Report No. 15718-YEM

Yemen
Towards a Water Strategy
An Agenda for Action

August 13, 1997

Rural Development, Water and Environment Sector
Middle East Department
Middle East and North Africa Region

Document of the World Bank

CURRENCY EQUIVALENTS
(As of July 1997)

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ABBREVIATIONS AND ACRONYMS

AREA	-	Agriculture Research and Extension Authority
BCM	-	Billion Cubic Meters
CACB	-	Cooperative and Agriculture Credit Bank
DMS	-	Decentralized Management Study
EDI	-	Economic Development Institute of the World Bank
GAREW	-	General Authority for Rural Electricity and Water
LWCP	-	Land and Water Conservation Project
MAWR	-	Ministry of Agriculture and Water Resources
MCM	-	Million Cubic Meters
MDG	-	Multi Donor Group on Yemen Water
MEW	-	Ministry of Electricity and Water
MOPD	-	Ministry of Planning and Development
NEAP	-	National Environmental Action Plan
NGO	-	Non-Governmental Organization
NWRA	-	National Water Resources Authority
NWSA	-	National Water and Sanitation Authority
PER	-	Public Expenditure Review
PIM	-	Participatory Irrigation Management

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the World Bank

Report No. 15718-YE

YEMEN: TOWARDS A WATER STRATEGY

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And from water have We created every living thing

Holy Qur'an

Rural Development, Water and Environment Sector
Middle East Department
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REPUBLIC OF YEMEN

YEMEN: TOWARDS A WATER STRATEGY

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This report is based on the findings of a mission of the Multi-Donor Group for Yemen Water (IDA, UNDP, Netherlands) that worked with Yemeni counterparts during November 1995. The IDA team comprised Messrs. Christopher Ward (Leader), John Hayward (Law and Institutions), Alex McPhail (Economics), Janusz Kindler (Water Resources), Mario Zelaya (Urban), Nejdet Al-Salihi (Irrigation), Roger Norton (consultant, Macroeconomics), and Muhammad Al-Eryani (consultant, Institutions). Messrs. Aslam Chaudhry (UNDP) and Ton Negenman (Netherlands) took part in the mission. Ms. Josephine Salang provided invaluable assistance in the preparation of this report. Discussion Papers were put out by the mission in December 1995. This report was prepared under the supervision of Mr. Salah Darghouth (Acting Sector Director, MNSRE). The Country Director is Mr. Inder K. Sud. The peer reviewer was Mr. David Grey (AFTES).

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Introduction

Strategy: *the art of projecting and directing the larger movements and operations of a campaign.*

Oxford English Dictionary

Background

Yemen is one of the oldest irrigation civilizations in the world where dam irrigation and rainwater harvesting techniques were developed when Rome was still an undrained marsh and America a trackless waste.

In recent times, the country has fallen into a water crisis characterized by very rapid mining of groundwater, extreme water supply shortages in the major cities, and limited access of the population to safe drinking water.

The main causes of the water crisis are familiar from other countries of the Middle East: rising demand as population grows and market-led agriculture develops; groundwater exploitation getting out of hand; and a framework that has promoted expansion rather than efficient use and sustainable management.

Yemen, however, stands out amongst countries in water crisis. First because of the gravity of the problem - in no country in the world is the rate of exhaustion of aquifers proceeding so fast, in no country in the world is the capital city of the nation literally going to run out of water in a decade.

Second, Yemen stands out because of the lack of the governance structures that would allow anything approaching a real solution to be simply imposed from the top. The only conceivable way to control groundwater use is to take users into partnership - as joint trustees of the resource. But even these solutions will inevitably be arduously brokered and slow to bear fruit.

But the challenge has to be met, if the country is not to become a desert. Even if the results of action can be no better than a partial solution, the results of inaction would be catastrophic.

Preparation of this Report

In 1995 and in partnership with Government and other donors, the World Bank (IDA) began an in-depth review of the whole water sector. The process began with fact-finding, a field study on how rural communities manage water, and the design of a pilot project.

In November 1995, at Government's request, and with support from UNDP and the Netherlands Government (fellow-members of the Multi-Donor Group for Yemen Water), IDA sent a mission to

review the water sector and to prepare elements for a possible national water strategy. Discussion Papers[1] were sent to Government and the Multi-Donor Group in December 1995, and based on these and on further discussions, a draft of the present report was sent to Government on August 31, 1996.

The draft report was presented and discussed with cabinet ministers and senior officials in a half-day seminar in November 1996. It was also presented and discussed in two workshops: (i) a workshop organized by NWRA with EDI in Sana'a for a broad range of stakeholders in December 1996; and (ii) a workshop organized by the University of Aden in Mukalla for local officials and stakeholders in the regions in June 1997. The report has been reviewed by all Government departments concerned and extensive written comments were received in July 1997. Comments, criticisms and guidance from all these sources have been incorporated into this final version of the report.

Since the issue of the draft report in August 1996, several developments have occurred that have also been reflected in the report. First, the Government's newly created agency for water resources management, the National Water Resources Authority (NWRA), has become operational and has begun to play a role in formulating sector strategy. Second, experience has been gained in testing new approaches to water management at the local level (notably through the IDA-supported Taiz Pilot Water Supply Project). Third, the agenda for reform in urban water management has been agreed and Government has issued a decree adopting the agenda and setting up a secretariat to implement it. Fourth, a sector review of rural water supply has been issued and a reform agenda outlined. And finally, Government has issued a statement of intent to hand over responsibility for management of surface (spate) irrigation schemes progressively to users, and has begun to develop a practical agenda for doing this.

Throughout the preparation of this report, there has been enormous enthusiasm and support from the Yemeni side, both Government and private. The frankness and sincerity of these contributions are a testament to the recognition by key actors in Yemen of the nature of the crisis and of the need to act. This report acknowledges these contributions by presenting ideas with equal frankness. Many of these ideas have come from the Yemeni side; others are contributions from Yemen's friends, presented in a desire to support right actions to tackle the looming crisis.

The Way Ahead

This report brings together the arguments for change, and proposes the essential components of a strategy to deal with the crisis. The common theme of this strategy is that policies and institutions at the center have to work in partnership with water users, engaging stakeholders at all levels in a reform agenda. Self-management and self-regulation will be at the heart of a solution to Yemen's water crisis. The main elements of the agenda are: a campaign to generate national consensus on actions to be taken; macroeconomic policy reforms to create the right signals for water conservation and efficiency; harnessing private sector energies in urban water supply; and a partnership approach to engage rural water users in self-management of their own resource.

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[1] See Annex 10 for a list of these Discussion Papers, which are available on request.

The immediate step is awareness - and ownership - by the Yemeni nation, followed by decisive action.

In the longer term, the economy has to diversify away from activities heavily dependent on water.

Recommendations in the report have been kept simple and action-oriented. They are addressed in the first place to the decision makers and stakeholders in the Yemen water sector as a contribution to the national debate on how to tackle the crisis. The recommendations are also addressed to Yemen's external partners, particularly the donors in the Multi-Donor Group for Yemen Water which has been established. Finally, the recommendations form the basis for IDA's own proposed interventions in Yemen's water sector.

Government, through NWRA, intends to prepare a national water strategy - the target date for the first draft is late 1997. The recommendations in this report will help form the common vision and partnership approach essential to this national strategy. It is hoped that they will thereby contribute to resolving the water crisis.

REPUBLIC OF YEMEN

Chapter I - Yemen's Water Crisis

A. The Resource

Yemen has little water

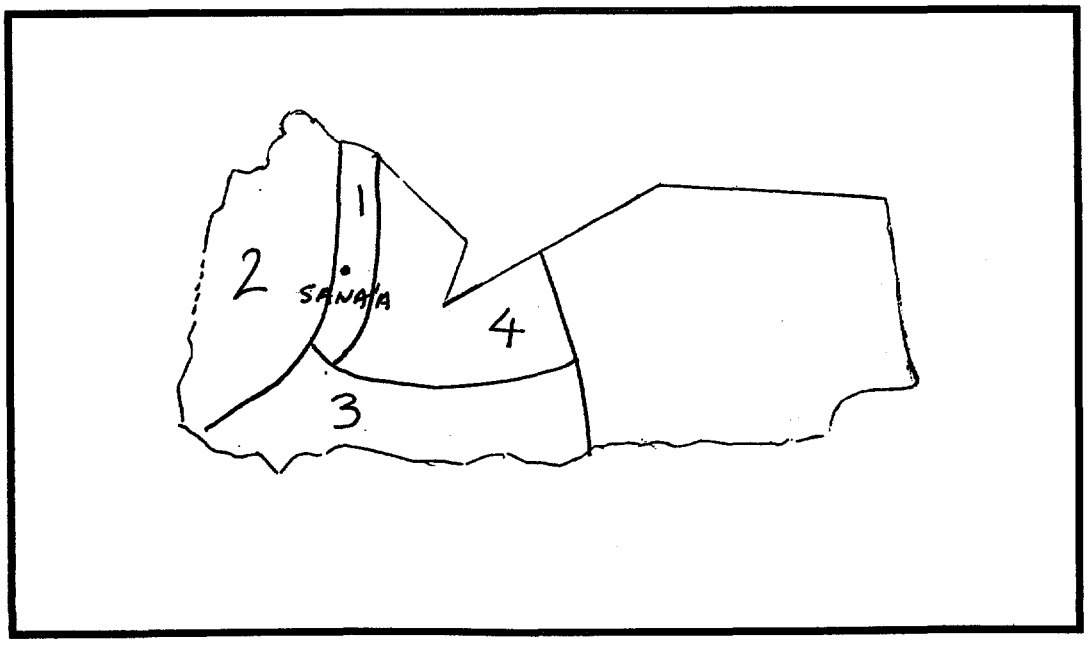
1.1 Yemen's total annually renewed water resources are estimated at 2.1 billion m^3 (BCM). With a population of around 14 million, available resources thus amount to little more than 150 m^3 per person each year. This compares with the Middle East and North Africa average of 1,250 m^3, and the worldwide average of 7,500 m^3. According to worldwide norms, domestic uses alone require up to 100 m^3 per person per year, and food self-sufficiency requires 1000 m^3. Thus, Yemen is a water-scarce country. Resources are unevenly distributed, too; 90% of the population has under 90 m^3 annually. Notable is the prevalence of groundwater in water resources - 60 percent of renewed resources (1.3 BCM) is groundwater recharge.

Most water is already fully exploited - and often overexploited

1.2 In 1994, water use was estimated at about 2.8 BCM. The country thus overdrew its resources of 2.1 BCM by 0.7 BCM. In general, all surface water sources in Yemen are harnessed and exploited, and in most areas groundwater is already being exploited beyond the level of recharge. It is estimated that there are about 45,000 private wells in the country (although some estimates are considerably higher) and about 200 drilling rigs. Government's sporadic attempts to license and control wells and drilling rigs have not been successful.

Overpumping is worst in the western half of the country

1.3 The most stressed area is the western portion of the country - the mountains, escarpments and coastal plains (Zones 1-4 on the map) - which contain more than 90% of the population.



In this western half of the country in 1994, groundwater use was 1.8 BCM, recharge was 1.1 BCM, a 70% overdraft. Usable storage in the western half is about 35 BCM, so at present rates of extraction the area will be dry within 50 years.

The situation is particularly bad in the highlands

1.4 In the densely populated highland valleys and plains (Zone 1 on the map), the situation is even worse. In the Sana'a basin, where 10 % of the population live (1.5 million people), use in 1994 was 224 million m^3 (MCM), recharge was 42 MCM, a 400 % overdraft. The water is literally running out. **Groundwater is expected to be pumped dry in the Sana'a basin in about ten years time.** In Qa' Al Boun near Amran water levels have dropped 60m in the last twenty years - and 30m in the last five years.

Only in the south-east may there be any significant untapped reserves

1.5 The exception to this picture of overdraft is Hadramawt in the sparsely populated south-eastern area of the country, 500 km from the capital, where recent resource assessments have revealed a water resource that could be as much as 280 MCM of annual recharge, together with vast storage, equivalent to several thousand years of supply at current rates of use in the area.[2]

B. The Three Main Problems

Three severe water problems have developed in recent years

1.6 Since time immemorial Yemen practiced sustainable irrigation and lived in balance with its resources. Since the creation of the modern state, however, very rapid changes have taken place which have produced some of the most severe water problems anywhere in the world. The three main problems are briefly discussed in the following paragraphs.

....groundwater is being mined at such a rate that large parts of the rural economy could disappear within a generation.

1.7 In some of the most stressed areas of the country, agriculture is running out of water. Witness the case of Wadi Bani Khawlan near Ta'iz, where uncontrolled groundwater extraction for agriculture and water sales by upstream riparians have drained the aquifer and led to drying up and the abandonment of agriculture further down the Wadi.[3]

....major cities have grown very short of water

1.8 Major towns are running out of water. The present main sources of supply to Sana'a, the Eastern and Western Wellfields, which are currently delivering 600 liters per second (lps), are drying up and by 2008 will deliver only 100 lps. In the summer of 1995, the city of Ta'iz received water once every 40 days. Box 1 describes some of the consequences.

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2 Groundwater Resources Assessment, Hadramawt - Masila Region, KOMEX for Government of Yemen and CIDA, April 1997. These estimates are new and need to be confirmed. They are not reflected on the map attached to this report.

3 In some cases, even potable water is hard to find. See Annex 11, Box 2 for the case of the community of Al Sinah.

1.9 The effect of transfers to towns is felt in rural communities too. The city of Ta'iz taps water from the Wadi Al Haima, and even though the city claims the water comes from a deeper stratum than that used by local farmers, the Wadi is certainly drying up.

....many people, particularly the poor in the cities and the countryside, do not have access to safe water.

1.10 Nationwide, about 60% of urban households are estimated to be connected to mains supply - but often that supply is inadequate. In Sana'a, the public utility, NWSA, supplies only 36% of households: two thirds of the water consumed in Sana'a does not come from a safe public supply, and much comes from shallow wells in contaminated groundwater beneath the city.

1.11 The urban poor are faced with higher costs. The NWSA supply is cheap - as little as Rls 7/m3 (4 US cents), but poor people usually have to buy their water from private vendors at very much higher prices - Rls 50-200/m3 (35-140 US cents). As a result, the costs of the poor are much higher and the quantity purchased is very much lower. In Sana'a, for example, those buying from the private sector exclusively (including most of the poor) consume only 28 liters per day (lpd), against 80 lpd for those connected to the NWSA system (WHO recommended minimum is 180 lpd)[4].

1.12 The negative impact of inadequate water supplies on the poor is even more marked in rural areas, where 81% of the population, and most of the poor, live. Fewer than a half of rural households (49%) have access to safe water, compared to the average for the Middle East and North Africa Region of 82%. Access to safe sanitation is limited to 19% of households. Government programs for rural water supply have concentrated on the area around the capital to the neglect of the poorer, further-flung areas. Sanitation has been largely neglected, with consequent environmental and health problems.[5]

1.13 Yemen has the region's lowest life expectancy (51 years) and the highest infant mortality (11.7 percent of live births). A leading cause of death in infants and children is diarrhea, partly caused by unsafe water and poor sanitation. Children living in rural areas experience on average seven cases of diarrhea a year. Rural under-five mortality rates deteriorate markedly in households that do not have access to safe water or sanitation.

1.14 Access to water also has an important impact on the lives of women. In rural areas unserved by piped water, women and girls typically spend up to seven hours a day fetching water.

C. The Economic Costs of the Water Crisis

The economic consequences of this crisis are likely to be very severe.

Supply costs are likely to rise sharply as water has to be brought from further and deeper.

1.15 In Sana'a, the options now being explored for the next source of supply all cost over $1/m3. Drilling for new groundwater sources for Sana'a has taken place to a depth of over 2 km. The ultimate - and nightmare - option for the capital is desalination and transport up from the coast, estimated to cost up to $6.60/m3.

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4 Sources for Sana'a Water Supply (SAWAS), 1997.

5 Sources: Rural Water Supply Sector Study, Cosgrove et al for World Bank, August 1996; and Yemen Poverty Assessment, World Bank (Report No. 15158-YEM, June 26, 1996).

There is increasing conflict over water resources.

1.16 The city of Ta'iz, faced with problems over the apparent depletion effect of its extraction from Wadi Al Haima, negotiated with the neighboring rural area of Habir to extract water. The negotiations dragged on for years in a difficult atmosphere. Now, agreement has been reached: rural people in Habir have agreed to allow the city to extract water from a previously untapped deep aquifer in exchange for investments in village water supply, schools and women's centers, and for support to community water management. In addition, town and country have agreed to meet together regularly in a committee to ensure that extraction is sustainable. The agreement is under implementation (with support from the IDA-financed Taiz Pilot Water Supply Project) but the costs - and risks - of the experience are high and implementing the agreement requires delicate handling.

Already, shortages of water are constraining urban and industrial development.

1.17 In Sana'a, NWSA is unable to keep pace with new housing establishment and industrial development. New development is obliged to buy water from private sources at prices as high as Rls 50-200/m3 (35-140 US cents).

The existence of the rural economy is threatened.

1.18 Agriculture supports 70 percent of the population and produces 18 percent of GDP. The whole rural economy is vulnerable to declining water availability. In the Al-Irra area north of Sana'a, a typical farmer has deepened his well 50 m over the last twelve years - increasing his costs - but he has still seen the amount of water he can extract drop by two thirds. With higher costs and only one third of the water, this farmer can no longer make a living from farming.

D. Causes of the Problems

1.19 Since the 1970s, Yemen has witnessed very rapid changes, often unmatched by development of instruments of governance. Many of these changes have a profound effect on water use.

Demand for water has risen with population growth

1.20 The population has doubled in the last twenty years, and Yemen currently has one of the highest rates of increase in the world (3.7 percent).[6] Demographic changes have increased demand for water and for products whose production requires water, particularly agricultural produce. The same changes have contributed to a large increase in the rural population. Intensified agriculture has employed many of the extra people, in some cases an increase of four times in the space of a single lifetime - and provided them with a higher standard of living. But the strain on natural resources has become intense.

...and as markets for qat and other profitable cash crops have developed

1.21 Agriculture has developed rapidly with the growth of market opportunities. Profitable cash crops have been adopted - particularly grapes, vegetables and - the largest and most intractable problem - *qat*,

[6] An IDA study, begun in 1996, is examining Yemen's demographic problem, its implications for the economy and natural resources, and options for development.

which has exploded[7] in the last twenty years as a social and agricultural phenomenon. This has increased the incentives to use water.

Overpumping of groundwater has been made possible by new technology

1.22 The advent of tractors, chemical inputs and -- above all -- tubewell technology has made possible the shift away from age old farming practice based on careful husbandry and family labor. Technological changes have made extracting groundwater easy.

...and this has been encouraged by economic policy

1.23 Government has actively encouraged water use, and is still doing so by a series of direct and indirect subsidies. Principal examples include the following:

- Diesel fuel, used in most water pumps, is priced at a quarter of its equivalent international level. Electricity, used in some pumps, is dearer but is still subsidized.
- The Cooperative and Agricultural Credit Bank (CACB) lends for the purchase of water pumps at nominal interest rates of 9 to 11 percent, compared to market interest rates above 20 percent.
- International donors continue to provide concessional funding for water pumps.
- Urban water supplied through the public system is priced very low compared to the cost of supply and to the opportunity cost, with consequent negative fiscal and equity impacts.
- Fruit, vegetables and *qat*, highly water intensive crops, are favored by import bans that raise their profit margins and hence their attractiveness for farmers.

It is evident that current policies constitute a powerful engine pushing in the direction of exhaustion of Yemen's aquifers.

...with little control from law and tradition

1.24 For centuries, traditional society managed common resources like water and pasture in a sustainable way. Social changes and powerful economic incentives have relaxed traditional controls over resource use. Government has not stepped in to replace these traditional controls with modern regulation. In the case of *qat,* the absence of Government policy has allowed the huge growth of consumption.

Environmental degradation has added to water problems

1.25 Deforestation, the abandonment of terraces and of traditional water harvesting systems and the consequent degradation have provoked widespread soil erosion, increasing risks of floods - witness the severe floods of 1996 - and reduced recharge of aquifers.

Public institutions have not been efficient

1.26 Government's urban water utility, the National Water and Sanitation Authority (NWSA) has not done well. Its internal efficiency indicators are all unfavorable: unaccounted for water is 40 percent minimum; collections are only 64 percent of billings; there are too many staff - 6-24 staff per '000

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7 *Qat* production and marketing is a huge industry. Although not recognized anywhere in official statistics, *qat* is estimated to contribute 25% of GDP, 16% of employment - and to account for 30% of water use. The profitability of *qat* can justify irrigation by tankered water [at a cost of over US$1/m3].

connections against an international norm of 2-5; salaries are 66 percent of costs, against an international norm of 30-50 percent; and cost recovery is low - tariffs average 5-8 US cents, compared with marginal costs of over US$1.[8] Nor is local government any better; in Bajil the utility run by the municipality went bankrupt.

1.27 Government's rural water supply agency, the General Authority for Rural Electricity and Water (GAREW) has not been effective in reaching rural communities. There is a heavy concentration of its activities in a few areas (80 percent in the Governorate of Sana'a alone), schemes are begun but run out of money (500 schemes are suspended incomplete) and the sustainability of completed schemes is poor.[9]

1.28 Other public institutions have fared little better: agricultural research got off to a good start in the 1970s and 1980s in both north and south but, since unification of the two Yemens in 1990, the combined Agricultural Research and Extension Authority (AREA) has suffered from lack of strategic focus and a very low budget for actual research. Yet there is a crying need for good technology for improving returns to water in irrigation and for alternative technologies in water harvesting and dryland farming.

1.29 With donor support, Government has developed or improved spate irrigation systems throughout the coastal plains. Now, the Ministry of Agriculture and Water Resources (MAWR) does not have the resources to operate and maintain these schemes; as a result, the systems are deteriorating, water distribution - and hence farm productivity - are dwindling, and the systems are increasingly vulnerable to damage from the flash flood flows in the wadis.

Public expenditure patterns have not helped

1.30 The recent review of the public expenditure program[10] for water shows a program skewed towards capital expenditures, with not enough attention to user participation in design, financing and management, and inadequate operating budgets for key services like research, extension, and water resources management. Urban cost recovery is woefully low. There is too much emphasis on water resource development, too little on conservation.

Public policy in water has not favored the poor

1.31 Public programs have tended to confirm an inequitable distribution of water. One example is targeted and subsidized agricultural credit through CACB. In effect, it is the better off who generally succeed in getting hold of this cheap money, and then often failing to repay. Another example is spate irrigation, where development tended to favor upstream users. A third area is in groundwater drilling. Here, public policy hitherto has been "hands off", and the absence of any administrative or traditional controls on drilling has concentrated a valuable resource in the hands of the locally powerful. In addition, public policy has given the landowners access to the cheap credit and equipment that enable them to drill. The poor who lack the means to develop their own water resource then have to pay for irrigation or rely on rainfed cultivation. Finally, potable water supply in towns has concentrated on established areas rather than on the poorer neighborhoods, and in rural areas on those governorates nearest to the capital, predominantly around Sana'a.

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8 Source: Urban Water Supply Sector Restructuring Study, John Kalbermatten for NWSA, August 1996. The study is summarized in Annex 6.

9 Source: Rural Water Supply Sector Study, Cosgrove et al for World Bank, August 1996.

10 Public Expenditure Review, World Bank (Report No. 16147-YEM, November 1996).

Chapter II - Objectives, Constraints and the Challenge of Sector Management

2.1 Yemen is struggling with the consequences of these rapid and unplanned developments which are mining resources at a perilous rate. Reform attempts will be shaped by the objectives the nation sets for itself, and will be limited and formed by natural conditions, circumstances of the past and the varying interests of the stakeholders. This chapter sets the water crisis in this physical, social and political context, and thereby tries to describe the framework within which reforms can take place.

A. Objectives

Yemen has three vital objectives in the water sector

2.2 Yemen has not yet adopted a national water policy, and development objectives, when formulated by Government, are not necessarily coherent or stable. The recently issued Five Year Plan does contain some statements which act as a point of reference. This source, and others, highlight the need for solutions to the three main problems: groundwater mining, cities short of water, inadequate access to potable water.

....to return water use towards a sustainable basis

2.3 Yemen cannot continue to live off its water capital - the horizon of complete exhaustion of the resource is too close. Reforms must take place that will return water use *towards* sustainability.

2.4 *Towards* sustainability because full sustainability is not achievable. In the case of the Sana'a basin, a 1992 analysis [UNDP] estimated that with all conceivable demand and supply management measures applied, 57% of remaining aquifer storage would still be lost by the year 2010. Even if the mechanisms were invented to sharply reduce extraction, in many areas the abandonment of resource mining would have catastrophic consequences on the rural economy.

2.5 Every nation takes decisions about the speed and scale at which natural resources may be mined. The challenge is to take the decisions in a rational framework and to be capable of dealing with the ultimate consequences of depletion. This will require action to slow down the rate of depletion, with the main effort in the most severely affected areas and in areas key to aquifer recharge, combined with alternative strategies for development of rural incomes.

...to facilitate transfers of water from rural to urban areas

2.6 With the growing water shortage, competition has arisen between town and country over the water resource. In some cases this has been resolved through the market, but at risk to the resource. In other cases, Government had simply appropriated water in a way seen as unfair by rural people. What is needed is a workable legal and planning framework that will allow a sustainable flow of water to cities in a way acceptable to both rural and urban dwellers.

....to increase coverage of clean water supply and sewerage and so improve health and reduce poverty.

2.7 The low coverage of the population, and the consequent impacts on health and poverty, have been mentioned above. Government rightly has plans to increase coverage. The challenge will be to ensure that this is done in an affordable and sustainable way. In urban areas, the existence of a lively private sector is an

asset to develop. In rural areas, community involvement is already strong and this can provide a pointer to future strategy.

B. Structural Constraints to Sector Management

Models for water sector management working in other countries have to be adapted to the Yemen context

2.8 The model for water resources management generally advocated by the World Bank supposes an integrated Government management function responsible for policy, water allocation, regulation and environmental aspects. In Yemen, it is difficult for Government to execute this integrated function for a number of reasons.

Yemen differs physically

2.9 The predominance of groundwater makes for individual exploitation, and makes control difficult. The fragmented geography and hydrology, and the predominance of dispersed rural water uses make central control and master planning difficult. The mismatch between population and remaining resources reduces planning options too; most of the population and economic activity is concentrated in the water-depleted western highlands, making it difficult to explore alternative water sources such as the Hadramawt aquifer or desalination. In addition, most irrigation is small scale and private. Only a few spate schemes represent that large scale irrigation which typically would allow the Government a measure of control over resource development and allocation.

....institutionally

2.10 Modern public institutions and systems are developing slowly in Yemen and the role of central government is balanced by the strong influence of decentralized, traditional structures. This makes it difficult to impose a vision of development from the center.

2.11 The system of laws and rights is similarly a compromise. There is no clear modern system of water rights, and neither modern nor traditional systems have coped with the sudden irruption of tubewell technology, which has a power to produce water - and to mine common resources - quite unforeseen in the *shari'a.* Work is going on to develop a modern law, but enforcement at the local level will take time.

....and economically

2.12 There are stronger - often distorted - incentives to agricultural water use than exist in most countries, due to Government incentives, capital transfers - and the phenomenon of *qat.* Agricultural overuse of water is very profitable, and can compete with urban uses in some cases.

C. History of Sector Management - and the Challenge Ahead

Hitherto there has been no coordinated approach

2.13 Until recently, approaches to the water sector in Yemen were fragmented. When awareness of the water crisis began to grow in the early 1990s, there was no institution within government with the mandate or power to take the lead. As a result, a lot of studies, reports - and even three draft laws - were prepared but with little practical result.

Donors have not coordinated either

2.14 Similarly amongst donors, until recently there was little effective coordination. IDA concentrated on sectoral water use in urban water supply and irrigation, and promoted the MAWR as the agency for integrated resource management. UNDP struggled for over ten years to create the High Water Council, but the Council never met and in the end the effort produced only slim technical results. The Dutch supported water resources assessment through a third institution, the General Department of Hydrogeology in the Ministry of Oil and Mineral Resources, without any link to integrated management. Other donors, such as Germany and Japan, financed specific projects rather than elements of an integrated water sector development program.

....until recently

2.15 In 1995, UNDP, Netherlands and the World Bank agreed to a coordinated approach to water in the Multi-Donor Group for Yemen Water (MDG). This group worked together on the preparation of the current report and on a framework for support to sector institutions. The MDG has met several times in Sana'a, the Hague and the Washington, D.C. The representatives of Germany and of FAO have worked with the MDG periodically.

A central planning institution has been created

2.16 After years of effort to work with the structure of the High Water Council, Government passed a decree in 1995 to create the National Water Resources Authority (NWRA), with responsibility for water resources planning and monitoring, legislation, regulation and public awareness.

....but a central management function will take time to build and is not sufficient

2.17 NWRA will take time to build capacity and credibility. Given the natural, social and political factors tending to decentralization in Yemen, regulation and central planning by themselves are unlikely to have much impact in the foreseeable future.

Decentralization and partnership with stakeholders are also necessary

2.18 The argument that Yemen is by nature and circumstance decentralized has been made above. To succeed in water management in Yemen it will be necessary to exploit this "natural decentralization", even to turn it to advantage. Decentralization to local areas allows planners to deal with a more manageable hydrological, social and economic unit. Decentralization also creates more possibility for stakeholder participation in planning and management - and without involvement of the stakeholders little will happen. In addition, there are the classic arguments in favor of decentralization - closeness to market, more efficient information flow, more adaptability to local conditions. In all this, the focus has to be on rural areas where the resource overuse problem is concentrated. A major effort is required to understand the attitudes, incentives and constraints of rural users, to develop communications channels, and to design incentives and support programs that can help users to change their behavior.

Management of change in rural areas has to work from existing rights systems and management practices

2.19 The definition of rural water rights in a way that reconciles modern need with traditional custom is essential. And improved management needs to be founded on traditional management and regulatory and dispute resolution procedures. Again, understanding these is an essential precondition to action.

Government's influence on water resources management will be mainly felt through the economic framework and public expenditures

2.20 In the context of Yemen, with the relatively poor prospects for imposing workable controls and regulations, Government's influence on water resources management will be felt most through policy adjustment - particularly correction of the distorted incentive framework and changes in public expenditure.

Government can also act on sectoral reforms in both water supply and irrigation

2.21 Government is a major player in both urban and rural water supply - through NWSA and GAREW - and in irrigation, particularly spate irrigation, through MAWR. Reform programs have been adopted for all three sectors. For ***urban water***, a sector restructuring study was carried out in 1995/96. The report (Kalbermatten 1996) was discussed at two workshops in 1996 and a reform agenda adopted. The Prime Minister set up a steering committee under the Minister of Electricity and Water, together with a Technical Secretariat, to implement the agenda. GTZ is providing support to the Secretariat. For ***rural water***, a sector study was carried out in 1996. The report (Cosgrove et al 1996) was discussed at a workshop in August 1996 and GAREW has begun tentatively to implement the recommendations. For ***irrigation***, MAWR conducted a workshop in Aden in March 1997 that resulted in a declaration (the "Aden Agenda") that users and user groups should progressively take over responsibility for the management of public spate schemes, at least of the networks, if not headworks. There is thus a rich agenda for reform at the sectoral level. The challenge - as always in Yemen - will be effective implementation.

Chapter III - What Solutions Are Realistically Available?

3.1 This chapter analyzes what practical solutions to Yemen's water crisis are available. These solutions are mostly ones on which action could begin in the near future, without the need for time-consuming studies. Some longer haul actions are also proposed. The following table lists the proposed solutions according to the **principal** problem each might resolve - but of course water flows, and each action may have some impact on all three problems.

Table 1: Summary of Proposed Solutions

Problem	Macro Solutions	Sector Management Solutions	Local Level Solutions	Longer Term Agenda
Groundwater Mining	Move to efficiency pricing for water National debate Act on qat Reorient public expenditures	Regional planning Try regulation Water conservation programs for agriculture	Community partnership	Capacity building Policy and strategy Water law Long Term Perspectives Study
Cities are short of water		Regional planning Water markets		
Limited access to potable water		Urban water sector restructuring Promote local private supply Action plan for rural water supply		

A. Macro Solutions

Move to efficiency prices for water

3.2 Government is able to send powerful signals to users through the pricing system. The challenge is to remove all the distortions and incentives that have led to overpumping of groundwater - effectively to change relative prices to discourage groundwater use. The agenda might include: introducing a higher price for diesel, levying higher tariffs and taxes on pumping equipment, eliminating credit subsidies - and perhaps eliminating credit programs - for pumps, and removing current incentives (such as import controls) to the production of agricultural products that are water intensive, notably *qat*. Making these changes would carry significant costs of adjustment, some of which would be felt in other sectors (e.g., the transport sector would also pay the higher diesel price).[11] However, action on relative prices has the strong merit that Government could actually do it, whereas other actions like trying to regulate and control water user behavior at the well head are much more difficult in the Yemeni context. The adjustments would have to be phased to allow users time to reposition themselves in the economy.[12]

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11 Although there would indeed be increases in transport costs, raising the price of diesel would also contribute to recovery of road user costs and would be consistent with the Government's policies for the transport sector. Reducing domestic petroleum consumption through higher diesel prices would also increase the exportable surplus of petroleum, with positive economic benefits. There would thus be benefits as well as costs in the effects on other sectors.

12 As changes in the price of diesel do have important effects on many sectors and segments of the population, Government proposed during discussions of the draft of this report that a study should be conducted of the economic and equity impact of moving towards border pricing for diesel. This proposal is integrated in recommendations in Chapter VI.

Conduct a national debate on water

3.3 Change in the water sector, particularly in the cost of water or in the amount of water used, would be an intensely difficult and unpopular agenda amongst many constituencies. Only if there is a nationwide recognition of the nature of the crisis and significant national commitment to tackling it can there be hope that the needed tough solutions can be adopted and implemented. MOPD and NWRA should lead a national debate on water, and reach the nation through a public awareness campaign. The objective should be to build on the benefits of change - improved access to potable water, more equitable conditions for rural-urban transfers, sustainability of the resource - and so create national consensus for a partnership between all sections of society to tackle the crisis.

Act on qat

3.4 *Qat* is the most important crop in Yemen and the country's greatest consumer of water. It cannot be ignored. Government should include *qat* in statistics, make it the object of research and extension in order to exploit water saving potential[13], and support a long-term education and public awareness campaign on *qat*. Ideally, an NGO should take the lead on public awareness on *qat*. The successful anti-smoking campaign in many countries over the last three decades should provide ideas.[14]

Reorient public expenditures

3.5 Public expenditures are the practical expression of Government policy and can have a powerful influence on outcomes in the water sector. The recent review of the public expenditure program[15] made a series of recommendations to reorient expenditures in line with sectoral reform. First, adequate resources have to be allocated to sector management (NWRA), to water conservation in agriculture and to participatory approaches to water management. Second, major investments in improving access to safe water in town and countryside are justified, but these resources should also support improved management (e.g. decentralized or privatized management in NWSA, a decentralized, more participatory approach in GAREW), and investments should be refocused on poorer areas and communities. Third, the current inequities implicit in public spending should be eliminated - credit schemes for well owners, upstream development of dams that take from downstream, the skew in NWSA and GAREW towards the "haves". Finally, NWRA should assume its role of coordinating sector investment, including donor programs.

B. Sector Management Solutions - Groundwater

NWRA should concentrate on regional planning

3.6 The mandate of the new sector management institution NWRA is very ambitious; realism of expectations is essential. NWRA will have a vital role to play centrally in sector coordination among different institutions and donors. But in the key planning function, given the problems inherent in central planning approaches, NWRA is rightly giving priority to particularly vulnerable areas, for which it intends to develop regional water management plans. These plans work with a manageable local area - the Ta'iz region, the Sana'a basin - and bring together all the water resources, economic and social information needed to

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13 Government recently instructed AREA to begin research on the agronomics of *qat*, which is a move in the right direction.

14 During review of the draft of this report, the recommendations on *qat* drew extensive comment and discussion, particularly the question of whether *qat* imports should be allowed in order to reduce incentives to domestic production. Government recommended a study and this has been included in the recommendations in Chapter VI.

15 Public Expenditure Review, World Bank (Report No. 16147-YEM, November 1996).

permit rational choices about water allocation and management. The plans should also look at aspects like watershed protection for recharge, at wastewater as a potential resource, and at the problem of flood control. The database will be important to allow an informed dialogue, management and monitoring of results. The key is to make sure the plans are developed - and implemented - in partnership with all stakeholders, particularly rural water users. Work has started in Ta'iz (where the communities are being successfully brought in - see Annex 11, Box 3). Ta'iz will be followed shortly by Sana'a. Hadramawt should be added as a priority, too, as the region's vast unexploited resource represents an opportunity for national economic development. Action in Hadramawt now would guide development and also avoid the catastrophe of uncontrolled private development.

Try regulation

3.7 Although attempts at regulation have been unsuccessful up to now, the growing crisis - and the proposed national debate and partnership approach - should begin to create a climate in which regulation can become a possibility. The NWRA should work with the users and communities to initiate the licensing and control of drilling rigs, as it would be empowered to do under the new draft water law (see below). A good place to start is the extremely water-stressed Amran Valley where a pilot regulation program is already proposed under the IDA-financed Land and Water Conservation Project. The program should be initiated in partnership with the local community and with close monitoring and evaluation. At the same time, action is needed to protect water sources from pollution. This was a focus of the National Environmental Action Plan (NEAP) of March 1996. Measures proposed in the NEAP are summarized in Annex 8.

Develop a water conservation program for irrigated agriculture

3.8 MAWR, with NWRA, should draw up a program for water conservation in agriculture. The imperative to preserve as much as possible of the rural economy whilst reducing water use highlights the need for efficiency improvements, maximizing returns to water. The aim is to increase the return per m3 of water. The program should include:

- ***revived research and extension***, especially research in advanced irrigation techniques, including economic and financial returns; and further promotion of advanced irrigation technology. Research and extension on rainfed systems, including water conservation and harvesting, and on livestock should be pursued vigorously;
- ***incentives for conservation activities*** - e.g, hill farming subsidies to maintain the terraces etc. During review of the draft of this report, Government suggested creating a water conservation fund, and a mechanism like this could be used to provide subsidies to support water conservation investments. Such activities are already being financed under MAWR's Agricultural Development Fund and their extension and linkage to water strategy should be considered;
- ***review of the potential for dams*** - technical, social and economic aspects of dams in Yemen should be re-examined, particularly in the context of the small dams program on which Government has embarked. This exercise should also cover the related issue of groundwater recharge, which was raised by Government during review of the draft of this report;
- ***spate rehabilitation and management*** - in order to ensure that spate irrigation schemes are properly maintained and the water efficiently used, users should increasingly take responsibility for their operation and maintenance. At the same time, many schemes are in poor and fast deteriorating condition. It is therefore recommended that a process of "participatory irrigation management (PIM) be launched that combines under a project both rehabilitation of schemes

and their progressive handover to users. EDI, which has good experience in PIM, should help mount workshops to explore this agenda and develop an action plan. This is in line with Government's statement of intent under the Aden Agenda;

- ***testing other sources*** - the potential for irrigation through reuse of treated wastewater and use of saline water is being studied under the Land and Water Conservation Project, and the lessons should be applied (although the volumes involved are quite small); and
- ***alternative rural enterpises*** - in the long run, diversification out of agriculture will be necessary. Government and donors should introduce alternative income programs and a safety net for rural communities.

C. Sector Management Solutions - the Urban Supply Problem

Develop new sources within an integrated regional planning framework

3.9 Search and development for new sources of supply for cities has to be done, as far as possible, within the context of the regional water management plans that NWRA will be developing (see above). The cooperation between NWRA and NWSA on the search for a new source for Taiz (under the IDA-financed Taiz Pilot Water Supply Project) is a first example of working in an integrated framework.

Organize water markets

3.10 Water markets are already well established in Yemen, ranging from opportunistic tanker sales by well owners to supply schemes for whole towns. The latest example is the quasi-purchase of water by Ta'iz city from Habir (Annex 11, Box 3). Government is reluctant to officialize such markets, and there are many issues associated with water markets based on groundwater sales, including: (i) *ownership* - what is the law that gives one group or individual the right to sell? (ii) *definition* - how can a fugitive and uncharted resource be quantified so that it can be sold? (iii) *regulatory* - how can it be ensured that water sales are not depleting the resource? Nonetheless, this is an essential area for further development as (a) water markets are a fact - they are developing fast and the law and regulation need to catch up if only to get some control over the depletion problem; and (b) some form of market exchange is essential to ensure the transfer of water out of agriculture and into towns. NWRA should set up a task force to work on this issue. The necessary studies could be done during preparation of a future urban supply project. The result should be incorporated into the water law (see below).

D. Sector Management Solutions - Improving Access to Potable Water

Implement reform of urban water supply through NWSA

3.11 The urban water supply reform agenda for NWSA is well-defined and the Steering Committee and the Technical Secretariat should proceed to implementation straight away. The agenda provides for two stages: stage one calls for NWSA to decentralize, for branches to have more autonomy, and for internal reforms to improve incentives and reduce staff; under stage two, branches would progressively be turned into regional corporations that could associate private management and ultimately private capital. In view of the urgency of the urban water supply crisis and the suitability of several municipalities for private sector management, stage two should be accelerated. In practice, some branches could simply skip stage one - already there is agreement to explore private management options for Ta'iz and the same approach should be considered for Sana'a, Aden and other major towns. Loss reduction should be a key objective and a performance criterion for private sector involvement. In addition, private management (and capital) could

play an important role in the development of sewage treatment.[16] Tariff reform, to match changes in supply costs, is also part of the agenda, and is already being implemented in Rada'a in the context of a Dutch-financed project.

Promote local private supply

3.12 The urban water supply reform agenda discussed above focuses on NWSA, which supplies less than half of urban water nationwide. In fact, Yemen is notable for the active involvement of local private investment and ownership in urban water supply. Two thirds of the capital's water requirements are met by private supply, and several whole cities are supplied by private utilities (Zabid, Bajl ...). Steps should be taken to promote further development of private supply, in order to increase coverage and reduce costs. This could comprise: legislation defining the rights and duties of private water suppliers; the development of a series of concession agreements for organized private supply to towns, with an exclusive groundwater extraction zone in which the concessionaire has an interest in conservation; and working out of a system of "light regulation by exception" to protect the public interest and ensure sustainable exploitation of the resource. This light regulation could be contracted out as it has been in Gaza. Study and action on this agenda should be a top priority as it can hold the key to improving quality and coverage of service for the majority of Yemen's urban population. The Technical Secretariat is studying this agenda and it will form a major topic at a workshop on private sector participation in urban water that the Technical Secretariat will put on with EDI support in the last quarter of 1997. An important related issue is sanitation and the protection of groundwater quality. Private sector development has to take account of the evacuation and treatment of wastewater if a major environmental and health disaster is not to occur.

Prepare an action plan for rural water supply

3.13 The importance of rural water supply for health, women's development and poverty alleviation has been discussed above. Government recognizes the need to expand coverage, and many communities have initiated self-help schemes to bring in potable water. Efforts so far, however, have left Yemen far short of its objectives. In addition, problems are emerging with existing schemes as water sources run dry (see Annex 11, Box 2) and as the communities' capacity for self-financing has diminished with the disappearance of remittance income and the decline in incomes nationwide. Hitherto, outside involvement in the rural water supply sector has been scant and there was a need to improve the knowledge base. A review was therefore carried out jointly between Government, other Yemeni stakeholders and the donors, beginning in June 1996, to assess the sector and its needs, and focusing on the scope for community participation in design, financing and management in the present economic climate. The principal recommendations of the review (Rural Water Supply Sector Study, Cosgrove et al, August 1996) cover: (a) strengthening community initiatives to promote sustainability, including association of communities in projects from the earliest stages, training, financial cost sharing and access to technical help and credit for major maintenance; (b) development of institutional capacity to deliver projects in a cost-effective and participatory fashion, with a focus on GAREW, which needs to decentralize its operations; (c) drafting and adoption of a sector reform program to implement the above plan; and (d) subsequent mobilization of external financing, with priority to a pilot project in participatory approaches and to completion of the numerous schemes already begun and for which there is inadequate finance for completion. On the technical side, an important extra consideration is sanitation; rural schemes have largely neglected the issue of evacuation of wastewater, to the detriment of environment and health. Future programs should provide systematically for a sanitation component (see Annex 11, Box 2).

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[16] See Annex 9 for a description of options for private sector participation in urban water supply.

E. Measures at the Local Level

Promote community partnership and self regulation

3.14 Decentralization and partnership with rural users of groundwater will be an essential complement to attempts to coordinate and manage the sector from the center. Such an approach has to start from a recognition that it is the water users who have the problem (i.e., depletion) and that only water users can act on the solution (i.e., reduce pumping). The essence of the partnership approach is for agents of change (Government, NGOs, donors) to work with users and communities to develop practical proposals for local groundwater management, working from existing rights systems and management practices. A recent IDA-supported study, the Decentralized Management Study (DMS) on rural water use (see Annex 11, Box 3), shows that there is a basis for community involvement and self-regulation. The IDA-financed Ta'iz Pilot Water Supply Project is testing a partnership between Government and local communities for joint management of allocation and conservation of groundwater. The DMS recommended further pilot projects. The lessons of pilot projects should be learned as soon as possible, and this partnership approach should be developed and adopted within the regional management plans for all vulnerable areas.

F. In the Longer Term

Capacity building is essential - for NWRA and others

3.15 NWRA deserves the full support of all stakeholders, and donors should take the initiative to promote this. However, there should be a slow build up, and not too much should be expected of the infant institution. It will be vital early on, also, that NWRA clearly define its role and working relationships vis-a-vis other sector institutions. NWRA will need further recruitment and training, supported by additional technical assistance, which should be sought. Further water sector training is needed for all sector institutions. There should be an emphasis on essential skills currently in short supply, particularly economics and the social sciences, both in training and recruitment.

NWRA should prepare a water policy and a strategy

3.16 In the long run, Yemen should develop a national water policy. In the near term, NWRA should prepare and put out for discussion a strategy paper focusing on what measures can be taken right now. Particularly important will be to encourage stakeholder involvement in the development of this strategy - this should be the central part of the national debate proposed above. What would such a strategy look like? This chapter provides IDA's own recommendations.

Pass a water law

3.17 Once the fundamental principles of water policy are established, they need to be reflected in a water law.[17] The key question is water rights and property; it is essential that the formulation of these reflects both traditional approaches and the new partnership approach.

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[17] A new draft law has already been prepared by NWRA. Experience shows that this may take time to pass through Parliament, and no doubt improvements will be made to the draft over time as the national debate gets underway and in the light of experience.

Study and plan for the long term

3.18 Government should prepare a "long term perspectives study" of options that will provide for development of a less water-intensive economy, including the development of regions where there is more water, and of sectors that are efficient water users. The study should also link the water issue to policy on population.

Chapter IV - How Can Solutions be Delivered?

A. Recent Developments

There has been progress at the policy level...

4.1 There is a growing awareness of the crisis both in Government and amongst other stakeholders. A group of concerned "wise men" came together in late 1995 to form an NGO to promote water conservation. In November 1995, a seminar on the water supply crisis for Sana'a was attended by the Prime Minister and received nationwide attention. Water issues also received wide coverage during the National Environmental Action Plan (NEAP) workshop in December 1995. Government has created the NWRA and the institution is beginning work. In December 1996, NWRA, with EDI support, mounted a national seminar on water resources management. A sector reform program has been adopted for urban water, and an implementation mechanism has been set up. Sector reform programs have been identified for rural water and for spate irrigation.

...at the technical level

4.2 NWRA will soon complete its regional water management plan for Ta'iz. The Decentralized Management Study is complete and one of the pilot projects it proposed is underway. The NEAP, adopted in March 1996, identified priority environmental actions required in water resources management (see Annex 8). An urgent relief project for Ta'iz water supply is under implementation.

...and amongst donors

4.3 The MDG (see above) has proved a useful means of coordinating donor activities, and NWRA has assumed its chairmanship.

...but some hesitation, and not much action

4.4 Government is facing decisions that it will be easy neither to take nor to implement. A recent example is diesel pricing. Government raised prices from Rls 3 to Rls 9/lit in January 1996, but had subsequently to reduce prices back to Rls 6 in face of protest. When a further general round of price increases took place in July 1997, diesel was the exception - the price was not raised. The draft water law presented to the Cabinet is making slow progress. NWRA has taken longer than expected to get going, and key decisions - e.g., on staff responsibilities - remain to be taken. The urban sector reform agenda was adopted to general enthusiasm in September 1996 - but subsequently the Steering Committee did not meet and the process is stalled.

B. Key Actions to Deliver Solutions

Strategy is vital

4.5 The exceptional nature of Yemen's water crisis cries out for a strategic approach. The problems are many, the solutions proposed are legion, capacity to implement solutions is weak. It is imperative to prioritize and to concentrate effort on a coherent, integrated approach to solutions. This is the essence of strategy. Table 1 in Chapter III is an example of what a strategy would look like.

Change will require partnership and will be a long term process

4.6 The challenge is to bring about a major adjustment in the behavior and the economy of a nation. This will require national consensus and considerable persistence. What is required is that Government, other stakeholders and the donors persist in the process of analysis, decision taking and change over a number of years, building in partnership. The strategy will change, deepen and - above all - be implemented during this process. A broad national debate, involving stakeholders and mobilizing the nation at large through public awareness campaigns, is needed. **Clearly, the role of strong political leadership in this is vital.** Ultimately, full ownership of a reform program is needed. There will be costs, and it will be important to have some successes and some corresponding benefits to show.

Build consensus

4.7 Consensus building at two levels is needed: one level is a national debate with key stakeholders and decision makers in order to build constituencies for change (see Annex 1 for analysis of stakeholders). This will require a dialogue with a broad range of actors, including politicians (from the President down), traditional leaders, the press, universities etc. Activities such as conferences, media events, seminars, films etc. are an appropriate way of developing this dialogue. Policy dialogue between donors and Government will form a complementary part of the process. Developing consensus for change will also require careful attention to incentives. The expected outcome would be a reform program that is owned by the key stakeholders.

4.8 The second level of consensus building is with the population at large, all of whom are water users in some sense or another, all of whom are concerned citizens, all of whom will be required to bear the burden of adjustment. A public awareness program is the most appropriate way to engage this very broad constituency.

4.9 Much of the awareness program should be aimed at rural users. The program should focus on specific target regions and populations and promote just a few essential themes, conveying simple but alarming truths about the categorical imperative of water conservation in Yemen. A major campaign on *qat* could be introduced. NWRA has begun to take the lead in coordinating public awareness initiatives on water, and all concerned national institutions should support this (by joining the coordinating committee, working on message development, etc.). Donors should unite in supporting this vital effort. The expected outcome would be a sense of national crisis, and a willingness to participate in solutions that are understood to be essential and equitable.

The process has to lead decision and action early on

4.10 The challenge is ownership - but also action; it is essential that the agenda in this report - and in the numerous other reports on the subject and in the minds of concerned Yemenis and donors - be debated in full

by the nation and a consensus reached. It is equally important that the nation proceed early on to action and not get lost in over-long discussions. This will require careful management of the process of debate, and the facility to move from discussion to decision to action.

NGOs and community groups should be encouraged to play a role

4.11 NWRA, and Government in general, have only limited capacity to influence minds and events. It will be important to allow - and encourage - the development of non-governmental institutions, both technical support and action groups like the new NGO, and decentralized community groups. The chances of getting ownership of a reform program will be much greater if such groups are involved in the national debate, too.

Develop donor coordination and partnership

4.12 NWRA has a key role in coordinating donor interventions in support of the national water strategy. The Technical Secretariat plays a similar role for the urban water reform agenda. The role of the donors is, first, catalytic, helping to develop the reform program through technical assistance, studies and dialogue. Second, the donors should back up the adjustment dialogue with project conditionality or possibly even adjustment lending. Finally, the donors should support capacity building and project investments within the public expenditure program, each investment addressing priority need and supporting the policy agenda.

4.13 The donors' usual partner is government, and the main channel of donor support will inevitably continue to be through government. But the donors can have a role, too, in promoting the broader national dialogue. EDI's role could be seminal here. Examples of how donors could work with national institutions in an "ownership campaign" are given in Annex 2.

Promote a top/bottom partnership

4.14 The objective is partnership between central or regional agencies and communities in the sustainable management of the resource for the common good. This, as has been elaborated at length above, is the key imperative in Yemen - bringing a national framework of rules and incentives into reconciliation with 45,000 autonomous well owners. The key requirements for success are that the **top** come with sound information about the problem, some technical options for change, some incentives, and some ability to facilitate community organization; and that the **bottom** prove ready to adopt communal management approaches and to work in partnership with Government (or regional agencies, or NGOs) on management plans that are efficient and equitable.

Make strategic investments

4.15 Lack of investment is a secondary problem: investments are productive only when a coherent sector strategy is in place. However, as that strategy emerges, investment plainly has a key role to play both in relieving supply problems and in advancing the policy agenda. The investment priorities are set out above. At the Consultative Group meeting for Yemen in June 1997, it was evident that donors wished to back the reform program with their investments, and in fact linked the two to the extent that slackening of reform, e.g. in urban water, raised the prospect of a sharp fall off in donor support.

Develop institutions and people

4.16 The proposed water agenda will place great demand on sector management capacity and tools, particularly the partnership approach. This will require capacity building and training, not only for NWRA and sector management agencies, but also for non-governmental associations and training institutions. The emphasis would be on resource monitoring and planning, public awareness and participation.

Chapter V - Risks and Scenarios

A. Will all this Help Yemen achieve its Three Objectives?

Return water use towards a sustainable basis

5.1 This is the toughest challenge. Few societies have been able to establish effective control over groundwater, and they are highly regulated and developed ones (some US states, Israel...). The conditions in Yemen are particularly difficult. Nonetheless, under the threat of impending loss of the resource, the nation has to act.

5.2 Government will have to take some key decisions on the macro solutions. There also has to be decentralization and partnership with communities, and a continuous process of dialogue and communication.

5.3 The outcome cannot be certain. In particular, the power of the community partnership approach to reverse the tragedy of the commons has yet to be demonstrated even on a pilot scale; and scaling up will pose huge institutional and financial problems. At best, even if the partnership approach succeeds, the impact of action can only be to slow the rate of resource depletion, to allow the nation time to develop economic activity less dependent on water mining.

Facilitate transfers of water from rural to urban areas

5.4 The quantum of water that has to be transferred to meet urban needs is small in relation to the overall availability. But lack of an institutional framework for transfers, and the excessive competing use in irrigation, represent formidable problems. The regional planning framework that NWRA is developing should provide the means for identifying water availability and its rational allocation; the involvement of the private sector and the development of community partnership approaches can provide the means of negotiating and effecting actual transfers. However, uncertainty is high, as transfers of an already over-used resource will be dependent on contracts between town and country which may prove expensive or unworkable.

Increase coverage of clean water supply

5.5 If Government will implement the reform agenda for urban and rural water supply, public sector ability to supply clean water efficiently should markedly improve. But the development of private sector activity in urban supply - which is essential - is a more subtle agenda, that will need a lot of attention on the policy front. Donors have an important role to play in financing and guiding NWSA and GAREW, but also in supporting the development of a durable and efficient private sector that contributes to - rather than militates against - resource conservation.

B. Possible Scenarios

What would the nation do in the best of all possible worlds?

5.6 An "upside scenario" would have the Yemeni nation enter a period of national debate on the water crisis under strong political leadership and with technical guidance from the NWRA. A strong reform program would be adopted by consensus. Donors would provide support to the policy dialogue, backing up the reform program with investment in institution building and conservation and supply projects, and possibly with balance of payments support. Strong sectoral reform programs would be implemented in urban water supply (decentralization, tariff adjustment, association of private management in major towns, promotion of private investment in smaller towns) and in rural water supply (community participation). Spate irrigation schemes would be progressively handed over to user groups, and communities and public agencies would work together on sustainable groundwater management at the local level. A long-term plan would be adopted to diversify the economy away from water intensity, to sustain rural incomes, and to site future growth near to available water, particularly in the Hadramawt. The result would be slower depletion, improved urban and rural potable supply, and prospects of more sustainable growth.

5.7 The very real risks to this scenario are: lack of political commitment, lack of national consensus on solutions, and inability of Yemeni institutions to forge the top/bottom partnerships.

And what would happen if the nation does nothing?

5.8 The corresponding "downside scenario" - if nothing changed from the present situation - would see continued mining of groundwater; there would be some relief of the urban water supply problem, if only because modern cities cannot simply die of thirst, but rural/urban antagonism would worsen, costs would increase sharply and water would become the dominant constraint to economic growth. The nation would have little prospect of meeting growth targets. The poor would suffer particularly as supply costs rose and conflict over water intensified.

5.9 It is evident that the outcome will lie somewhere between these two scenarios. The challenge is to push towards the upside end of the continuum. The downside scenario represents, in effect, the logical continuation of past trends. It is what will happen if no action is taken. The upside scenario represents the results to be expected from full and vigorous adoption of a water strategy on the lines proposed in this report.

Chapter VI - Moving to Action

A. Implementation Steps

6.1 Implementation of the agenda proposed in Chapters III and IV would broadly require four groups of activities: (i) national debate, consensus building, ownership; (ii) implementation of sectoral programs; (iii) capacity and program building actions; and (iv) longer term actions. The following paragraphs contain suggested priority actions that Yemeni institutions and donors could undertake within a strategic framework. The list is not a complete recipe for resolving the problem; it is intended as a constructive contribution to the national debate. The actions are all selected on the basis of their importance and relevance, and of their feasibility in the Yemen context.

Promote national debate, consensus building, ownership

(a) ***Conduct a structured national debate.*** Ownership by key constituencies is vital, and NWRA has launched a national debate on the water crisis. EDI is helping NWRA with a program of workshops and seminars, that commenced with a workshop in November 1996 to promote consensus amongst key stakeholders on the components of the crisis. This debate needs to be structured, sustained and high profile.

(b) ***Launch a coordinated public awareness campaign.*** NWRA should build up its capacity to orchestrate public awareness campaigns as a priority.

(c) ***Coordinate with donors.*** Government should develop coordination with donor partners through the MDG in a structured way; NWRA has already taken over chairmanship of the MDG and has convened two meetings. A key objective will be to avoid overlap and seek synergy amongst donors. The MDG concept has exactly this objective, and donors are to some extent specialized. UNDP and Netherlands are providing major inputs into the long-term agenda with NWRA itself, notably in capacity building, the policy framework and water law, and into regional planning. For other activities, donors are working in partnership and this should continue - urban water sector (IDA, Germany and Netherlands), strategy for rural water supply (IDA and Netherlands).

(d) ***Develop a national water strategy.*** Interacting with the national debate, NWRA should develop a national water strategy that will focus on the practical steps that can be taken to alleviate the crisis. The strategy will change and develop over time, but there should always be a summary of actions like that in Table 1 in Chapter III. NWRA has begun the process and proposes to produce a draft in late 1997. This should be the subject of broad discussion. The revised version should then be presented to Government for adoption. A reasonable target date for a final version would be mid-1998.[18]

Develop sectoral programs

(a) ***Move to efficiency pricing for water.*** MOPD and NWRA should prepare a phased macroeconomic adjustment program to move to efficiency pricing for water and to promote conservation. Ways to protect and help the poor should be important considerations in designing the reform process. Donors should support studies to analyze options, to quantify the anticipated impact of reforms on various stakeholders and on the economy, and to prepare follow up monitoring of actual outcomes.

(b) ***Act on qat.*** NWRA, MOPD and MAWR should work on an agenda for ***qat.*** NGOs should be invited to help design and implement the long-term public awareness campaign. A study on policy options for *qat* should be carried out.

(c) ***Pursue regional planning.*** NWRA should focus on the program of regional planning, bringing forward the Hadramawt plan to 1997/98 (the financing for the Hadramawt plan is already provided under an IDA Credit).

(d) ***Try regulation.*** NWRA should work with MAWR and LWCP to launch the pilot regulation program in Amran.

(e) ***Develop the agenda for water conservation in agriculture.*** A workshop is planned, with IDA and FAO support, for late 1997. Government intends to use this to draw up the agenda

[18] During review of the draft of this report, Government proposed that preparation of the strategy should precede the national debate, so that the debate could be better structured. This has a logical appeal. However, stakeholders need to have their say in the development of the strategy and the national debate would allow this. In practice, the two processes are likely to proceed together and to be mutually reinforcing.

for water conservation in agriculture. A study on small dams and related recharge should be conducted.

(f) ***Begin handover of spate schemes to users.*** Working with EDI, MAWR should develop the agenda for participatory irrigation management (PIM) in spate and prepare a project.

(g) ***Develop community partnership and self-regulation of groundwater.*** Based on current pilot experiences and studies, NWRA and MAWR should develop a project to promote community partnership in groundwater management.

(h) ***Develop private supply to towns.*** NWRA and NWSA should work on a program to build on private sector capacity. This could include regularizing water markets (NWRA should set up a task force to work on the issue) and developing the legal and (light) regulatory framework to encourage private supply schemes, whilst ensuring they do not contribute to the problems of resource depletion or contamination.

(i) ***Implement the urban water sector reform program.*** Full support should be given to the agreed reform agenda. MEW should reactivate the Steering Committee, and the Technical Secretariat should press on with these vital reforms. The creation of regional corporations and involvement of the private sector should be accelerated.

(j) ***Develop a rural water supply strategy.*** The reform agenda identified in the sector report should be adopted and a national strategy and action plan developed.

Build capacity and investments

(a) ***Develop NWRA and its programs.*** Government should complete the setting up of NWRA and pass the water law. The capacity building program for NWRA should be implemented, including support to the establishment of the proposed National Water Resources Information System.

(b) ***Develop a pipeline of investment projects to implement the strategy.*** NWRA, MOPD and sector institutions should work with donors to identify and prepare a series of projects in support of the strategy. This would include capacity building projects for NWRA; urban water supply investments supporting implementation of the sector reform agenda[19]; a rural water supply project to help implement the reform agenda for that sector; an irrigation improvement project that would rehabilitate spate schemes and support the development of user groups to take over; and a project to develop community participation in water conservation and groundwater management.

(c) ***Subsidize water conservation activities.*** Recurrent and capital subsidies to water conservation are desirable. The scope for extending the conservation program of MAWR's Agricultural Development Fund (and its linkage to water strategy) should be reviewed.

Develop analysis and plans for the longer term

(a) ***Conduct further studies.*** NWRA and other partners should conduct studies to develop the strategy further. The immediate agenda includes three rapid studies (macroeconomic options for water pricing, *qat* and water, and feasibility of small dams).

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[19] Ta'iz and Sana'a are priorities but other major cities also have needs. These projects should not only finance needed investments but also promote the urban water sector restructuring and implement a series of partnership agreements with rural water users. In view of the predominance of the private sector in the capital city - and the impossibility of NWSA to expand its percentage coverage - a private concession approach could be very suitable for Sana'a and a project for Sana'a could help develop the needed legal and regulatory framework for this, as well as providing finance for its implementation.

(b) ***Plan for the longer term.*** MOPD and NWRA should work to launch the Long-Term Perspectives Study.

B. MDG and IDA Contribution

6.2 Donors have an important role to play in supporting the Government and the nation through dialogue, technical assistance and project finance. Over the next two years, the following are the priority activities for donors.

Support from the MDG in general

6.3 Donors have provided extensive support to the sector over two decades. This support was renewed in declarations at the June 1997 Consultative Group Meeting, where donors indicated their commitment to the sector, whilst emphasizing the vital nature of the reform program. Donors' role would call on them to:

- work within the framework provided by the MDG.
- support sector studies, debate and capacity building (especially for NWRA)
- support the reform agenda by dialogue, technical assistance and conditionality
- support physical investments

...and from IDA in particular

6.4 The IDA agenda, to be expressed in the forthcoming FY98 Country Assistance Strategy, focuses on support to Yemen to achieve its three sectoral objectives through: (i) support from ongoing projects; (ii) support from new projects, each of which would be designed to carry forward a key part of the reform agenda; and (iii) a linked program of "learning" and capacity building, also designed to promote the reform agenda. The specific activities would be to:

- support the national debate through EDI, policy dialogue and sector studies
- conduct, with Government, a study on macroeconomic options for moving to efficiency pricing of water, particularly the economic and equity impacts of moving to border pricing of diesel
- support capacity building for NWRA through the IDF grant facility
- conduct, with Government, a study on policy options for *qat,* particularly options to reduce incentives to groundwater mining for irrigated *qat*
- conduct, with Government, a study on the technical, social and economic feasibility of small dams and on related groundwater recharge
- support follow-up to the rural water supply and sanitation sector review, help Government develop the action plan and work with national partners to prepare a project for rural water supply and sanitation that will emphasize participation, decentralization and completion of schemes already begun. The project could also include a line of credit to help communities to effect system replacements, upgrades etc.
- continue support for the Land & Water Conservation Project, aligning it with NWRA's role, and support further work on water conservation in agriculture through AREA. This support would initially be under the ongoing Agriculture Sector Management Support Project, and thereafter through possible future support to agricultural services and research.
- support the program for progressive handover of spate irrigation schemes to users through: (i) EDI support to PIM seminars leading to a strategy; and (ii) identification of an irrigation improvement

project that would combine rehabilitation of the physical structures with development of users' management capacity, leading to progressive handover.

- support the program for community management and conservation of groundwater, based on the current pilot experiences and studies. Support would be provided through: (i) a seminar with EDI support reviewing the current pilot experiences and studies; and (ii) identification of a possible project (perhaps linked with the spate project proposed above).
- within the urban water sector reform agenda, conduct a seminar on private sector participation in urban water (EDI) and then prepare projects for urban water supply and sewerage in Sana'a, Ta'iz and possibly other cities, that will finance needed investments but also carry forward the sectoral reform agenda in a practical way, focusing on decentralizing or privatizing management, reducing unaccounted for water, empowering the private sector within a light regulatory framework, and on shared management of the water resources with the communities of origin; and
- support the long term studies agenda.

C. Conclusion

The proposals discussed in this report can fairly be described as high risk; there is virtually no track record to show how likely they are to work. However, *necessity is the mother of invention*, and innovations in sector management give hope that the risks can be allayed. Of the innovations proposed, four stand out. First, national debate and consensus - this is like mobilizing a nation for war, which in a sense it is (and "strategy" is a martial metaphor). Second, prioritization, which requires a definite rigor in identifying the *real* problems and the *realistic* solutions. The first draft of this report contained over one hundred recommendations; now the agenda in Table 1 has only seventeen items (but this is probably still too many and the national debate and other processes of winnowing will thin it down). Third, the reliance on the indigenous private sector and local water markets: the scale is very different from the challenge of a Buenos Aires, but there is nonetheless a tough policy agenda to ensure that local business can improve quality and price and conserve the resource. Finally, partnership...participation... the hoped for coincidence of national and local interests in self-management of groundwater. This is the most attractive of all solutions - building on the nation's traditions and common sense to brake the runaway mining of the last three decades and return resource management towards the age-old balance reflected in that luminous *hadith*:

> *Cultivate your world as if you would live forever*
> *Prepare for the hereafter as if you would die tomorrow*

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Who are the stakeholders?

Mobilizing the nation to deal with a national crisis requires an understanding of the stakeholders - who is involved, what are their interests, what could their role in change be, how could they be brought in?

political leaders have a vital role to play as initiators and champions of change. Without leadership, change cannot occur.

central government is an important actor. In the water sector many central government institutions are involved (see Annex 3). For the reasons discussed above, these institutions have not worked well up to now.

parliament, which brings together modern political and tribal forces, commercial interests, and urban and rural water users.

shaykhs and the traditional establishment, both secular and sacred, who have considerable influence - and tribal leaders and local notables often have actual physical control of the resources.

decentralized official structures - the provincial governors, and branches of central agencies like NWSA, GAREW, MAWR.

"wise men", a number of individuals within Government and outside, who are concerned about the good of their country and knowledgeable and influential about the sector. Some of these individuals have helped draft the statute of NWRA and the new water law. Many of these individuals have recently come together to form a new NGO, the "Yemen Water Protection Society".

donors, who are very influential in determining the investment program and, to a lesser but still significant extent, in guiding national water policy. Four donors are particularly prominent in the water sector - UNDP, the Netherlands, Germany and IDA.

the private sector, which is very active in both urban and rural water supply, and in drilling.

the press and the media, which have a growing role in forming public opinion.

users, far and away the most important group, as the actual decision takers on water use. The challenge in the water sector is to change user behavior, so all strategies must start and finish with users. However, users are a heterogeneous collection of interests - rich and poor, owners and sharecroppers, organized and unorganized.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Getting to Yes: Stakeholders, Donors and the National Debate

The stakeholders	What is required of them?	How could donors help develop ownership?
Political leaders	Initiate and champion change	Sustained top-level contacts, adjustment dialogue, EDI program, Long-Term Perspective Study
Central government	Political commitment, decisions, actions	Sector analysis, workshops, projects, adjustment operations, EDI program, Long-Term Perspective Study
Parliament	Commitment, laws, leadership	Seminars, discussions, EDI program
Shaykhs and the traditional establishment	Reconciliation of old and new	Informal sessions
Decentralized official structures	Implementation, working with the grass roots	Projects
Wise men and NGOs	Commitment, advocacy	Symposium, projects, Long-Term Perspective Study
Private sector	Management, capital, entrepreneurship	Seminars, adjustment program, projects, EDI program, Long-Term Perspective Study
Press and media	Public awareness, opinion forming	Briefing, articles, structured involvement in the public awareness campaigns, EDI program
Users	Adoption of difficult adjustments, participation in managing them, change of water use behavior	Public awareness, decentralized projects and programs
The nation as a whole	A national consensus for action	Sustain a long-term commitment

REPUBLIC OF YEMEN

YEMEN: Towards a Water Strategy

Water Sector Agencies

Agency	Estimated employees for water activities	Responsibilities for water	1996 Budget Transfers[1/] (YR million)
National Water Resources Authority(NWRA)	120	Sector planning, legislation, regulation and enforcement	Recurrent 26 Investment 0
Ministry of Electricity and Water(MEW)		Oversight of NWSA and GAREW	
National Water and Sanitation Authority (NWSA)		Potable water supply and sewerage in urban areas (>30,000 population)	Recurrent 0 Investment 3,695
General Authority for Rural Electricity and Water Supply (GAREW)	500	Potable water supply and sewerage in rural areas (<30,000 population)	Recurrent 37 Investment 2,290
Ministry of Agriculture and Water Resources (MAWR)		Development and management of larger scale irrigation schemes and small dams, research and extension on water management for farmers	Recurrent 515 Investment 966 (for irrigation and potable water only)

1/ Source: Public Expenditure Review. Budget transfers are the measure of direct public subsidy of the agencies.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Sources of Water in Farming

Source of Water	Hectares ('000s)	Percentage of Total Area
Spate	98	9
Spring	20	2
Tubewell	363	34
Rainfed	571	55
Total Cultivated Area	1,052	100

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

The National Water Resources Authority - NWRA

NWRA is starting up slowly

The decree was issued for the creation of NWRA in late 1995, and the Chairman was appointed in April 1996. The institution is housed in good offices near to other water institutions in Sana's. The initial nucleus of staff came from existing agencies, and is predominantly technical, with skills in resource assessment. There are big gaps in areas like policy analysis, public awareness, social aspects, legislation and economics.

NWRA is focusing on doing a few things well. At headquarters, this comprises the national debate and the public awareness campaign. In the field, this comprises a major focus on Taiz, setting up an office there and putting in place the first regional water management plan.

There is project support for NWRA

A project "Support to Water Resources Management Capability" (SWRMC) is designed to support the development of NWRA. SWRMC began in 1994 and is presently financed by UNDP and the Netherlands, and executed by UN/DDSMS.

The objectives of SWRMC are as follows:

- to strengthen the institutional and technical capabilities of NWRA in water resources assessment, planning and management. Technical assistance is in place in management and resource assessment.
- to support the preparation of water legislation.
- to develop NWRA capabilities in the preparation and execution of regional water management plans. Four plans are proposed for 1996-9: Ta'iz (underway), Sana'a (1997), Abyan Delta and Masila.
- to develop a comprehensive public awareness program for water conservation. An initial mission has taken place and the framework for a national coordination council has been outlined.
- to assist NWRA in assuming the leadership role in overall sector planning and management, including coordination of donor activities. This has not yet started.

A SWRMC mission in June 1997 helped NWRA to put in place a practical organization chart, to assess its staff and to draw up a recruitment and training program.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

The Urban Water Sector Reform Agenda[1]

A. Analysis

There are six main problems in the urban water sector:

Water sources are running out and new ones are difficult to access

NWSA has had to prospect for future resources in a piecemeal and ad hoc way. Virtually all sources considered are already in use. For lack of an integrated legal and institutional framework for water transfers, NWSA has run into almost intractable socio-economic and political problems.

The public utility, NWSA, is in very poor shape

NWSA is a highly centralized organization. Its coverage is poor (60 percent of the urban population, and only 36 percent in the capital) and it cannot even supply the population connected - Ta'iz is the extreme case. Internal efficiency indicators are all unfavorable: unaccounted for water is 40 percent minimum; collections are only 64 percent of billings; there are too many staff - 6-24 staff per '000 connections against an international norm of 2-5; salaries are 70 percent of costs, against an international norm of 30-50 percent; and cost recovery is low - tariffs average 5-8 cents, marginal costs are over $1.

Access to potable supply is limited, with consequent impact on health and poverty

The poor coverage, its health impact, and the uneven way in which the poor bear the burden are discussed above.

Lack of water in towns is a constraint on economic development

Availability - and cost - of water is the major determinant of location for new development. Manufacturing and service industries return much more to water than agriculture (see Chapter 1-A) but often lack of water is the constraint in setting up businesses.

The private sector is quite active, but the systems are expensive and do not protect the resource

One emerging solution to the problem of water shortages in towns is the water market, which supplies more than half the needs of Sana'a and Ta'iz and elsewhere, transferring water from rural areas to urban uses in return for payment. Most of these arrangements consist of tanker transfers. This is a very high cost system (expensive for urban consumers). Because it is unregulated, it generally contributes further

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1 This annex is in large part a summary of the Urban Water Supply Sector Restructuring Study (Kalbermatten for NWSA, August 1996).

to resource depletion. In addition, sanitation is neglected, presenting a major environmental and health risk.

Government, with donor help, has begun tentatively to explore a variant of the water market solution by negotiating rural-urban transfers in exchange for rural development packages in Ra'dah and (ongoing) Ta'iz/Habir.

Poor development of wastewater treatment is an environmental problem

Sewerage connections have not kept pace with water supply. In the northern governorates, the official figure is 23 percent of urban households served, in the southern governorates 50 percent. Poor wastewater collection is responsible for surface accumulations of sewage, and for infiltration into leaky pipes and ultimately into groundwater.

B. Recommendations

NWSA will remain the leading agency for urban water supply. As NWRA develops progressively an integrated approach to water resource planning, NWSA has to work within this. Decentralization and association of the private sector are the keys to improving NWSA efficiency. However, this structure cannot provide adequate coverage, and ways should be found to improve the provision of service by pure private operators. Association of users in planning, implementation and management can reduce costs and increase sustainability.

Develop new sources within an integrated framework

New resource search and development has to be done, as far as possible, within the context of the regional water management plans that NWRA will be developing (see above).

Implement sector restructuring

The recommendations of the institutional restructuring study begun in 1995 ("Kalbermatten Report") are being discussed and an action plan should subsequently be adopted and implemented. The report proposes a plan in stages: Stage One provides for NWSA to decentralize, for branches to have more autonomy, and for internal improvements to improve incentives and reduce staff; under Stage Two, branches would progressively be turned into regional corporations that could associate private management and ultimately private capital. The report also recommends involvement of communities - and possibly NGOs - in both planning and implementation.

Promote private supply

As NWSA can only supply a fraction of the market, steps should be taken to promote further development of private supply, in order to increase coverage and reduce costs. This could comprise: legislation defining the rights and duties of private water suppliers; the development of a series of concession agreements for organized private supply to towns, with an exclusive zone in which the concessionaire has an interest in conservation; and working out of a system of "light regulation by exception" to protect the public interest and ensure sustainable exploitation of the resource.

Development of this agenda will require extensive further study and research as there is a fearsome list of issues associated with concessions and water markets based on groundwater sales, including: (a) *ownership* - what is the law that gives one group or individual the right to sell? (b) *definition* - how can a fugitive and uncharted resource be quantified so that it can be sold? (c) *regulatory* - how can it be ensured that water sales are not depleting the resource?

....beginning in Sana'a

In view of the predominance of the private sector in the capital city - and the impossibility of NWSA to expand its percentage coverage, a private concession approach could be very suitable for Sana'a. It is recommended that the issue be thoroughly studied during preparation of the proposed Sana'a Water Supply and Sewerage Project and implemented, at least on a pilot scale, under that project.

Prioritize

As the problems are many, attention for new supply development should be on priority stressed areas. These areas include Ta'iz and Sana'a.

Pay attention to wastewater

NWSA, together with NWRA and EPC, should develop a wastewater treatment and reuse plan. However, wastewater is not likely to be a significant economic resource for some time. UNDP (1992) estimated total sewage collected nationwide as 37 MCM (2 percent of national water use), of which the greatest proportion is discharged untreated to the sea.[2]

2/ Northern Governorates (1990): urban sewerage coverage 23%; sewage collected 13 MCM. Southern Governorates (1992): urban coverage 50%; sewage collected 24 MCM, most discharged to the sea.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Water Conservation in Agriculture

A. Analysis

Traditionally, the predominant farming systems in Yemen were spate and spring irrigation, terrace agriculture, and rainfed farming in the plains. In the last twenty years, tubewell irrigation has become the most important contributor to agricultural output, and now occupies 34 percent of the cultivated area.

Sources of Water in Farming

Source of Water	Hectares ('000s)	Percentage of Total Area
Spate	98	9
Spring	20	2
Tubewell	363	34
Rainfed	571	55
Total Cultivated Area	1,052	100

There are four main problems in irrigation:

Tubewell irrigation is living off capital

Water resources are depleting; it is unlikely that the decline can be reversed anywhere, as this would require a massive voluntary abandonment of irrigated agriculture - but the rate of depletion could be slowed. What happens when a resource depletes? First, - costs go up, ultimately to unacceptable levels. Eventually the resource literally dries up. Some communities are already finding their existence in jeopardy (see Box 3). So the challenge is, how can the rural economy adjust to a more sustainable pattern of water use without massive disruption.

There are no incentives for water conservation

The policies and environment that have led to over use of water are described above. In effect, groundwater in Yemen is a classic example of the tragedy of the commons in which no individual user has any incentive for conservation.

Water use is inefficient

Because the scarcity of water is not reflected in its financial cost, farmers often use water inefficiently. There is scope for improving conveyance efficiency and on-farm water management.

Development is all top-down

There are virtually no programs or institutions that work from the bottom up. What is needed is a partnership approach.

B. Recommendations

In a varied and fragmented country like Yemen, the problems in each area are different, and this points to decentralization. This is reinforced by the weakness of Government: the virtual impossibility of regulation puts emphasis on the need for decentralization and community responsibility.

The need to preserve as much as possible of the rural economy whilst reducing water use highlights the need for efficiency improvements, maximizing returns to water.

If water markets develop, as seems inevitable, they have to be regulated to avoid depletion of the resources - and this could be done according to circumstances by either communities or Government or - better - by both.

Develop a coordinated approach to water conservation in agriculture

MAWR, with NWRA, should hold an open forum to debate technical, institutional and aspects of water conservation in agriculture, and prepare a coherent approach. Note: preparations for this forum are underway.

Promote community involvement and self regulation

Decentralization and partnership are likely to be the best approaches, working from existing rights systems and management practices to promote change. The ongoing Decentralized Management Study (DMS) on rural water use shows that there is a basis for community involvement and self-regulation and this could be reinforced by government and para government institutions. The DMS should be expanded and should feed into pilot projects and full projects.

Government and donors should adopt a community-oriented, bottom-up approach. This implies: a farming system and research action approach for research and extension; a responsive, community-oriented approach to extension; and emphasis on community initiatives in natural resource management. Emphasis should be on local and regional approaches and institutions, within the framework of the regional water management plans. Ideally, private not for profit organizations ("NGOs") would be involved.

Develop a public awareness program

To develop partnership and get key messages across, a public awareness program is essential, aimed at rural users, focussed on specific target populations and promoting just a few essential themes. NWRA is taking the lead in coordinating this program (see above), and all concerned national institutions should support this (by joining the coordinating committee, working on message development, etc.). Donors should work together in supporting this vital effort through ongoing (e.g. LWCP) and future assistance.

Mitigate the negative impact of the adjustment process by promoting technical improvements

Government and donors should work to develop technical programs to increase the return per m3 of water. The programs should include research in advanced irrigation techniques, including economic and financial returns; and further promotion of advanced irrigation technology, with an initial subsidy to introduce it and to compensate for the distorted incentive structure. Research and extension on rainfed and livestock should be pursued vigorously.

Government and donors should not push irrigated agriculture in threatened areas, and may need to change the nature of the existing or future programs towards range, rainfed or off farm employment. Government should introduce incentives for those activities - e.g, hill farming subsidies to maintain the terraces etc.

Improve the efficiency and sustainability of spate irrigation

Some spate schemes have been improved at Government expense. In order to ensure that these schemes are properly maintained and the water efficiently used, users should increasingly take responsibility for their operation and maintenance.

Compensate rural communities for reducing their water use

Government should set up the legal and institutional framework that will allow rural people to receive compensation for the rising opportunity cost of their water through water markets (see above).[3]

Even if set aside is not a viable option, there are means of creating incentives for economizing on water use through Government programs. Government and donors should introduce alternative income programs and a safety net for rural communities.

Include qat in policy and programs by planning for it....

Qat is the most important crop in Yemen and the country's greatest consumer of water. It cannot be ignored. MOPD and MAWR should include *qat* in statistics, and MAWR should make it the object of research and extension in order to exploit water saving potential.[4]

3/ In theory, Government could also purchase rights and then retire them from use - the practice of "set aside". However, this supposes a framework of rights, monitoring and enforcement which would be hard to implement. In addition, set aside would be prohibitively expensive.

4/ Government recently instructed AREA to open *qat* research, which is a move in the right direction.

....considering opening up the qat trade

One option that Government could consider would be to open *qat* to free trade; prices in neighboring Ethiopia are much lower, and the import of *qat*, particularly at times requiring high irrigation such as April/May, could significantly bring down prices in Yemen and reduce local production incentives. It would also allow taxation at point of entry. As this involve major issues of public policy, the options should be studied carefully before any action is taken.

...and changing attitudes to qat

Government should develop a long-term education and public awareness campaign on *qat*, focussed like, successful anti-tobacco campaigns, on its pathology, on "lifestyle disamenities" like loss of vitality, loss of family life, reduction of disposable income, and on the cost. Ideally, an NGO should take the lead. A number of Government agencies should be involved, as well as other stakeholders.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

National Environmental Action Plan - March 1996

Recommendations for Actions in Water Resources Management

Targets/ Instruments	Legislative Tools	Institutional Measures	Economic Instruments	Financial Investment	Information Instrument	Community Involvement
To conserve water sources	Issue and enact the Water Law. Issue regulations regarding import of water exploitation technology.	Activate the National Water Resources Authority.	Increase custom duties on drilling equipment. Introduce new water tariffs that reflect the real cost. Provide incentives to reduce water consumption in irrigation.	Build dams and water reservoirs, based on technical, economical and environmental feasibility. Introduce water-saving irrigation techniques and systems.	Upgrade information on water balance of aquifers. Create a complete water resource database system.	Continue public awareness campaign to promote rational use of water. Involve water users and local conservation groups in water management
To protect water sources from pollution	Issue by-laws for environ-mental protection. Issue and enact the Water Law.	Establish centers for water quality control. Create national network of water analysis labs.	Impose penalties on polluters. Support pollution-free industries.		Disseminate information on water pollution, its causes and treatment.	
To provide clean drinking water to 75% of the population by the year 2000[1]	Purify drinking water (network and wells). Prohibit the use of drinking water for qat irrigation. Impose regulations to curb illegal water uses.	Strengthen national water authorities, in technical and administrative ways. Promote private sector maintenance of water networks.	Increase tariff for water consump-tion. Use revenues from water fees to protect, develop and conserve water resources.	Encourage private sector to build water reservoirs. Adopt new technologies. Develop alternative sources of drinking water.	Study existing water sources to know available drinking water. Collect statistics on population, households and construction water needs.	Decentralize water management. Empower local administration in water management. Involve NGOs, private sector, and the media in water management issues.

[1] In commenting on the draft of this report, Government pointed out that this target is unrealistic (Coverage in 1997 is under 50h). This table, however, is simply a summary of what is in theGovernment's own NEAP of 1996, not an endorsement or advocacy of that NEAP.

Source: Yemen Environmental Action Plan, EPC/MPD, March 1996.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Options for Private Sector Participation in Urban Water Supply[5]

Private Sector Participation

Private sector participation (PSP) in the delivery of municipal water and wastewater services can improve managerial and operational efficiency, help mobilize financial resources, and boost the pace of sector development and service improvement. A broad range of options (from limited service contracts to a full concession) is available. They vary in the degree of private sector involvement and in the way risks are shared between private firms and local government. PSP arrangements need to be carefully designed to ensure that customers benefit. Contracts are best awarded through a transparent and competitive bidding process. Governments should seek expert advice to structure mutually beneficial partnerships with private operators. A PSP-friendly regulatory environment is necessary to attract the best private firms and keep them from sharing a risk premium. To encourage private entry and ensure it takes place in an orderly way, Government should assume an active role by preparing guidelines and model contracts for the different PSP options, access independent advice, make sure that national financial support or the tax regime do not discriminate against private sector options, and supporting a few pioneering PSP undertakings.

The Case for Private Sector Participation

Public sector management of utilities has a generally disappointing record. With the exception of a few counties that have a strong public service tradition in high-income economies (e.g., Germany, Switzerland), public water utilities (municipal or national) worldwide have a performed poorly in terms of service reliability, productivity, attention to customers, financial management, or the selection and implementation of investment projects. In general, the state has not been successful in regulating its own enterprises or holding them to acceptable performance standards. A growing awareness of this poor performance, combined with the realization that public funds alone cannot meet the large investment needs of the sector, have led to great interest in private sector participation (PSP) as a complement for the government's role in the financing and delivery of water and wastewater services.

PSP: a public/private partnership rather than a full "privatization". Even in countries that have opted for extensive PSP, central and/or local governments retain a commanding role in providing guidance, regulation and oversight for the water sector. This role is fully justified by the externalities (environmental, public health, urban and regional development) which pervade the sector, and by its natural monopoly features. This does not imply, however, that the state needs to do everything by itself: the day-to-day operation of a utility consist largely of industrial and commercial processes that private firms tend to handle in a more efficient way than public enterprises. Private participation does not mean that the public sector disengages entirely or losses control, but that it opts for a new division of labor between public and private partners based on comparative advantage.

The experience to date. Private water utilities have been in operation successfully for decades in several states of the USA, even though the tax regime is slanted in favor of public ownership. In the 80s, Britain converted its regional state-owned water enterprises into stock companies and floated their shares on the stock market,

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5/ This note is adopted from "Institutional Options for the Provision of Infrastructure" by Christine Kessides, World Bank Discussion Paper Number 212.

transferring full ownership to private investors and limiting the public sector's role to one of standard-setting and regulation. In France, local governments own the infrastructure, but a growing number - now accounting for about 75 percent of all urban water connections in the country, though less for sewerage - have opted to delegate the operation to private firms under management contracts, leases or concessions. Similar arrangements are spreading in Spain and Italy and are being adopted in cities of Latin America, East Asia and Africa. In Germany, private firms serve only about a quarter of all users, but even municipally-owned utilities farm out a large share of their work, and a dynamic industry of specialized sub-contractors has developed. To accelerate the modernization of the water sector in the eastern states (Lander) of Germany, private entry is being encouraged in that region.

Potential benefits of PSP in the water sector. Enlisting the private sector to leverage the financial and managerial resources of the state and introduce efficiency incentives can help countries attain better service coverage and quality faster and at a lower cost to users. A good example of these potential benefits is given by the competitive award in 1992 of a concession to refurbish, expand and operate the water and sewerage systems of Buenos Aires, the capital of Argentina. These systems were left in an advanced state of disrepair and financial crisis by many years of inept management under a state enterprise. The winning bidder committed himself to investments of about $500 million during the first five years of the concession, and still was able to reduce the existing tariffs by about 20 percent. The PSP experience in countries like France or Spain also provides a consistent record of tighter management (shown for instance by sharp reductions in water losses) and reliable service whenever reputable private firms are called to operate waterworks formerly handled by municipal enterprises.

Different Forms of Private Sector Participation

Private firms can be brought into the operation and/or development of water and wastewater services in different ways, which vary by their scope and the extent of responsibilities and risks assumed by the firms and the contracting authority.

- Under a **service contract**, a utility hires a private firm to carry out specific tasks (e.g., leak detection, meter reading, water quality measurements) while retaining full responsibility and risk for service provision. Subcontracting is especially advisable for activities that have large peaks (for instance, construction), or when the in-house level of activity is insufficient to reach an efficient scale of operation (for instance, water quality laboratory, or vehicle fleet maintenance). Even for other activities (for instance, meter reading) private contractors working under competitive pressure are often more cost-effective than utility departments.

- A **management contract** is a service contract where the utility or its municipal owner hire a management team from a private firm. It can be used to bring in new management systems, organization and skills, or as a preliminary step to restructure a dilapidated utility before a concession. Compensation is cost-plus-fee, and the contracting municipality retains most of the operational and commercial risks of the utility, though some risk-sharing may be built into the contract using performance bonuses or contingent fees.

- In a **lease contract**, a private firm takes over the operation and maintenance of the system, collects user charges, and is compensated with an agreed portion of the revenues. The municipality remains responsible for system expansion and replacement of major assets and recovers part or all of its costs from its own share of user charges. The lease holder may also administer investment funds as agent to the municipality, without taking related financial risks.

- In a **concession** or build-operate-transfer (BOT) scheme, private investors arrange the financing and construction (or rehabilitation) of either a self-contained facility (e.g., a treatment plant) or a complete water/sewerage system, then operate it for the period of the concession. For a treatment plant-type BOT, the investor is compensated by the public utility under a "take-or-pay" obligation, and the public utility retains the commercial relationship with the end-users and assumes the related risks. In a system-wide concession, the investor bills and retains user charges for the concession period.

- **Full private ownership**, arising from the sale of all utility shares to private investors (the model in England and Wales), is unlikely to materialize in Poland for at least the next few years. Even if municipalities were interested in selling (the proposal would face strong political opposition in most cities), they would not find responsive buyers given (a) the lack of regulatory experience, and uncertainties on sector institutions, policies, the utility's cost structure and revenue base, and the macroeconomic environment; and (b) the limited size of the capital markets and the lack of private domestic enterprises with relevant experience and sufficient resources.[6]

- A municipality can share ownership with private shareholders in a **joint-venture** company. This company itself may either own the assets or (most often) be given a franchise by the local government as in one of the lease or concession arrangements described above. This option is popular in Central and Eastern Europe.

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6 Although in principle, shares in regulated utilities might provide an attractive risk diversification element in a "vouchers privatization" portfolio.

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

Discussion Papers

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1.1 Economic Policies for Water Management (Norton)

2.1 Water Policy and Water Law (Hayward)
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4.1 Agriculture and Irrigation (Ward)

5.1 Sana'a Action Plan (Ward/Zelaya)
5.2 Ta'iz Action Plan (Zelaya/Ward/Al-Salihi)
5.3 Decentralized Management Study (Moench)

REPUBLIC OF YEMEN

TOWARDS A WATER STRATEGY

BOXES

Box 1: Ta'iz Water - The Reality

"Municipal water supply in Ta'iz has reduced from every two weeks (May 95) to once every 40 days (August 95). The quality is atrocious - 2000 uS/cm or more. Nobody will drink it, though some boil it and drink it. Reduced municipal supply has led to increased business for private suppliers. They bring water of reasonable quality from more distant boreholes, treat it and fill plastic jerry cans which are sold in the shops. Water is obtained for washing purposes from tankers. The price has increased noticeably over the last four months by about 15 to 25% due to the tankers having to go further as wells dry up (before which the quality was deteriorating to 3000 and even 4000 uS/cm). One can only find water in the mornings, the wells being dry by the afternoon. The price also depends on how many storeys there are to your building. The richer members of society live in single storey villas and hence pay less than those living in apartments. Most people cannot afford the tankers, so the children (and some women and even men occasionally) go to the benefactors who have private wells, e.g. rich families and some of the mosques, and fill up several yellow ex-corn oil containers (2 lit) which they drag from the well in make-shift cut-out jerry can toboggans pulled by string.

"When the mains water finally arrives, all social engagements are canceled and the mother and daughters will work from 6:00 am to 12:00 pm for the one or two days the water is connected. The washing has accumulated into a huge pile, some clothes are being worn a second time over and there are no clean clothes or bedding left in the house. The next day after the water stops is drying day. There is usually not enough room, so clothes are often draped on the roof over any object available - reinforcement bars, water tanks, etc. The next event is ironing. The whole cycle is about 4-5 days of constant water related activity by all female members of the household."

Extracted from an informal note of August 13, 1995 by Chris D. Handley

Box 2: The Water Problems of Al Sinah

In the 'uzla (community) of Al Sinah, between Taiz and Turbah, the women used to have to walk 7 km distance and bring water 700m uphill. In the 1960s, the community decided to develop a piped drinking water supply. To pay for it, the women sold their gold and villagers working away from home contributed through savings clubs. The scheme was successful, but by 1985 the original wells had dried up. The villagers found new water near to the old wells but the neighboring 'uzla objected as the site was in their territory. The villagers of Al Sinah then found a third source on land that was in another 'uzla but was owned by members of their own 'uzla. They parlayed a deal with the other 'uzla on the grounds that the water was for drinking, which could not be denied in religion. Wells were drilled to 155 m. But soon sporadic irrigation development began in the area. In order to protect this last source of drinking water, Al Sinah surreptitiously began to buy up plots of land in the area, drill wells and then cap them. This was because communities in the region broadly recognize spacing restrictions of 500-1000m between wells. The capped wells counted, and no one else has drilled near to them. For the moment.

Source:Local Water Management: Options and Opportunities in Yemen (Summary Report on the Decentralized Management Study, April 1997).

Box 3: Partnership in Water Management - the Case of Ta'iz

Management of water from the center is exceptionally difficult in Yemen, due to the weakness of government and the fragmented nature of the water resource. Policies and institutions at the center have to work in partnership with users, and self management and self regulation have to be at the heart of the solution to Yemen's water crisis. This will require exceptional attention to decentralized structures, to community involvement, to existing rights systems and management practices, and to incentives and sanctions that work within local society.

The Decentralized Management Study (DMS) was carried out in 1995/96 on IDA and trust fund finance to examine the scope for partnership with communities in water resources management. The DMS studied two particularly water-stressed areas - Ta'iz and Amran - to :

- identify stakeholder attitudes and constraints
- assess ways of changing incentives and behavior
- evaluate the scope for market-based rural-urban water transfers
- evaluate scope for self-management
- develop, with users, pilot projects to test the partnership approach to water resource management

Major findings are:

- there is a long history of cooperative institutions involved in water management
- water markets and water sale for profit are widespread and are recognized as legitimate
- effective control over water resources is concentrated in a few hands
- in some areas existing local rights structures provide a basis for regulation, and in a few cases, local communities have already taken action to limit groundwater extraction
- the capacity of Government institutions to work with communities on self-management of water is very limited

The study shows that there is scope to build a partnership between regional institutions and communities in water management. Phase 2 of the study developed this in Ta'iz by working with the community of Habir on an agreement to transfer water to Ta'iz city in exchange for benefits and to improve management of the common water resource to ensure its conservation. With support under the Ta'iz Water Supply Pilot Project, community water associations are now to share management of the aquifer with Ta'iz city. An NGO, the Arid Lands Initiative, is providing support to the communities on water conservation and monitoring, and on self-management through water user associations.

The lessons from the study and the pilot project will be incorporated in the Taiz regional water management plan that NWRA is preparing.

Source: Local Water Management: Options and Opportunities in Yemen (Summary Report on the Decentralized Management Study, April 1997).

MAP SECTION

IBRD 28266

REPUBLIC OF YEMEN
WATER RESOURCE MANAGEMENT REGIONS

SAUDI ARABIA

OMAN

ETHIOPIA

ERITREA

DJIBOUTI

RED SEA

GULF OF ADEN

Approximate Total Average Resources [Mm^3/year]

Estimated Total Water Use*- 1994 [Mm^3/year]

* Groundwater obstraction + surface (spate) withdrawals.

MAIN ROADS
SECONDARY ROADS
WADIS
INTERNATIONAL BOUNDARIES

DISTRICT CENTERS
PROVINCE CENTERS
NATIONAL CAPITAL

1 Intermountanous Plains:
1a. Sadah
1b. Al Harf, Hamra, Al Ashah & Attaf
1c. Amran
1d. Sana'a
1e. Dhamar
1f. Rida
100 | 500

2 Tihama
741 | 1000

3 Wadis Tuban & Bana and Abyan Delta
355 | 364

4 Eastern Escarpment
315 | 540

5 Ramlat As Sabatayn
0 | 0

6 Hadramawt
161 | 281

7 Al Ghaydah
No Data | 77

8 Wadis Ahwar, Mayfa'ah & Hajar
180 | 102

9 Rub Al-Khali
171 | No Data

no defined boundary

SANA'A
Saadah
Harad
Maydi
Huth
Al Harf
Al Hazm
Al Ghayl
Khamir
Hajjah
Raydah
Suq 'Abs
Al Luhayyah
Amran
Sa'ir
Az Zaydiyah
Al Mahwit
Marib
Shabwa
Jihanah
Manakhah
Al Hudeidah
Mabar
Al Mamuniyah
Dhamar
Rida
Boyt al Faqih
Zabid
Yarim
Ibb
An Nabirah
Al Beida
Hays
Mudiyah
Mawshki
Hobir
Taiz
Lawdar
Mocha
Al Khodah
Al Masani
Tur Al Bahah
Jaar
Shaqra
At-Turbah
Lahij
Zinjibar
Aden
Ghadir
At Turbah
Harib
Khawrah
Nisab As Said
Ataq
Rawdah
Habban
Al Huwaymi
Ahwar
Al Hawrah
Al Irqah
Bir Ali
As Sufal
Burum
Al Mukalla
Ar Riyan
Al Shihr
Al Ghaydah
Haswnah
Harrah
Saybut
Qishn
Nishtun
Al Ghaydah
Mar'ayt
Dimqawt
Hawf
Rakhyut
Habarut
Sanaw
Thamud
Minwakh
Saddat ash Shuqqah
Zamakh
Al 'Abr
Tarim
Gail Omar
Shibam
Seiyun
Taribi
Al Qatn
Mishta
Howrah
Al Qarah
Mawlá Mator
Atud

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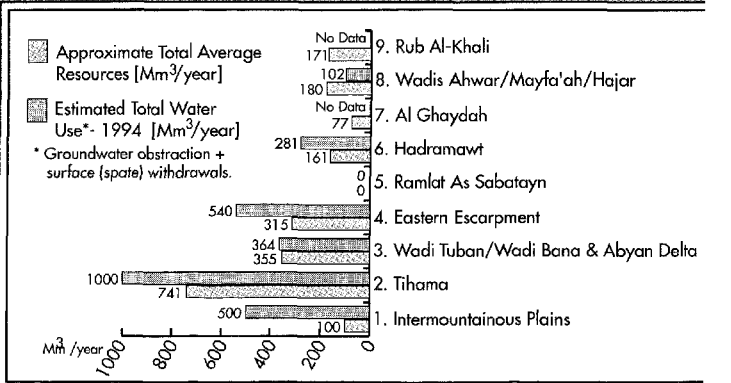
0 25 50 75 100 Kilometers
0 25 50 75 100 Miles



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IMAGING

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