization**
1	Radman Bin Braik	Cabinet / House of Deputies
2	Khalid Al Ansi	Parliament
3	Mohammed Al Jaradi	MWE
4	Ahmed Al Arashi	MOPIC
5	Ali Mohmed Al Surimi	GARWSP-Chairman
6	Abdulhamid Bashiri	GARWSP-Deputy Chairman
7	Fawzi Kharbash	GARWSP-International
8	Abdallah Abdul Malik	GARWSP
9	Tawfiq Al Shargby	GARWSP
10	Nasser Al Eshawi	GARWSP
11	Mohammed M. Al Aghbari	GARWSP
12	Samira Abdallah Qasim	National Women Council
13	Abdul Wali Al-Shami	PWP-Head of Social and
14	Jawad Al Jailani	SFD
15	Ali Abdul Wali Majed	SFD
16	Jean Francois Leures	French Embassy
17	Mohammed Al Aroosi	Dutch Embassy
18	Tim Kennedy	TA-RWSP
19	Yoji Hattori	Japanese Embassy
20	Zaid Jurji Wes	Unicef
21	Abdel Qader Hanash	RWSP-WB
22	Mohammed Abdul Razzak	RWSP-WB
23	Fares Ahmed Al Aliyi, Amin Alabassi	Jamaiyya Mustaqbal
24	Afrah Al Mahfati	Yemen Women Union
25	Irwa Al Soul	Al Soul NGO
26	Jamiila Ahmed Damaj	Al Soul NGO
27	Husniyya Al Kadri	Yemen Women Union
28	Matthias Leibbrand	Facilitator - ICS
29	Kamal Sulaiman	Translator ICS

Irrigation Thematic Group

	Name	**Organization**
1	Mutaher Zaid	Director GDI
2	Qahtan Al Asbahi	GDI
3	Dr. Ismail Muharram	AREA
4	Farook M. Kasem	MAI/ Planning
5	Dr. Khader B. Atroosh	AREA
6	Ali Gunaid Ali	MAI/Planning
7	Saeed Al-Absi	MAI/Planning
8	Sultan Abdul Kareem	MAI/Planning
9	Mohamed A. Al-Adhroei	Farmers Union
10	Abdul Mumen Hashem	FAO

11	Anwar Girgira	WB-Irrigation Project
12	Suha Al Qubaiti	Council Ministers
13	Abdel Malik Al Thawr	MAI
14	Ahmed Yahya Saber	MAI/Planning
15	Dr. Husain Mukbel	Presidential Office
16	Khaled Mohamed Saeed	MoPIC
17	Dr. Abdel Wahed Mukred	Facilitator irrigation group

Human and Environment Thematic Group

	Name	**Organization**
1	Mahmoot Shideiwa	Chairman EPA
2	Salem Baquhaizel	EPA
3	Hilal Al Riashi	EPA
4	Dr. Mohammed S. Al Mashgari	EPA
5	Abdullah Own	EPA
6	Mohammed Shamsaan	MWE
7	Noori Jamal	MWE
8	Ali Saleh Al Galal	MWE
9	Ellen von Zitzewitz	CIM-Advisor MWE
10	Nadia Othman	MoPIC
11	Aref Moharrem	NGO
12	Morad Moharrem	NGO
13	Fahmi Ahmed	NGO
14	Waheeb Al Eryani	UNDP
15	Danae Issa	UNDP
16	Fuad Al Qadessi	UNDP
17	Ali Fadheel	Projects?
18	Nasser Al Yazidi	NWRA
19	Jamal Al Lawzi	EPA-Aden
20	Maroof Uqba	NGO-Aden
21	Najib Al Maktari	Consultant
22	Nadir Awad	World Bank
23	S. Ba-asher	Parliament
24	Ahmed Saif Qubaiti	Parliament / Al Qabeita NGO
25	Wael Al Eryani	Secretariat of the Presidency
26	M.S. Gaze	Secretariat Council of Ministers
27	Dr. Khalid Al Hariri	Facilitator

Annex 2: Investment Program for each Sub-Sector

2.A Water Resources Management

2.B Urban Water Supply and Sanitation

2.C Rural Water Supply and Sanitation

2.D Irrigation and Watershed Management

2.E Environment

Annex 2.A: Water Resources Investment Program (required additional funds are shaded)

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
0	**Design and implement NWSSIP monitoring system (irrigation part monitored by MAI)**	MWE	0.40	0.04	0.04	0.04	0.04	**0.56**			0.56	MWE + NWRA, NWSA, GARWP, EPA, MAI	No funds committed yet
1	**Strengthening of WR information system**												
1.1	National water well census	National	0.30	0.30	0.30	0.30	0.30	**1.50**			1.50	NWRA	Part of funds to be mobilized through committed donor funds; additional funds required
1.2	Water resources assessment studies	National			1.00	2.00	2.00	**5.00**			5.00	NWRA + MoMR	
1.3	Development of decisions support system	National				0.12	0.13	**0.25**			0.25	NWRA + MWE	
1	**Subtotal WR information system**		**0.30**	**0.30**	**1.30**	**2.42**	**2.43**	**6.75**			6.75		
2	**Establishing WR monitoring system**												
2.1	National WR monitoring network	National	1.00	0.50	0.75	0.39		**2.64**			2.64	NWRA + RDAs	Part of funds to be mobilized through committed donor funds; additional funds required
2.2	National grid of observation/exploratory wells	National	1.50	1.50	1.50	1.50	1.50	**7.50**			7.50	NWRA + RDAs	
2.3	Strengthening national WR information center	National	0.11	0.10	0.10	0.10	0.10	**0.51**			0.51	NWRA	
2.4	National laboratory for water quality analysis	National	0.30	0.20	0.17			**0.67**			0.67	NWRA + EPA	
2	**Subtotal WR monitoring system**		**2.91**	**2.30**	**2.52**	**1.99**	**1.60**	**11.32**			11.32		
3	**Creating WR infrastructure**												
3.1	Assessment of dam policy; evaluation of social and environmental impact of dam implementation; preparation of national master plan for dams	National and country	0.50					0.50			0.50	MWE + MAI, NWRA, AFPPF, EPA	Part of funds to be mobilized through committed donor funds; additional funds required
3.2	Development of institutional structure / mechanisms to make investment decisions for water infrastructure	National	0.20	0.10	0.10	0.05	0.05	0.50			0.50	MWE + NWRA, MAI	
3	**Subtotal WR infrastructure**		**0.70**	**0.10**	**0.10**	**0.05**	**0.05**	**1.00**			1.00		
4	**Regional WR management plans**												
4.1	Preparation of regional integrated water resources management plans	Tihama, Rada, two other basins		**1.00**	**1.00**	**1.00**	**1.00**	**4.00**			4.00	NWRA + basin committees	Part of funds to be mobilized through committed donor funds or AFPPF; additional funds required
5	**Support to CBOs and water basin committees**												
5.1	Support to CBOs and water basin committees for co-management/self-regulation of the basin	Tuban, Sadah, Hadramawt, Sana'a	**0.60**	**0.60**	**0.60**	**0.60**	**0.60**	**3.00**			3.00	Basin committees + NWRA	Part of funds to be mobilized through committed donor funds; additional funds required
6	**Monitoring, Implementation and Enforcement**												
6.1	Monitoring implementation of WRM basin plans	Tuban, Hadramawt, Sadah, Sana'a	0.20	0.20	0.20	0.20	0.20	**1.00**			1.00	NWRA + MWE	Part of funds to be mobilized through committed donor funds; additional funds required
6.2	Implementation of Taiz WRM plan	Taiz	0.60	0.60	0.60	0.60	0.60	**3.00**			3.00	NWRA	
6.3	Community mobilization for WRM (including community mobilization teams)	Tuban, Hadramawt, Sadah, Sana'a	0.48	0.48	0.48	0.48	0.48	**2.40**			2.40	NWRA	
6.4	Expansion and strengthening of NWRA branches	Sadah, Hadramawt, Tihama, Rada	0.20	0.20	0.20	0.20	0.20	**1.00**			1.00	NWRA	
6.5	Licensing, registration system and enforcement of WRM measures	National	0.22	0.12	0.12	0.12	0.12	**0.70**			0.70	NWRA and regional entities	
6.6	Pilot projects for establishing groundwater rights	Tuban, Hadramawt	0.10	0.10	0.10	0.10		**0.40**			0.40	NWRA	
6.7	Pilot projects for rural-urban transfers	Tuban, Hadramawt	0.04	0.04	0.04	0.04	0.04	**0.20**			0.20	NWRA	
6.8	Introduction of water saving devices for households/hotels (demonstration purposes)	National	0.04	0.04	0.04	0.04	0.04	**0.20**			0.20	NWRA	
6	**Subtotal monitoring, implementation, enforcement**		**1.88**	**1.78**	**1.78**	**1.78**	**1.68**	**8.90**			8.90		

Annex 2.A: Water Resources Investment Program (required additional funds are shaded)

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
7	**Education and awareness campaigns**												
7.1	Education programs	National	0.03	0.03	0.03	0.03	0.03	**0.15**			0.15	Girls WCC + NWRA, NGOs	Part of funds to be mobilized through committed donor funds; additional funds required
7.2	Training on water law and user rights to judges, police, water courts	Country	0.12	0.12	0.12	0.12	0.12	**0.60**			0.60	NWRA + MOJ, MOI, MWE	
7.3	Awareness campaigns	National	0.20	0.20	0.20	0.20	0.20	**1.00**			1.00	NWRA	
7	**Subtotal education and awareness campaign**		**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	**1.75**			1.75		
8	**Strategic human resources development**												
8.1	Long-term degree oriented academic training program	National	0.40	0.80	0.96	1.12	2.32	**5.60**			5.60	NWRA + MWE	Part of funds to be mobilized through committed donor funds; additional funds required
8.2	Short-term training program	National	0.14	0.14	0.14	0.14	0.14	**0.70**			0.70	NWRA	
8.3	Regional study tours	National	0.08	0.08	0.08	0.08	0.08	**0.38**			0.38	NWRA	
8.4	Center of Excellence for water resources economics	Sana'a	0.70	0.40	0.40	0.40	0.40	**2.30**			2.30	Sana'a University, WEC	
8	**Subtotal human resources development**		**1.32**	**1.42**	**1.58**	**1.74**	**2.94**	**8.98**			8.98		
9	**Institutional strengthening and sector coordination**												
9.1	Water forum	National	0.05	0.05	0.05	0.05	0.05	**0.25**			0.25	NWRA + MWE	Part of funds to be mobilized through committed donor funds; additional funds required
9.2	Delegation of authorities to local authorities to implement the water law	National	0.13	0.13	0.13	0.13	0.13	**0.65**			0.65	NWRA + Local Authorities	
9.3	Integrated hydro-economic models for policy analysis	National				0.10	0.10	**0.20**			0.20	NWRA	
9	**Subtotal Institutional strengthening and sector coordination**		**0.18**	**0.18**	**0.18**	**0.28**	**0.28**	**1.10**			1.10		
Planned allocations from donors and local funds													
A	National program on IWRM	National, Taiz, other basins	0.49	4.84	4.66	3.63		**13.62**	12.26	1.36		NWRA	RNE (USD 9.3 million) and UNDP (USD 3 million); 10% local contribution
B	Groundwater and Soil Conservation Project	Country	0.92	1.01	0.46	0.18		**2.57**	2.18	0.39		MAI + NWRA	World Bank; part of GSCP is allocated for IWRM; 15% local contribution
C	Sana'a Basin Water Management Project	Sana'a Basin	0.80	0.80	0.80	0.80		**3.20**	2.56	0.64		MWE + NWRA	World bank; part of SBWM is allocated for IWRM; 20% local contribution; exact IWRM allocation difficult to distinguish
D	Sadah WSS project - supplementary measures	Sadah	0.10	0.15	0.10			**0.35**	0.35			NWRA	KfW; part of Sadah WSS project is allocated for IWRM measures; no local contribution
E	Integrated Water Resources Management project, including geo-hydrological mapping and studies	Amran, Sadah, Ibb	1.00	1.00	1.00			**3.00**	3.00			NWRA	German Government GTZ (USD 1.8 million) and BGR (USD 2 million); no local contribution
F	IWRM allocations of GoY, including AFPPF funds	Country	0.98	0.98	0.98	0.98	0.98	**4.90**		4.90		NWRA + AFPPF	Funding through AFPPF and minor additional local funding (100% local funding)
TOTAL planned allocations from donors and local funds			**4.29**	**8.78**	**8.00**	**5.59**	**0.98**	**27.64**	**20.35**	**7.29**			
TOTAL planned investments			**8.64**	**8.07**	**9.45**	**10.25**	**10.97**	**47.36**					
TOTAL committed/pipelined donor funds			**2.96**	**7.00**	**6.33**	**4.06**			**20.35**				
TOTAL estimated allocated local funds			**1.33**	**1.78**	**1.68**	**1.53**	**0.98**			**7.29**			
TOTAL required additional funding for investments			**4.35**	**-0.72**	**1.45**	**4.66**	**9.99**				**19.72**		

Annex 2.B: Summary for Urban Water Supply and Sanitation Investment Program (required additional funds are shaded)

HARDWARE	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
TOTAL planned investments	**150.00**	**150.00**	**150.00**	**150.00**	**150.00**	**750.00**				LCs, NWSA + MWE, MOPIC, MOF	Total planned investments in hardware for 32 towns/urban centers in 2005-2009
TOTAL committed/pipelined donor funds for 32 towns/urban centers	**86.50**	**101.20**	**67.65**	**16.15**	**23.80**		**295.30**			LCs, NWSA + MWE, MOPIC, MOF	Total committed/pipelined donor funds for 32 towns/urban centers in 2005-2009
TOTAL committed donor funds not allocated to towns/urban centers				**30.00**	**30.00**		**60.00**			LCs, NWSA + MWE, MOPIC, MOF	Total committed/pipelined donor funds (WB APL2 2008-2009) that are not yet allocated to specific towns
TOTAL estimated allocated local funds for 32 towns/urban centers	**23.50**	**23.90**	**16.35**	**2.85**	**4.20**			**70.80**		LCs, NWSA + MWE, MOPIC, MOF	Total estimated allocated local funds in 2005-2009 (contribution to loans and support decentralization of 13 NWSA branches)
TOTAL estimated local funds not allocated to towns/urban centers	**26.50**	**26.10**	**38.65**	**52.15**	**50.80**			**194.20**		LCs, NWSA + MWE, MOPIC, MOF	Total estimated local funds in 2005-2009 that are not yet allocated to specific towns
TOTAL required additional funding for hardware	**13.50**	**-1.20**	**27.35**	**48.85**	**41.20**				**129.70**	LCs, NWSA + MWE, MOPIC, MOF	Total required additional funding that needs to be mobilized in 2005-2009; around **17%** of the planned investments

SOFTWARE	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
TOTAL planned software components	**8.92**	**11.34**	**11.17**	**8.15**	**8.45**	**48.03**				Various UWSS sector institutions and donors	Total planned software components in 2005-2009
TOTAL committed/pipelined donor funds for software	**7.62**	**8.14**	**6.92**	**1.00**	**1.00**		**24.68**			Various UWSS sector institutions and donors	Total committed/pipelined donor funds for software components in 2005-2009 (grants/loans)
TOTAL estimated allocated local funds for software	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**			**0.00**		Various UWSS sector institutions and donors	Contribution of local budget to loans is spend on hardware, not on software; no local funds are earmarked for software
TOTAL required additional funding for software	**1.30**	**3.20**	**4.25**	**7.15**	**7.45**				**23.35**	Various UWSS sector institutions and donors	Total required additional funding to be mobilized in 2005-2009; around **48%** of the planned software
The following towns are included in the hardware investment program: Aden, Al Bayda, Al Hauwta, Al Jawf, Al Mahweet, Al Qaida, As Shaher, Ataq, Bait al Faqih, Bajil, Dhalla, Dhamar, Ghaydah, Harib, Hudeida, Ibb, Jaar/Zinjibar, Jibla, Khamir, Labous/Yafeh, Maber, Manakha, Mareb, Mukallah, Rada, Radfan, Sa'adah, Sana'a, Shibam/Kauwkaban, Taiz, Tur Al Bahah, Zabid;											
The national coverage targets for 2009, based on investment of 750 million over 2005-2009, is 71% for water supply and 52% for sanitation. An additional 2.5 million people will be served with water supply and an additional 2.3 million with sanitation											

Annex 2.B: Urban Water Supply and Sanitation Investment Program (required additional funds are shaded)

Software Components

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
1	**Support to decentralization process**												
1.1	Institutional support project for the decentralization of five "Aden branches"	Al Hauwta, Abyan, Ad-Dhalla, Radfan, Tur Al Bahah	0.72	0.72				1.44	1.44			NWSA + Aden LC, MWE, TS	Funds committed from European Commission
1.2	Institutional support and capacity building for the decentralization of 13 NWSA branches	Al Jawf, Al Mahweet, Al Ghaydah, Harib, Qaida, Bayda, Khamir, Manakha, Maber, Shibam, Labous, Mareb, Ataq	0.50	1.50	2.00			4.00	4.00			NWSA + MWE, TS	Funds to be mobilized from APL1 WB
1.3	Continued support for institutional strengthening and decentralization of branches/urban centers	Country				2.00	2.00	4.00			4.00	NWSA + MWE	No funds committed yet
1.4	Capacity building of 7 LCs in project management & implementation and senior management training	Sana'a, Aden, Taiz, Hudeidah, Mukallah, Ibb, Seiyun	0.70	0.70	0.70			2.10	2.10			LCs + MWE, TS	Funds to be mobilized from APL1 WB
1.5	Institutional support and capacity building for the establishment of 5 new LCs	Dhamar, Abyan, Lahj, Hajjah, Sadah	0.30	0.50	0.70	1.00	1.30	3.80			3.80	LCs + MWE, TS	No funds committed yet
1.6	Support program to introduce a GIS-based OMS-system in corporations and utilities	Taiz, Ibb, Hudeidah and other LCs and utilities	0.50	0.50	0.50	0.50	0.50	2.50	1.00		1.50	LCs + NWSA, MWE	Funds committed by Germany (GTZ); no funds committed after 2006
1.7	Support project for customer and public relations departments in LCs and utilities	Country		0.10	0.10	0.10	0.10	0.40			0.40	LCs, NWSA	No funds committed yet
1.8	Studies to prepare master plans for Ibb and Aden Local Corporations	Ibb, Aden	1.00	1.50	1.50			4.00	4.00			LCs + MWE	Funds committed from APL1 WB
1.9	Piloting and evaluating the establishment of a "governorate water office"	Hudeidah governorate		0.02	0.02			0.04	0.04			Hudeidah governorate + TS, LC, utilities, MWE	Funds committed from TS-project
1.10	Establishment and capacity building of "governorate water offices" in other governorates	Country			0.05	0.05	0.05	0.15			0.15	Governorate administration + TS, LCs, utilities, MWE	No funds committed yet
1	**Sub total decentralization**		**3.72**	**5.54**	**5.57**	**3.65**	**3.95**	**22.43**	**12.58**	**0.00**	**9.85**		
2	**Support to national level**												
2.1	Support project to the Technical Secretariat for WSS Sector Reform	National level	0.50	0.50	0.50			1.50	1.50			TS + MWE	Funds committed from Germany (GTZ-project)
2.2	Study for the development and establishment of a national regulator for UWSS	National level	0.10					0.10	0.10			TS + NWSA, MWE	Funds committed from APL1 WB
2.3	Establishment of regulator and capacity building program/outsourcing of regulatory functions	National level	0.40	0.40	0.40	0.40	0.40	2.00			2.00	MWE + TS, NWSA	Funds not committed yet, but could be mobilized through APL1 and APL2 WB
2.4	Study to define new role of NWSA and staff-streamlining, training needs assessment and capacity building for NWSA and MWE	National level	0.10	0.20	0.20			0.50	0.50			NWSA, MWE + TS	Funds to be mobilized from APL1 WB
2	**Sub total national level**		**1.10**	**1.10**	**1.10**	**0.40**	**0.40**	**4.10**	**2.10**	**0.00**	**2.00**		

Annex 2.B: Urban Water Supply and Sanitation Investment Program (required additional funds are shaded)

Software Components

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
3	**Capacity building**												
3.1	Advisory Services to the Urban Water Supply and Sanitation Sector	National level/country	1.20	1.00	1.00			3.20	1.20		2.00	NWSA + MWE, LCs, utilities	German funds committed in 2005; funds expected to continue till 2007 (GTZ-project)
3.2	Support project for Personnel Development in the UWSS sector	National level/country	0.60	0.60				1.20	1.20			NWSA	Funds committed from Germany (GTZ-project)
3.3	Further development and implementation of national HRD program (modules)	National level/country			0.50	0.50	0.50	1.50			1.50	NWSA + MWE, training institutes	No funds committed yet
3.4	Training program for local contractors on tendering procedures/procurement guidelines, standards	National level/country	0.10	0.10	0.10	0.10	0.10	0.50			0.50	NWSA + MWE, training institutes	No funds committed yet
3.5	Implementation of Performance Indicator Information System on national and local level	National level/country		0.50	0.50			1.00			1.00	NWSA + TS, LCs, utilities, MWE	No funds committed yet; implementation includes hardware
3.6	Long-term master-level training for UWSS sector professionals	Abroad	0.20	0.20	0.20	0.20	0.20	1.00			1.00	MWE, NWSA, LCs, utilities	No funds committed yet
3.7	Capacity building, training programs for UWSS sector institutions (to be defined at later stage)	National level/country				2.00	2.00	4.00			4.00	MWE, NWSA, LCs, utilities	No funds committed yet
3	**Sub total capacity building**		**2.10**	**2.40**	**2.30**	**2.80**	**2.80**	**12.40**	**2.40**	**0.00**	**10.00**		
4	**Public-Private-Partnership**												
4.1	Development of management contract for Sana'a Local Corporation	Sana'a	0.20					0.20	0.20			Sana'a LC + TS, MWE	Funds committed from APL1 WB
4.2	Implementation of management contract for Sana'a Local Corporation	Sana'a	1.00	1.00	1.00	1.00	1.00	5.00	5.00			Sana'a LC + TS, MWE	Funds committed from APL1 WB
4.3	Development of Utility Support Program for Aden Local Corporation	Aden	0.20					0.20	0.20			Aden LC + TS, MWE	Funds committed from KfW
4.4	Implementation of Utility Support program for Aden Local Corporation	Aden	0.10	0.90	1.00			2.00	2.00			Aden LC + TS, MWE	Funds committed from KfW
4.5	Public-Private-Partnership Option study to be done for Aden Local Corporation	Aden			0.20			0.20			0.20	Aden LC + TS, MWE	Funds could be mobilized through KfW
4.5	Possible development and implementation of PPP-arrangement for Aden Local Corporation	Aden				0.30	0.30	0.60			0.60	Aden LC + TS, MWE	Funds could be mobilized through KfW
4	**Sub total Public-Private-Partnerships**		**1.50**	**1.90**	**2.20**	**1.30**	**1.30**	**8.20**	**7.40**		**0.80**		
5	**Innovation and alternative water sources**												
5.1	Feasibility studies for appropriate (low-cost) technologies (especially for sanitation/treatment)	Country	0.20	0.20				0.40			0.40	NWSA + EPA, MWE	Funds could be mobilized from KfW; pilot-projects are part of hardware investment
5.2	Preparation of pilot-project (Taiz) for desalinization of brackish water and national workshop	Taiz, national level	0.20					0.20	0.20			Taiz LC, MWE	Funds committed from APL1 WB; hardware included in UWSS-investment program
5.3	Feasibility studies for desalinization of seawater for drinking purposes	Pilot areas	0.10	0.20				0.30			0.30	LCs, NWSA + MWE	No funds committed yet
5	**Sub total Innovation and alternative water sources**		**0.50**	**0.40**				**0.90**	**0.20**		**0.70**		
TOTAL planned software components			**8.92**	**11.34**	**11.17**	**8.15**	**8.45**	**48.03**					
TOTAL committed/pipelined donor funds			**7.62**	**8.14**	**6.92**	**1.00**	**1.00**		**24.68**				
TOTAL estimated allocated local funds			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**			**0.00**			
TOTAL required additional funds for software			**1.30**	**3.20**	**4.25**	**7.15**	**7.45**				**23.35**		

Annex 2.C: Summary of Rural Water Supply and Sanitation Investment Program (required additional funds are shaded)

HARDWARE	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
TOTAL planned hardware investments	**55.75**	**72.45**	**91.75**	**109.25**	**125.25**	**454.45**				Various RWSS sector institutions and donors	Total planned investments in hardware in 2005-2009
TOTAL committed/pipelined donor funds for hardware	**20.95**	**19.60**	**13.50**	**12.00**	**12.00**		**78.05**			Various RWSS sector institutions and donors	Total committed/pipelined donor funds in 2005-2009 for hardware
TOTAL estimated allocated local funds for hardware	**18.40**	**19.30**	**20.30**	**21.30**	**22.40**			**101.70**		Various RWSS sector institutions and donors	Total estimated allocated local funds in 2005-2009 for hardware
TOTAL required additional funding for hardware	**16.40**	**33.55**	**57.95**	**75.95**	**90.85**				**274.70**	various RWSS sector institutions and donors	Total required additional funding to be mobilized in 2005-2009 for hardware; **60%** of the total planned hardware investments

SOFTWARE	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
TOTAL planned software investments	**5.20**	**6.70**	**6.10**	**5.20**	**5.30**	**28.50**				Various RWSS sector institutions and donors	Total planned software investments in 2005-2009
TOTAL committed/pipelined from donors for software	**1.95**	**1.80**	**1.35**	**0.60**	**0.60**		**6.30**			Various RWSS sector institutions and donors	Total committed/pipelined funds for software investments in 2005-2009
TOTAL estimated allocated local funds for software	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**			**0.00**		Various RWSS sector institutions and donors	Contribution of local budget to loans is spend on hardware, not on software; no local funds are earmarked for software
TOTAL required additional funding for software	**3.25**	**4.90**	**4.75**	**4.60**	**4.70**				**22.20**	Various RWSS sector institutions and donors	Total required additional funding to be mobilized in 2005-2009 for software, which is **77%** of the planned software
Based on a per capita investment of $ 110 (for water supply and sanitation) and a total investment of $ 454 million over 2005-2009 an additional 4.1 million people will be served with both water supply and sanitation. The expected national coverage for 2009 will then be around 43% for water supply and 39% for sanitation.											

Annex 2.C: Rural Water Supply and Sanitation Investment Program (required additional funds are shaded)

Software Components

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
1	**Support to national level**												
1.1	Ongoing TA-project for RWSS: policy and strategy development, support GARWP HQ, development plans for BOs, institutional support to WB-RWSP)	National level	0.60	0.20				**0.80**	0.80			GARWP + MWE	Funds committed from WB
1.2	Support for reform office for RWSS linked to MWE: policy and strategy development, restructuring plan for decentralization, institutional strengthening and capacity building of GARWP HQ	National level	0.15 0.25	0.20 0.60	0.15 0.65	0.80	0.80	**3.60**	0.50		3.10	GARWP + MWE	Some funds committed from RNE; additional funds required with high priority!
1.3	Development and implementation of RWSS Emergency Plan	National level	0.50	0.50	0.50	0.50	0.50	**2.50**			2.50	GARWP + MWE	No funds committed yet (including hardware)
1	**Sub total national level**		**1.50**	**1.50**	**1.30**	**1.30**	**1.30**	**6.90**	**1.30**		**5.60**		
2	**Support to decentralization of GARWP**												
2.1	Support to the decentralization process GARWP: institutional strengthening, capacity building and training for 20 GARWP Branch Offices (BOs)	20 governorates	0.60 0.60	0.80 0.60 0.60	0.60 0.60 0.80	0.60 0.90	0.60 1.00	**8.30**	5.00		3.30	GARWP + reform office, MWE	USD 2 million committed from RNE for 4 BOs (2005-2007); Expected to be committed from Japanese Embassy USD 3 million for 9 BOs (2005-2009); Additional funds required with high priority
2.2	Implementation of water quality testing for BOs (training, sampling, analysis, data management)	Every governorate	0.40	0.80	1.00	1.00	1.00	**4.20**			4.20	GARWP BOs + local private sector	No funds committed yet
2.3	Support to Water User Groups and CBOs to monitor and improve O&M of RWSS schemes	Every governorate	0.40	0.80	0.80	0.80	0.80	**3.60**			3.60	GARWP BOs + WUGs, CBOs	No funds committed yet
2.4	Development of training materials to support Water User Groups and CBOs	Every governorate	0.40	0.30	0.20	0.10	0.10	**1.10**			1.10	GARWP BOs + WUGs, CBOs	No funds committed yet
2.5	Establishment of a database on RWSS	Every governorate and on national level	0.40	0.60	0.20	0.10	0.10	**1.40**			1.40	GARWP + TA-RWSP, local private sector	No funds committed yet; minor funds can be allocated from WB TA-RWSP
2	**Sub total decentralization of GARWP**		**2.80**	**4.50**	**4.20**	**3.50**	**3.60**	**18.60**	**5.00**	**0.00**	**13.60**		
3	**Innovation and strengthening of CBOs and NGOs**												
3.1	Support to the establishment and capacity building of national NGOs and Community Based Organizations involved in RWSS	Every governorate	0.50	0.30	0.20			**1.00**			1.00	NGOs, CBOs and other stakeholders	No funds committed yet
3.2	Pilot projects in cooperation with NGOs and CBOs on implementing low cost and alternative technologies	Every governorate	0.40	0.40	0.40	0.40	0.40	**2.00**			2.00	NGOs, CBOs and other stakeholders	No funds committed yet
3	**Sub total capacity building**		**0.90**	**0.70**	**0.60**	**0.40**	**0.40**	**3.00**	**0.00**	**0.00**	**3.00**		
TOTAL planned software components			**5.20**	**6.70**	**6.10**	**5.20**	**5.30**	**28.50**					
TOTAL committed/pipelined donor funds			**1.95**	**1.80**	**1.35**	**0.60**	**0.60**		**6.30**				
TOTAL estimated allocated local funds			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**			**0.00**			
TOTAL required additional funding for software			**3.25**	**4.90**	**4.75**	**4.60**	**4.70**				**22.20**		

Annex 2.C: Investment program Rural Water Supply and Sanitation (required additional funds are shaded)

Hardware Components

No.	Activity/project	Location	2005				2006				2007				Remarks on source of funding
			Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	
1	Implementation of RWSS projects through **GARWP**	Every governorate	2.40	17.20	0.40	**20.00**	3.00	18.20	3.80	**25.00**	3.00	20.30	6.70	**30.00**	Funds committed by RNE USD 3 million (2005-2007); Funds expected Japanese Embassy USD 8 million (2006-2009); Funds committed EU Food Security (2005) USD 1.4 million; Estimated allocated local funds are based on annual 5% increase of total budget
2	Implementation of RWSS projects through **SFD**	Every governorate	5.00		3.00	**8.00**	5.00		6.00	**11.00**	5.00		9.00	**14.00**	Estimated committed donor funds are USD 5 million per year; Implementation capacity could be increased if additional donor and local funds are mobilized
3	Implementation of RWSS projects through **PWP**	Every governorate	5.00		1.00	**6.00**	5.00		3.00	**8.00**	5.00		5.00	**10.00**	Estimated committed donor funds are USD 5 million per year; Implementation capacity could be increased if additional donor and local funds are mobilized
4	Implementation of RWSS projects through **WB-RWSP**	Ibb, Hajjah, Abyan, Amran, Lahj, Dhalla, Sana'a, Shabwah, Al Jawf, Taiz	6.80	1.20		**8.00**	6.10	1.10		**7.20**			10.00	**10.00**	Current WB funding (15% local contribution) ends 2006; expansion for a new phase is to be expected but funds are not committed yet
5	Implementation of RWSS projects through **UN/Nexen program**	Hadramawt	0.50			**0.50**	0.50			**0.50**	0.50			**0.50**	Funding through Nexen oil company; continuation not clear
6	Implementation of RWSS projects through **UNICEF**	Mahrah, Abyan, Lahj, Amran, Sana'a, Hajjah, Sadah, Hudeidah	1.25			**1.25**			1.25	**1.25**			1.25	**1.25**	Funding UNICEF ends in 2005; additional phase can be expected but is not committed yet
7	Implementation of RWSS projects through **Local Councils**	Every governorate			2.00	**2.00**			4.00	**4.00**			6.00	**6.00**	Funds should come from local sources; no funds are committed although funds are expected to become available
8	Implementation of RWSS projects through **national CBOs and NGOs**	Every governorate			6.00	**6.00**			8.00	**8.00**			10.00	**10.00**	Funds will need to be made available from local and donor sources to strengthen implementation through national CBOs and NGOs
9	Implementation of RWSS projects **through international NGOs**	Every governorate			4.00	**4.00**			7.50	**7.50**			10.00	**10.00**	If funding (local and donor) can be increased, international NGOs can be attracted to work in Yemen to enhance implementation capacity
TOTAL planned hardware investments						**55.75**				**72.45**				**91.75**	
TOTAL committed/pipelined donor funds			**20.95**				**19.60**				**13.50**				
TOTAL estimated allocated local funds				**18.40**				**19.30**				**20.30**			
TOTAL required additional funds hardware					**16.40**				**33.55**				**57.95**		

Annex 2.C: Investment program Rural Water Supply and Sanitation (required additional funds are shaded)

Hardware Components

No.	Activity/project	Location	2008				2009				Total over 2005 - 2009				Remarks on source of funding
			Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	Donor funds committed or pipelined	Local funds estimated allocated	Additional funds required	Total funds (donor and local)	
1	Implementation of RWSS projects through **GARWP**	Every governorate	2.00	21.30	11.70	**35.00**	2.00	22.40	15.60	**40.00**	12.40	99.40	38.20	**150.00**	Total funds committed by RNE USD 3 million (2005-2007); Total funds expected Japanese USD 8 million (2006-2009); Total funds committed EU (2005) USD 1.4 million; Estimated allocated local funds are based on annual 5% increase of budget (including contribution to WB-RWSP)
2	Implementation of RWSS projects through **SFD**	Every governorate	5.00		12.00	**17.00**	5.00		15.00	**20.00**	25.00		45.00	**70.00**	Estimated committed donor funds are USD 5 million per year; Implementation capacity could be increased if additional donor and local funds are mobilized
3	Implementation of RWSS projects through **PWP**	Every governorate	5.00		7.00	**12.00**	5.00		9.00	**14.00**	25.00		25.00	**50.00**	Estimated committed donor funds are USD 5 million per year; Implementation capacity could be increased if additional donor and local funds are mobilized
4	Implementation of RWSS projects through **WB-RWSP**	Ibb, Hajjah, Abyan, Amran, Lahj, Dhalla, Sana'a, Shabwah, Al Jawf, Taiz			12.00	**12.00**			14.00	**14.00**	12.90	2.30	36.00	**51.20**	Current WB funding (15% local contribution) ends 2006; expansion for a new phase is to be expected but funds are not committed yet
5	Implementation of RWSS projects through **UN/Nexen program**	Hadramawt									1.50			**1.50**	Funding through Nexen oil company; continuation not clear
6	Implementation of RWSS projects through **UNICEF**	Mahrah, Abyan, Lahj, Amran, Sana'a, Hajjah, Sadah, Hudeidah			1.25	**1.25**			1.25	**1.25**	1.25		5.00	**6.25**	Funding UNICEF ends in 2005; additional phase can be expected but is not committed yet
7	Implementation of RWSS projects through **Local Councils**	Every governorate			8.00	**8.00**			10.00	**10.00**			30.00	**30.00**	Funds should come from local sources; no funds are committed although funds are expected to become available
8	Implementation of RWSS projects through **national CBOs and NGOs**	Every governorate			12.00	**12.00**			14.00	**14.00**			50.00	**50.00**	Funds will need to be made available from local and donor sources to strengthen implementation through national CBOs and NGOs
9	Implementation of RWSS projects **through international NGOs**	Every governorate			12.00	**12.00**			12.00	**12.00**			45.50	**45.50**	If funding (local and donor) can be increased, international NGOs can be attracted to work in Yemen to enhance implementation capacity
TOTAL planned hardware investments						**109.25**				**125.25**				**454.45**	
TOTAL committed/pipelined donor funds			**12.00**				**12.00**				**78.05**				
TOTAL estimated allocated local funds for				**21.30**				**22.40**				**101.70**			
TOTAL required additional funds hardware					**75.95**				**90.85**				**274.70**		

Annex 2.D: Irrigation and Watershed Management Investment Program (required additional funds are shaded)

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
1	Design and implement irrigation-part of NWSSIP-monitoring system	National level (MAI)	0.1	0.01	0.01	0.01	0.01	0.14			0.14	MAI + MWE	No funds committed yet
2	Irrigation Improvement Project	Wadi Zabid and Wadi Tuban	2.90					2.90	2.47	0.44		MAI + GDI	Funds committed from WB IIP; local contribution 15% (software and hardware)
3	Pilot Implementation of Agriculture Reform Program (A21A)	National level	0.30					0.30	0.30			MAI	Funds committed from FAO; no local contribution
4	Restructuring Program in MAI based on A21A, including MIS for MAI	National level	1.00	1.70	1.40	0.70	0.50	5.30	2.70		2.60	MAI	Funds (USD 2.7 million) committed by USAID; no local contribution; additional funds required 2007 onwards
5	Capacity building and institutional strengthening Irrigation Department MAI	National level and local level	0.50	1.00	2.00	1.00	1.00	5.50			5.50	MAI + GDI	No funds committed yet
6	Southern Governorates Project component for spate irrigation and Wadi rehabilitation	Hadramawt, Shabwah, Abyan, Lahj	3.00					3.00	2.55	0.45		MAI	Funds committed from WB project; local contribution 15% (software and hardware)
7	Dhamar Rural Development Project component for irrigation and watershed management	Dhamar governorate	1.50	1.50	1.15			4.15	3.53	0.62		MAI	Funds committed from IFAD; local contribution 15% (software and hardware)
8	Rayma Rural Development Project component for irrigation and watershed management	Rayma governorate	1.50	1.50				3.00	2.55	0.45		MAI	Funds committed from IFAD; local contribution 15% (software and hardware)
9	Groundwater and Soil Conservation Project (excluding IWRM measures)	Country	5.40	8.00	10.00	8.00	6.00	37.40	31.79	5.61		MAI	Funds committed from WB; 15% local contribution; some funds allocated to IWRM
10	Sana'a Basin Water Management Project (excluding IWRM measures)	Sana'a basin	4.95	6.43	6.15	5.13		22.66	18.13	4.53		MWE + MAI, NWRA	Funds committed from WB; 20% local contribution; USD 3.2 million allocated to IWRM; IWRM part difficult to distinguish
11	Construction of water structures and small dams for recharge and irrigation purposes	Country	8.00	8.00	8.00	8.00	8.00	40.00		40.00		AFPPF + MAI, NWRA, MWE	Funds from AFPPF; estimate is based on current level of disbursement from AFPPF on dams
12	Watershed management, terrace rehabilitation and water harvesting project	Ibb, Mahweet, Sana'a, Manakha, Taiz, others	1.20	1.80	1.80	1.80	1.20	7.80			7.80	MAI + NWRA, EPA, AREA	No funds committed yet; local contribution from farmers to be expected for terraces rehabilitation
13	Pilot projects with re-use for agricultural purposes ("downstream" software and hardware)	Pilot areas	0.30	1.70	1.10	0.90		4.00			4.00	MAI + NWRA, MWE, NWSA	No funds committed yet; funds for upgrading of treatment plants are within UWSS hardware program
14	Desertification project	Pilot areas		5.50	5.50	5.50	5.50	22.00			22.00	MAI	No funds committed yet
15	Applied research and extension (farmer support services, technology transfer) in irrigation	Pilot areas in highlands, eastern plateau and coast		4.00	4.00	4.00	4.00	16.00			16.00	MAI + AREA	No funds committed yet
16	Promotion of modern irrigation techniques to increase water use efficiency	Country	0.80 0.80	0.80 0.80	0.80 0.80	0.80 0.80	0.80 0.80	8.00		4.00	4.00	AFPPF + MAI, farmers union	Funds from AFPPF; estimated allocated local funds are based on current level of disbursement; additional funds required to be mobilized from AFPPF or other sources
17	Study to determine the effect of lifting subsidies on groundwater mining	National		0.30				0.30			0.30	MAI + NWRA, MWE	No funds committed yet; possibly mobilized from AFPPF
18	Study to determine the effect of and perception of local communities on water rationing, cost recovery and production	National		0.50				0.50			0.50	MAI + NWRA, MWE	No funds committed yet; possibly mobilized from AFPPF
19	Study on water rights in flood irrigation schemes (spate irrigation)	Pilot areas	0.30					0.30			0.30	MAI + MWE	No funds committed yet; possibly mobilized from AFPPF
20	Awareness raising on A21A reform program through conducting nation-wide workshops	Country	0.60					0.60			0.60	MAI + local MAI offices	No funds committed yet; possibly mobilized from AFPPF
21	Preparation of multi-media programs on rational and sustainable use of water in irrigation	National	0.40	0.40	0.40	0.40	0.40	2.00			2.00	MAI	No funds committed yet; possibly mobilized from AFPPF
22	Traveling workshops on rational water use/modern irrigation techniques for farmer groups and Water User Associations	Country	0.40	0.40	0.40	0.40	0.40	2.00			2.00	MAI	No funds committed yet; possibly mobilized from AFPPF
23	Mobile fairs and shows on modern irrigation techniques	Country	0.40	0.40	0.40	0.40	0.40	2.00			2.00	MAI	No funds committed yet; possibly mobilized from AFPPF
TOTAL planned investments			**34.35**	**44.74**	**43.91**	**37.84**	**29.01**	**189.85**					
TOTAL committed/pipelined donor funds			**17.42**	**16.19**	**14.40**	**10.90**	**5.10**		**64.01**				
TOTAL estimated allocated local funds			**11.94**	**11.74**	**11.70**	**11.03**	**9.70**			**56.10**			
TOTAL required additional funding			**5.00**	**16.81**	**17.81**	**15.91**	**14.21**				**69.74**		

Annex 2.E: Environment Investment Program (required additional funds are shaded)

No.	Activity/project	Location	2005 mil. USD	2006 mil. USD	2007 mil. USD	2008 mil. USD	2009 mil. USD	Total over '05 - '09	Committed Pipelined Donor	Estimated Allocated Local	Required Additional funds	Implementing + Collaborating Agencies	Remarks
1	Innovation pilot projects with solar energy to increase access to drinking water supply (desalinization)	Kamaran and Perim islands	0.50	1.50	2.50			**4.50**			4.50	EPA + GARWP, Island Authorities	No funds committed yet
2	Feasibility studies for pilot projects with renewable energy to increase access to drinking water supply (desalinization, solar pumps, wind energy)	selected areas (Tihama, coastal areas, islands)		0.25	0.25			**0.50**			0.50	EPA + GARWP, Local Councils	No funds committed yet
3	Feasibility studies for re-use of effluent of waste water treatment plants	Sana'a, Ibb, Hajjah, Yarim, Aden, Dhamar, Rada	0.30	0.30				**0.60**	0.30		0.30	EPA + LCs, NWSA, MAI	Funds committed by KfW (5 plants), additional funds not committed yet; item also mentioned also by irrigation, UWSS and WR-group
4	Improvement of landfill designs (35 sites), development of criteria for selection and standards	National	0.20	1.00	1.00	1.00	1.00	**4.20**			4.20	EPA + NWRA, MWE, Local Councils	No funds committed yet
5	Environmental assessment and pollution control measures (standards, regulations, EIA guidelines, safeguards, pilot project pollution inventory and prevention program)	National and pilot in Taiz	0.10 0.20	0.10 0.60	0.10 0.50			**1.60**	0.30		1.30	EPA + NWRA, MWE	Funds committed by RNE/UNDP as part of IWRM-program; additional funds required
6	Restructuring, institutional strengthening, capacity building and training for EPA	National and regional offices	0.40 0.60	0.40 1.60	0.40 1.60	0.40 1.10	 1.00	**7.50**	1.60		5.90	EPA	Funds committed by UNDP; additional funds required
7	Awareness raising regarding environmental laws, by-laws and regulations	National level and throughout the country	0.50	0.50	0.50	0.30	0.30	**2.10**			2.10	EPA + NWRA, MWE, Local Councils	No funds committed yet
TOTAL planned investments			**2.80**	**6.25**	**6.85**	**2.80**	**2.30**	**21.00**					
TOTAL committed/pipelined donor funds			**0.90**	**1.00**	**0.90**	**0.40**	**0.00**		**2.20**				
TOTAL estimated allocated local funds			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**			**0.00**			
TOTAL required additional funding for investments			**1.90**	**5.25**	**5.95**	**2.40**	**2.30**				**18.80**		

Annex 3: Stages of Development of Water Use in a Society

Stages of water use development in a society and the changing social perception of and response to the water scarcity problem (compiled from Ohlsson and Turton, 1999).

Scarcity bottleneck (challenge or Stage)	**Society's perception of, and response to, the problem**	**Arguments used by the society to demonstrate the "challenge"**	**Society's response (tools to meet the challenge) "what needs to be done"?**	**Society's handling of the conflicts created by the new ways of using water**
Supply Management Stage I: Getting More Water" Water is naturally abundant but supplies are *underdeveloped* so that too little water is available for use. The challenge is to develop the supplies to meet the society's needs	To drill more wells & expand networks of irrigation and domestic supply (more investment). The advent of modern tube-well and pumping technologies have shaped this perception of what needs to be done (to get more water)	Limited access to water services (domestic), low per capita consumption, food security aspirations	More investment to develop supplies and to expand access to domestic and irrigation waters	Conflicts arise with pre existing uses (drying up of shallow wells, springs, base-flows, etc) Slow response to these impacts. The society is not yet recognizing the connections, or impact of expanded use of groundwater on pre-existing use and not trained to handle pre-existing rights.

Scarcity bottleneck (challenge or Stage)	**Society's perception of, and response to, the problem**	**Arguments used by the society to demonstrate the "challenge"**	**Society's response (tools to meet the challenge) "what needs to be done"?**	**Society's handling of the conflicts created by the new ways of using water**
Supply Management Stage II: "Aquifers/ rivers are running dry" That is, too little water is left or supplies are "over developed"	Limited natural water resources (natural scarcity) compared to the use/ demand. Need to close the gap by more mega-supply projects and by developing previously over- looked sources (dams, desalination, etc)	Indices such as Water Stress Index.	More investments in water projects and mega-projects to furthers increase supplies Policies &strategies to increase supplies intercept natural water waste (e.g. flows to seas) and make inter-basin transfers, desalination, etc…)	Conflicts arise from competition among users. Vested interests of contractors/developers become deeply rooted and progressively more difficult to over-come or to stop and move to non-structural solutions such as demand management
Demand Management Stage III: "Water is being misused" (or demands are not managed)	There is a need to increase "end-use efficiency" to adapt to limited natural supplies	Low-use efficiency. Need to make "more crop per drop" or "more use per drop" without reallocating.	All tools of demand management (decentralized management, community participation, cost recovery, etc…)	Conflict with previous water uses (need to compensate grievant parties)