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Jordan Water Quality Improvement and Conservation Project

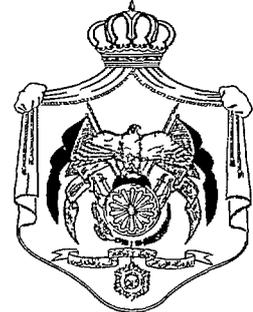
Proposed Policies for the Water Sector

Final Draft

Volume 2 Policy Profiles

Water Policy Committee

The Hashemite Kingdom of Jordan



Ministry of Water and Irrigation

Report 3114-96 1a 02



The Technical Assistance Team Includes

Development Alternatives, Inc

Science Applications International Corp

Harza Environmental Services, Inc

Development Associates, Inc



INTRODUCTION

Volume II Policy Profiles

The Process of Water Policy Development

The Ministry of Water and Irrigation, in cooperation with the U S Agency for International Development (USAID) and with a contribution of the German Agency for Technical Cooperation (GTZ), initiated a water policy development program for Jordan in early 1995. The program was supported by the USAID Water Quality Improvement and Conservation Project, implemented by Development Alternatives, Inc (DAI).

The first phase of the program included establishing a water policy committee, chaired by the Undersecretary of the Ministry of Water and Irrigation, and composed of experts who represented the full range of perspectives and interests in the water sector in Jordan. The core of the water policy committee numbered roughly 25 and was drawn from the MWI, WAJ, and JVA staff, the Ministry of Planning, and the Jordanian and international consultant community.

Program participants identified and reviewed relevant literature, including water policies adopted by other countries and studied in detail current and anticipated water problems in the country. The committee also reviewed existing laws and regulations related to water and identified policy gaps. Committee members with additional officers of the Ministry of Water and Irrigation formed 24 policy issue task forces which examined the issues closely, prepared policy profiles, and drafted policy statements, strategies, and action plans. The task forces then presented these products to the policy committee at regularly scheduled meetings. The policy committee reviewed and revised the policy statements, strategies, and action plans in open sessions. The policy statements, strategies, and action plans presented here represent the consensus of the committee members.

The water policy issues are grouped into six categories which form the major divisions of this volume:

- Water Resources and Supply Management
- Demand Management
- Allocation Priorities
- Water Quality
- Investment in the Water Sector
- Institutional and Social Aspects

The profiles, policy statements, strategies, and action plans have been reviewed by an editorial board which sought to eliminate inconsistencies and unnecessary duplication. Because of the overlap between some issues, they merged some issues and reduced the total number to 22. The policy statements, strategies and action plans were further refined after receiving input from the Minister and his staff in July and October 1996. The policy statements, strategies, and action plans are presented in Volume I of this report, and profiles are contained here in Volume II.

WATER RESOURCES ASSESSMENT AND MONITORING

Water resources planning, development, utilization, operations, and management should be based on a comprehensive national assessment and monitoring system. The MWI shall

- *improve national assessment and monitoring systems to ensure the collection and analysis of necessary water resources data pertaining to quantity, quality and uses*

Background

Securing a reliable supply of water, adequate in quantity and quality, is one of the most challenging issues facing Jordan today. Planning and policy formulation for the supply and utilization of water resources should be based on comprehensive and reliable data, including data on water quantity, quality, and its utilization. Surface water, groundwater, and treated wastewater supplies and utilization need to be carefully monitored. The importance of shared surface water supplies and shared groundwater aquifers demands a careful and consistent assessment and monitoring of these resources. Non-conventional water resources, particularly brackish water resources, need to be assessed as desalination becomes more economically feasible.

Time series data from monitoring the variations in annual rainfall, streamflow, and groundwater reserves have significant implications for the planning and management of Jordan's water resources. Knowledge of the variation of quantities and qualities of water and the factors that affect them can only be obtained by intense and sustained data collection and monitoring efforts.

In addition to monitoring water supplies, there is also an important need to measure water consumption. Performance data on irrigation, accounting for municipal water deliveries, and monitoring of groundwater abstractions provide important information to water managers on the efficiency of water use and have implications for policy.

Importance of the Issue

Given the shortage of water resources in Jordan and the growing threats of pollution, it is of extreme importance to carefully monitor and assess the Kingdom's water resources. In order to manage these resources effectively, the responsible agencies must have accurate data collection and analytical capabilities. The following contribute to the critical nature of the issue:

- There is a lack of adequate monitoring capability, both in staff and equipment, which is essential to planning and the flexible operation of water systems.
- Data collection and analysis are fragmented among several government organizations resulting in duplication of efforts and nonstandardized methods.
- Equipment for surface and groundwater monitoring are not standardized.
- Records show data gaps, errors, and missing data due to device malfunctions and/or human errors in data collection or processing.

Current Policy Framework

The Water Authority Law No 18 of 1988 states that WAJ will

- survey water resources, conserve them, and determine ways, means and priorities for their development and use,
- develop the potential water resources in the Kingdom, increase their capacity, improve their quality, and protect them from pollution, and
- draw terms, specifications and special requirements in relation to the preservation of water and water basins

Actions Taken to Address the Issue

The Water Quality Improvement and Conservation Project (WQIC) has as a major component the design of a monitoring system for collecting data on surface and groundwater resources

GTZ is updating the National Water Master Plan which was last prepared in 1977. The purpose of the plan is to assess present and future water resources and to provide a framework for policies, strategies, and action plans, which are intended to result in meeting the medium and long-term requirements of all water users in the Kingdom.

UNDP started a program in 1991 to assess water resources in Jordan and to strengthen capabilities in water policy development and planning.

Studies on groundwater resources in northern Jordan are being carried out. They are expected to provide information on aspects related to groundwater abstraction and improve monitoring.

A regional data bank project has been agreed to with neighboring countries. The United States Geological Survey is providing technical guidance to establish a regional water data bank so countries will be capable of sharing data.

Policy Gaps

Legislation, regulations, and operating rules concerning water resources monitoring and assessment are not consistent and are not complementary

Constraints to Resolving the Issue

Many constraints exist to improve assessment and monitoring of water in Jordan, these include

- regulatory functions and operational responsibilities are not separated in the organizational structure in the MWI,
- institutional inertia in the operating agencies (WAJ, JVA) and the resistance to change,
- fragmentation of monitoring efforts among several governmental organizations,
- inadequate water information system,
- lack of technical experience among the staff of the MWI, and
- budget constraints for human resources development

Strategy

To implement the policy, the MWI will pursue the following strategy

- Establish a national monitoring and assessment system within a centralized entity which will ensure the collection and analysis of necessary water resources data and avoid duplication

Action Plan

- Revise legislation to promote consistency in water monitoring and assessment
- Develop standardized monitoring programs for quantity and quality of water resources
- Develop monitoring programs for water utilization and efficiency
- Upgrade water monitoring system networks and equipment for monitoring programs
- Establish a central water database management system accessible to all users
- Develop the assessment and analytical capabilities of water resources professionals

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SURFACE WATER

Since the surface water resources are extremely limited, the MWI shall

- *optimize the development and use of surface water through supply-enhancing measures, including surface and subsurface storage, minimizing losses by surface evaporation and seepage, soil and water programs, and protecting surface water supplies from pollution*

Background

Development of the country's surface water potential can contribute to meeting rapidly increasing demands for all categories of water use in the country. Surface water supplies contribute substantially to Jordan's total water resources, and despite heavy investment in the construction of storage reservoirs, there are still opportunities for further investment in surface water facilities.

Potential surface water storage capacity in Jordan is estimated at 692 MCM per year. Because of the aridity in the eastern, southeastern and southern basins, and because of other economic constraints, only about 475-505 MCM of these water storage sites can be developed economically. The main sources of surface water in Jordan are

- flood water which is estimated to be 334 MCM, but due to limited capacity and storage sites only part of which can be stored annually, and
- river base flow and spring water which is estimated at 358 MCM, to which the Yarmouk River contributes an estimated average of 165 MCM.

In 1993, surface water resources contributed 417 MCM to Jordan's water consumption, representing 43% of the total water use of 726 MCM. This quantity was distributed as follows: 385 MCM for irrigation, 25 MCM for domestic consumption and 7 MCM for industrial use.

To date, the development of surface water through the construction of storage reservoirs provides 125 MCM of storage, representing about 18% of potential storage. Short-term development projects which include the construction of the Karamah Dam and increasing the capacity of Kafrein Dam will increase the storage capacity by 61 MCM or 27% of potential storage. Medium and long-term planning and studies call for the construction of more dams to increase the storage capacity by 319 MCM, so that the total storage capacity of existing and proposed dams will increase 505 MCM, equivalent to 73% of the available surface water resources.

Problems of surface water sites include

- high capital costs due to the lack of good dam sites and the lack of good yielding catchments,
- sites are typically distant from use sites, thus limiting their economic feasibility,
- surface water storage in Jordan is subject to high evaporation losses, controlling evaporation would improve economic return, and
- reservoirs are subject to pollution.

Importance of the Issue

Jordan's per capita share of water has dropped due to a growing population, the expansion of economic activities, and rapid urbanization. In order to meet the increased demand, Jordan has had to pump groundwater aquifers in excess of their safe yield, divert water from irrigation to municipal and industrial purposes, and imposed water rationing. Enhancing surface water supplies is an option that the MWI to consider through the development of appropriate storage facilities including underground water storage, water harvesting, and soil and water conservation measures to reduce sedimentation in water storage facilities and improve soil and water conservation.

Current Policy Framework

Surface water issues are addressed in a series of bylaws and regulations which are based on Law No. 40 of 1952 dealing with the settlement of land and water issues.

WAJ, established under the Law No. 34 of 1983, is responsible for water resources management and for providing water supply and sewerage services throughout Jordan. The Water Authority Law No. 18 of 1988 gives WAJ the responsibility for all water resources in Jordan. It prohibits water selling by all natural and judicial bodies, from any source, before obtaining in advance the written approval of the Authority. Anyone damaging WAJ-owned structures or polluting water resources may be sentenced to imprisonment or fined.

JVA, was created under Law No. 18 in 1988. The Jordan Valley Authority Law No. 19 of 1988 gives JVA responsibility for all water resources in Jordan Rift Valley. JVA was given full authority to use and distribute water in the rift.

Traditional water rights for about 70 springs have been recognized by the government since 1952. Owners are permitted to carry out gravity irrigation, but they are not allowed to pump to higher elevations.

Policy Recommendations under Consideration

The water policy framework adopted by the MWI calls for the development of sustainable management plans for surface water systems in the Jordan Valley, conversion of open canal systems to a pressurized pipe system, giving priority to modernizing and upgrading systems, and precedence to water projects which make significant contributions to meeting rising municipal and industrial demands. The plan also encourages Jordan's pursuit of its interests in obtaining the full rights of water resources shared with other countries.

Actions Taken to Address this Issue

In 1963, the King Abdullah Canal (KAC) was constructed to provide an average flow of about 120 MCM of water from the Yarmouk River to be used for irrigation in Jordan Valley. In 1977, the King Talal Dam was constructed with a capacity of 56 MCM and was raised in the early 1980s to a capacity of 86 MCM. Wadi Arab Dam was constructed in 1986 with a capacity of 20 MCM. Some of the KAC water is pumped and stored during winter months in this dam and released again to KAC in summer. Some other small dams have been built since late 1960s with total annual capacity in the range of 20-25 MCM.

Wadi Mujeb (including Hidan) discharges around 30 MCM/year to the Dead Sea without being used. Wadi Zarqa' Ma'in with the surrounding Zara springs also discharge about 18 MCM to the Dead Sea. A feasibility study for the beneficial use of these waters is presently being carried out by a consultant.

Studies have been completed for the At-Tannour, Wadi Mujeb and Wadi Wala dams, but the projects have not been funded.

In 1993, a regional seminar on the potential of artificial recharge of groundwater was held at the University of Jordan. The application of these technologies in Jordan is still very limited.

Several small desert dams for water harvesting have been proposed and several are constructed.

Policy Gaps

The following are policy gaps relating to surface water in Jordan:

- Priority for increasing water supplies has been given to the construction of new projects, while only limited financial resources are being allocated for the maintenance or rehabilitation of existing water distribution and irrigation systems.
- There is weak enforcement of existing legislation governing the use of surface water.
- The responsibility for the management of surface water is given to different authorities, resulting in lack of clear responsibilities and duplication of work.

Constraints to Resolving the Issue

The most serious constraints to resolving the issue are as follows:

- Limited financial resources have led to the postponement of some surface water development projects.

- Jordan's efforts to impound the Yarmouk River have not been successful because of the complicated riparian issue, while Syria's construction of more than 25 dams in the Yarmouk catchment has reduced flow in the river
- Surface water sites are typically not located near potential use sites, thus limiting their economic feasibility. Surface water storage in Jordan is subject to high evaporation losses
- There is a lack of a good database and of qualified technicians to collect and analyze data

Strategy

To implement the policy, MWI will pursue the following strategy

- Establish a comprehensive monitoring and assessment program for surface water quantity, quality, and uses
- Establish an integrated development and conservation program to increase the potential of surface water development in Jordan

Action Plan

This strategy will require the following actions

- Allocate necessary funds for the construction of feasible projects which have been prepared and initiate studies required for the construction of capture and storage facilities for undeveloped surface water run-off
- Construct or complete the development of mathematical models for all surface water drainage basins to predict the hydrologic behavior under climatic change scenarios and determine impacts and implications
- Initiate feasibility studies on artificial recharge as a new method for storage of collected surface water in underground aquifers

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GROUNDWATER

Excessive abstraction of renewable groundwater resources has resulted in the deterioration of quality and the depletion of aquifers. The MWI shall

- *take legal and financial measures to control and gradually reduce groundwater withdrawals with the final objective of maintaining the safe yield of aquifers,*
- *take measures to protect groundwater from all sources of pollution, and*
- *exploit non-renewable groundwater resources as an expedient measure to meet immediate water demands*

Background

Groundwater is a major renewable and nonrenewable water resource for Jordan. The average annual groundwater recharge in Jordan is estimated at 275 MCM or roughly 20 to 25% of the total renewable water resources. Fresh groundwater is an extremely important source of drinking water because of its suitable natural, physical, and chemical qualities and due to its relative proximity to the country's main population centers. About 76% of the 1994 total domestic water consumption was met from groundwater resources. Groundwater is also the main source of irrigation in the highlands and the Badia area in eastern Jordan. Of a total volume of 727 MCM of water used for irrigation in 1994, about 47% was groundwater.

However, total groundwater production regularly exceeds recharge. In 1994, withdrawals of 533 MCM were nearly double the estimated recharge. The country's total non-renewable groundwater reserves of acceptable quality and which are economically feasible for extraction are estimated at 11-12 billion cubic meters. Many believe that mining from this reserve is a reasonable solution to partially resolve the acute water shortage problem for the time being.

Brackish groundwater resources are an additional reserve and have been identified as a potential source for desalination as well as for use in irrigating salt tolerant crops. Only a rough assessment of this source is available, but it has been estimated at 2900 billion cubic meters, mainly found in the Ram aquifer system (formerly known as D1s1 Sandstone aquifer).

Importance of the Issue

The unsustainable abstraction of groundwater and the depletion of groundwater aquifers is one of the major problems facing the water sector in Jordan. The lack of enforcement of regulations on drilling and pumping has resulted in the rapid depletion of aquifers by the private sector, increased pumping costs due to the drastic drop in water levels, and increased salinity levels. The sustainability of irrigation in the highlands and the Badia areas will be greatly endangered unless strict measures are taken to address the issue.

Current Policy Framework

Various laws, bylaws, and regulations have been issued during the last fifty years governing lands and water, water use and water rights, and the management of conventional and non-conventional water resources. The following is a summary of the most important legislation governing groundwater.

- Groundwater Monitoring Regulation No. 26, 1977. Articles 10 and 11 deal with conservation of groundwater through licensing of drilling, water extraction, and groundwater use.
- Water Authority Law No. 34, 1983, established the Water Authority. Article 3 authorized WAJ to institute legal proceedings including the ownership of movable and real estate, acquire water rights, regulation and advice on the construction of wells, and licensing of well drilling, rigs, and drillers.

- WAJ Law No 18, 1988 emphasizes that groundwater is a state-owned property

Actions Taken to Address the Issue

The following actions have been taken by the MWI to develop the groundwater resources in Jordan

- groundwater investigations in the Hammad and Sarhan areas to assess the potential and formulate strategies for possible utilization,
- a project to explore additional ground water supply from the deep B2 A7 aquifer in the Azraq area for possible exploitation,
- investigations to update the 1977 national water master plan,
- a program to determine the feasibility of artificial recharge of groundwater on a regional basis,
- the project on brackish groundwater desalination and formulation of a strategy to cover north Jordan including the Jordan valley and Amman city,
- the Wadi Araba development project to study the potential for irrigation utilizing groundwater, and
- Qa' El Disi project to assess available groundwater resources in the Ram aquifer system and to determine the feasibility of conveyance to Amman for domestic purposes

Policy Gaps

Major policy gaps include

- the absence of an integrated water policy to provide guidance on the optimum use of the resource,
- existing legislation does not include clear and logical criteria to define groundwater abstraction limits, and
- the relation between land ownership, drilling licenses and groundwater abstraction is still ambiguous

Constraints to Resolving the Issue

The most important constraints include the following

- There is a lack of serious and equitable enforcement of legislation which restricts drilling and groundwater pumping
- There are insufficient data for the quantitative assessment and modeling of aquifers
- There is inadequate attention and funding for projects to develop alternative supplies to groundwater

Strategy

To implement water policy the MWI will pursue the following

- Establishment of an integrated program to assess the availability and exploitability of all resources at rates that can be sustained over long periods of time
- Adoption of the principle of planned and controlled groundwater mining from promising, extensive aquifers as a short- and medium-term option to mitigate the acute shortage of renewable groundwater resources
- Improvement and centralization of groundwater data collection, analysis, and monitoring
- Strengthening of the enforcement of groundwater legislation and regulations
- Encouragement of the use of groundwater conjunctively with surface water in places where such joint use has the potential for increasing the available groundwater supply
- Stimulation of applied research activities including artificial recharge to increase groundwater supplies. Employment of new technologies to optimize operational and development of groundwater systems and to promote more efficient and feasible uses of groundwater

Action Plan

These strategies will require the following actions

- Conduct hydrogeologic and water quality studies of promising aquifers to expand knowledge of exploitable water reserves
- Centralize and upgrade a groundwater data bank, including water quality data
- Develop comprehensive groundwater basin management plans
- Install measurement devices on all wells, and implement a monitoring program of observation wells and water quality monitoring stations

- Restrict issuance of groundwater licenses to all but high priority uses, enforce terms of existing licenses, and terminate the operations of all unlicensed wells. Modify licenses to be in accordance with groundwater basin management plans
- Carry out mathematical modeling for regional groundwater aquifers to predict their hydrologic performance under various assumption of pumping rates and periods of time

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BRACKISH WATER RESOURCES

Brackish water and other non-conventional sources may provide additional water supplies which are urgently needed for sustainable development. The MWI shall

- *consider the development of brackish water resources based on sound technical, economic and environmental criteria,*
- *allocate brackish water resources, either desalinated or in their natural condition, to their best uses to provide additional water supply and to ensure water productivity and sustainability,*
- *place high priority on desalination of brackish water which should be used mainly for domestic water supply, and*
- *support evaluations of other non-conventional sources based on existing international experience and locally initiated research and feasibility studies*

Background

Since a severe shortage of water resources in Jordan was first widely recognized in the early 1980s, many strategies and measures have been proposed to alleviate and overcome it. These have included supply augmentation measures involving the construction of various hydraulic structures and the development of groundwater. However, no single action can remedy the nation's water shortage. Rather, an integrated approach is needed to ensure water availability, suitability, and sustainability. Within this approach, the development of brackish water was identified as a potential source of supply augmentation.

It is estimated that in the year 2000 the per capita water allocation in Jordan will be about 240 cubic meters per year. This is less than half the international standard "water poverty line" of 500 cubic meter per capita per year. According to a World Bank projection, Jordan will have only 91 cubic meter per capita in the year 2020. This sobering projection can only be reversed by augmenting supply through developing new sources of water, including non-conventional sources. Sources of non-conventional water include

- desalination of brackish and salty water
- Development of non-renewable groundwater resources
- rainfall augmentation through cloud-seeding
- dew and fog harvesting
- iceberg exploitation
- solar distillation
- treatment and reuse of wastewater

Often than most promising wastewater reuse, the non-conventional source is brackish water. Brackish water can be used after desalination or directly in irrigated agriculture where it can be mixed with fresh water to achieve specified salinity levels appropriate for certain crops. Industries like the potash industry can effectively utilize brackish water. Other non-conventional sources, since they are not considered high priority areas at this time, are not treated further in this profile. The treatment and reuse of wastewater is dealt with in a separate profile.

Resource Evaluation

The potential amount of brackish water that can potentially be developed in Jordan is substantial. However, when referring to statistics about brackish water, the quality, quantity and location of this resource should be carefully studied in order to assess its potential for utilization.

The Japanese International Cooperation Agency (JICA) conducted an evaluation of the brackish ground water resources potential and quality in the central and southern parts of the Jordan Valley (1995). This study indicated that about 50 MCM of brackish water, of

salt content of 5,000 to 12,000 PPM, could be utilized annually from the area between Dair Allah in the north and Sweimeh in the south

Another study, which evaluated the water resources of Zarqa-Main and Zarah, showed that it is possible to extract about 40 MCM per year from brackish groundwater (2000 to 3000 PPM) in the project area. This area lies on the east coast of the Dead Sea and extends from Sweimeh in the north to Wadi Moujib in the South. It can provide a source of fresh water through desalination to meet the needs of the planned touristic development to be established in this area.

In recent studies by UNDP and PRIDE, it was reported that hydrogeological knowledge on reliable estimates of brackish ground water resources in Jordan is "poor". However, the following is a summary of available estimates of brackish water resources by basin:

- In the Disi sandstone, it is reported that about 27000 MCM of brackish ground water is available which is distributed in the Jordan River, Azraq, Jafr, Hammad, Dead Sea and Sirhan basins. The depth of water in the Sirhan area is about 2000 meters from the surface.
- The volume of brackish water stored in the Kurnub sandstones is reported as 75000 MCM in Azraq, Hammad, Dead Sea, Sirhan, and Jafer basins distributed as 16990, 12550, 26440, 12620 and 6400 MCM respectively.

Most of the Kurnub sandstone in the Dead Sea basin is outcropping and its water discharges directly to the local wadis, yet this water was counted in the discharge of brackish springs. The depth of ground water in Hammad and Sarhan basin in the Kurnub sandstone is about 1000 meters, while in Jafer basin the thickness of the sand stone unit is around 50 meters only.

In light of the questionable quality of the above estimates, it is recommended that an assessment of brackish water resources in terms of quantity, quality, and location for all basins be carried out.

Desalination Technology

Desalination technology has been developed to a point which can provide a reliable source of water at reasonable cost. The desalination option may prove to be cheaper than building new dams and pipelines to provide water to urban centers although negative environmental impacts associated with brine disposal need to be considered. Desalination costs are expected to continue to decrease and become more attractive compared to most other options. Desalting sea water using either distillation, multi-stage-flash method (MSF), or reverse osmosis (RO) can be from three to as much as seven times more expensive than desalting brackish water using RO or ED (electrical dialyses).

Distillation costs are high regardless of feed water quality due to the large amount of energy required to vaporize water. RO and ED costs are sensitive to feed water salinity and quality. ED tends to be more economical than RO at salinity less than 3000 PPM, and less economical than RO at salinities greater than 5000 PPM.

For desalting sea water, MSF used to be less expensive than RO in 1970s. By the early 1980s the costs of desalination sea water using RO or MSF (for plants larger than 20,000 m³/day) had become nearly the same, about US\$ 1.0 to US\$1.5 per cubic meter for very large sea water desalination plants (100,000 m³/day). A unit water cost of US\$ 0.70 - 0.80/m³ is achievable based on world prices for energy and capital. The unit cost for desalting low salinity brackish water in large plants is US\$ 0.25 to 0.40 / m³ using 1992 prices. It should be born in mind that the cost of water desalination depends on plant type and size, feed water salinity and quality, energy costs, plant location, operating skills and many other location and time specific factors.

RO of sea water is becoming increasingly more reliable and cost competitive. RO & ED are well developed and have been in commercial use for two to three decades for desalting low salinity brackish water.

Future development of desalination technology is expected to make more use of hybrid processes, especially innovative combinations of chemical, physical and electro-chemical processes. However, no major breakthroughs are expected in the foreseeable future. Attached to this profile in Annex A which contains data on the approximate cost of water from conventional and non-conventional sources. From this data it could be noted that the cost of desalination of brackish water can be competitive, in some cases, with developing conventional sources of water.

Besides the Ministry of Water and Irrigation, many agencies will need to be involved in brackish water development and utilization. These include the Ministry of Agriculture, Ministry of Municipal Affairs and Environment, Ministry of Health, Ministry of Industry, Ministry of Tourism, the Higher Council for Science and Technology, the Royal Scientific Society, private sector, consumers and NGOs.

Importance of the Issue

Besides wastewater reuse, brackish water, either by direct use or by desalination, appears to offer the highest potential non-conventional means of augmenting the country's water resources. Several brackish springs have been identified in various parts of the country. Tentative estimates of stored volumes of brackish groundwater for the major aquifers suggest immense resources, but not all of these quantities will be feasible for utilization.

Current Policy Framework

The Treaty of Peace, signed on 26 November 1994, states that

- "Jordan is entitled to an annual quantity of (10) MCM of desalinated water from the desalination of about (20) MCM of saline springs now diverted to the Jordan River "

Actions Taken to Address the Issue

Presently there are a few, very small desalination plants which are used for industrial purposes using RO and ED technology. These include the Jordan Electricity Authority, Oil Refinery, Pepsi Cola, Hussein Thermal Power Station and Potash Company. The MWI has initiated studies to evaluate the feasibility of water desalination in the country. These studies included evaluation of sea water desalination at Aqaba, while others, as discussed above, have focused on the desalination of brackish groundwater.

WAJ together with a consulting firm completed in 1991 a preliminary assessment of the brackish groundwater resources in Jordan.

The JICA study which was conducted in cooperation with the MWI formulated a brackish groundwater resource development strategy for the Northern part of Jordan including the Jordan Valley and Amman. The study concluded that there is a potential of producing 60 MCM/year of desalinated brackish water in the study area. A pilot plant producing 5 MCM/year of desalinated water was proposed in Kafraïn/Hisban area.

Policy Gaps

The MWI needs to establish a policy for the desalination of saline and brackish water which is based on studies and research findings. Laws and regulations for the extraction, treatment, and management of brackish water for desalination need to be established. The distribution of the produced fresh water as well as the disposal of the resulting brine, without causing negative environmental hazards, needs to be considered. There is also no established policy for the development and utilization of other non-conventional sources of water.

Constraints to Resolving the Issue

Constraints to further development of brackish water and other non-conventional water sources include lack of reliable data regarding cost and economic feasibility, technology transfer, training, capital and operation and maintenance costs.

Strategy

To implement water rights policy, the MWI will pursue the following strategies

- Assess potential brackish water resources in terms of technical, economic and environmental feasibility in all groundwater basins in Jordan
- Set regulations for development of brackish water in Jordan and establish means for enforcement
- Conduct research and studies on desalination and for optimizing the use of brackish water in agriculture and industry. Associated training and educational programs are needed. The feasibility of utilizing renewable sources of energy (wind and solar) for desalination purposes should be investigated
- Encourage regional and international cooperation for the promotion of research, development, exchange of information as well as training in the field of desalination and other non-conventional sources

Action Plan

These strategies will require the following actions

- Establish a unit in the MWI to be directly responsible for the planning, development and management of brackish water and other non-conventional sources other than wastewater reuse
- Carry out planning and feasibility studies to assess potential brackish water resources by basin, and determine possible uses of brackish water
- Establish guidelines and controls for the disposal of the produced brine
- Cooperate with Jordanian, regional and international agencies to promote and explore information on new technologies
- Encourage the private sector in the local production of desalination equipment, especially RO membranes. Assist potential users of desalination technology on the selection of technology
- Develop and implement programs for the efficient conjunctive uses of fresh and brackish water particularly for agriculture and industry. Identify and prioritize industries that can utilize brackish water

- Support research and studies for the utilization of solar technology in brackish water desalination and for potential uses of brine. Review, synthesize and publish the highlights of the findings of available international research and development and make it available to policy makers and the executing agencies
- Initiate pilot projects adopted to local conditions
- Initiate a training and fellowship program for up-grading the skills of selected national staff in these fields
- Promote regional co-operation for research, development and exchange of information and experience in the field of brackish water utilization and desalination

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WASTEWATER MANAGEMENT AND REUSE

In view of the scarcity of water, treated wastewater constitutes an important additional water supply. To protect human health and the environment and to provide additional water supply that meets the approved standards for its use, the MWI shall

- ensure that appropriate wastewater collecting systems and treatment facilities are provided for all sources of wastewater, wherever feasible*
- ensure that wastewater is treated, managed, and used in an efficient and optimized manner and that treated effluent is used only after complying with established national standards*
- ensure that all treated wastewater is of such a quality that can be used for unrestricted agricultural activities*
- give due consideration to environmental issues and contamination of groundwater aquifers in the development of wastewater reuse systems, and*
- establish standards for the construction and management of septic tanks where it is not feasible to have sewerage collection systems and treatment facilities*

Background

There are two major components to issues relating to wastewater

- management of the rapidly growing volume of wastewater due to population growth and mushrooming urbanization, and
- treatment of the effluent for reuse, with related environmental concerns

Jordan's experience with wastewater collection systems dates back to the early 1970s. To protect the environment from pollution caused by septic tanks, the Government constructed the first wastewater collection system. Since then, wastewater systems have multiplied, and the MWI presently provides wastewater collection and treatment services to fourteen major populated areas. More wastewater projects are planned, some are under study and others are being constructed. It is estimated that at present about 2 million people (about 50% of the population) are served by sewerage systems and the effluent quantity is estimated at about 50 MCM per year (1994).

The amount of treated wastewater is on the increase in view of the increasing population and the social and economic development of the country. It is estimated that by the year 2020 the volume of treated wastewater will be 237 MCM/year and will reach 552 MCM/year by year 2040 (World Bank). As available freshwater resources grow increasingly limited in Jordan, treated wastewater will play an ever more important role in the sector. Some suggest that in the future much of the Jordan Valley will be irrigated by treated wastewater. Of course, the employment of wastewater on such a level is a management challenge of almost epic proportions. The use of wastewater is environmentally threatening if not properly treated or used.

The Government, as well as the public, are well aware of the problem of environmental pollution in the country. Both are concerned about the proper treatment and reuse of wastewater. However, environmental as well as social and health considerations impose constraints. In order to assure safety to wastewater users and to consumers of wastewater produced crops, expensive treatment is required, and there are restrictions on the production of certain crops.

The main interested parties which are or should be involved in wastewater management are

- the Ministry of Water and Irrigation, which is responsible for the management of water resources, including the assessment, development, collection and allocation of wastewater for treatment and reuse,
- the Ministry of Health, which is responsible for the water and wastewater from the health point of view,

- the Ministry of Agriculture which is involved in reuse,
- institutions industries, and establishments which deal with the wastewater treatment on their own,
- the Ministry of Municipal and Rural Affairs and Environment,
- the private sector which deals with the reuse of effluent waters,
- the Department of Standards and Measures, and
- NGOs such as the Jordan Environment Society

Importance of the Issue

Due to a lack of experience and weak planning, the development of this sector has faced many problems. One of these is the safe disposal of the treated effluent without causing environmental and health hazards. This was partially solved by agreements signed between the Water Authority and other public agencies to use the effluent for irrigating fodder crops, as is the case in Madaba, Aqaba, Mafraq, Kufrijeh and Ramtha. The indirect reuse of treated effluent from other wastewater treatment plants (WWTPs), as is the case with Khirbet Al-Samra (about 130,000 cubic meters/day), is used for unrestricted irrigation.

Reuse of treated effluent for irrigation provides an additional resource rich in nutrients. The renewable water resources of Jordan are estimated at 1100 MCM/year. At present, roughly 65% is used for agriculture, 30% for domestic use and 5% for industry. Reused wastewater can supplement the extremely limited supplies for irrigation and other uses.

The future allocation of municipal water will undoubtedly increase at the expense of agriculture. Irrigated agriculture, however, is the main source of agricultural production and provides a valuable contribution to the economy. Consequently, limitations on irrigated agriculture can partially be offset by proper treatment and reuse of wastewater for irrigation. By recycling the wastewater, the negative effects of water shortages mentioned above can be minimized.

Current Policy Framework

The present policy of the MWI is to treat and use wastewater mainly for irrigation. Treatment plants are to produce effluent suitable for unrestricted irrigation, and while some claim that the effluent is presently used only for certain types of irrigated crops, farmers in the Jordan Valley using treated wastewater grow the same crops as other farmers do throughout the valley. To encourage reuse schemes the MWI has made it mandatory for all new sewerage treatment plant projects to include fully designed and operable reuse systems. New legislation was enacted in 1991, on industrial effluent quality. Legislation for the treatment of wastewater was introduced in March 1994, providing standards for treated domestic wastewater. This pending legislation is currently going through the parliamentary process. These measures reflect a tightening of standards in response to continuing problems with pollution of water sources and a general desire to harness a valuable and scarce resource.

Actions Taken to Address the Issue

The MWI plans to provide sewer systems to every sizable human settlement and to treat and use the effluent mainly for irrigation. Eight new treatment plants are either under study or construction in different parts of the country. Upgrading of some plants is being implemented.

In addition to the above mentioned legislation, the MWI has included wastewater as a resource in the country's water master plan. At present, about 50 MCM/year of treated effluent is being used for irrigation. It is projected that in the year 2005 this will reach 75 MCM and 106 MCM/year by the year 2015. In 1994 about 6,300 dunums were directly irrigated by treated effluent and more than 30,000 dunums (mainly in the Jordan Valley) are indirectly irrigated with treated effluent from Kherbet Al-Samra and other sewage treatment plants in the King Talal Dam Catchment area. Some of this treated wastewater is mixed with fresh water from the Yarmouk River.

Regional workshops have been organized in cooperation with WHO, FAO and others to establish a policy related to treatment and reuse of wastewater.

Policy Gaps

The policy of wastewater management and reuse must be backed up by adequate legislation dealing with site selection, collection, treatment and distribution systems, as well as responsibilities for reuse. The legislation must define the responsibilities and scope of various government agencies. The following are existing gaps:

- The institutional set-up for wastewater is not adequate. The responsibility for developing and operating wastewater treatment facilities and reuse in irrigation projects is not clearly defined.

- There is a need to establish standards for treated effluent for different uses and in harmony with local conditions
- More trained personnel are needed at various levels
- More research work is needed to develop improved management techniques and on ways to reduce the cost of treatment processes and increase their efficiency
- There is an absence of data and documentation on the environmental impacts of wastewater treatment and reuse projects
- There is an absence of regulations which define the areas to be served by wastewater projects
- Criteria need to be established for pricing treated wastewater according to quality and type of use
- Public participation in the selection of the location of treatment plants should be encouraged
- Specifications for septic tanks need to be developed and enforced so septic tanks will not adversely affect the environment
- No regulations exist for the utilization of sewage treatment plant sludge in agriculture

Constraints to Resolving the Issue

There are numerous constraints to resolving issues of wastewater reuse. These include

- financial limitations,
- social aspects, including acceptance of the principle of treated effluent reuse for irrigation purposes and the consumption of agricultural products,
- lack of highly trained personnel in the field of wastewater treatment and effluent reuse for irrigation and other uses,
- limited coordination between concerned government agencies, and
- limited public awareness

Strategy

The implement the policy, the MWI will pursue the following strategy

- Establish a unit with well qualified staff to be responsible for the planning, design, construction and management of sewerage system projects and for the reuse of treated effluent,
- Separate the wastewater section from the water supply section because of the differing needs and functions of these two areas,
- Put in place an institutional framework able to provide for wastewater allocation, quality, and health and safety aspects of wastewater collection, treatment and reuse

Action Plan

While some of the following actions may require the establishment of a new unit, others can move forward under the present institutional structure

- Develop a wastewater master plan which will establish targets for providing wastewater collection systems and treatment facilities to unserved areas throughout the country
- Carry out research in improving treatment processes as well as improvement of reuse
- Implement a training program for up-grading the skills of the staff of the above section
- Establish detailed legislation governing the reuse of treated effluent in agriculture and for other uses
- Establish quality standards for treated effluent which should ensure that there are no hazards for public health and the environment, taking into consideration socioeconomic conditions in the country
- Establish the institutional capability for monitoring, regulating and enforcing wastewater regulations
- Launch public awareness programs on the treatment and reuse aspects of sewage effluent Encourage members of the public and concerned agencies to participate in project studies and the environmental assessment of wastewater projects
- Require industries to recycle part of their wastewater and to treat the rest to acceptable standards before it is discharged into the sewer systems or elsewhere

- Develop and carry out plans to strengthen and improve management efficiency, including improving the performance of wastewater collection and treatment facilities
- Specialists from the concerned departments should develop regulations for septic tank construction
- Rules and laws related to wastewater should be unified in the different government agencies
- Wastewater should be included as a surface water source in the water master plan studies and elsewhere
- Ensure that effluent quality conforms to water quality standards for use in irrigation

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REGIONAL AND SHARED WATER RESOURCES

Considering the importance of water resources to the nation's economy, water's unique nature, the political dimension of regional and shared water resources, and the need to reach and adhere to bilateral and multilateral water agreements, the MWI shall

- *pursue efforts for establishing Jordan's rights in shared water resources through international agreements,*
- *cooperate and coordinate with neighboring countries for the optimal and sustainable use and management of the shared water resources, and*
- *cooperate and coordinate with other countries for additional water supplies*

Background

Most of the world's major river basins are shared by two or more riparian countries. All of Jordan's surface water is shared with other countries. Agreements exist, but differences regularly arise. Groundwater aquifers are also shared, sometimes involving huge quantities of primarily nonrenewable ground-water, but agreements dealing with sharing of these resources have not been reached. Sharing most of the surface and groundwater and the lack of agreements on their allocation have been important reasons for the instability and tension in the area.

Surface Water

Riparians on the Jordan and Yarmouk Rivers, in addition to Jordan, include Syria, Lebanon, Israel, and Palestine. The allocation of water among them has consistently been a complex process. Agreements exist between Jordan and Israel, on one hand, and Syria on the other, but there are frequent problems over allocation and use. In the mid 1980s, Syria constructed a series of small dams on the headwaters of the Yarmouk River on Syrian territory. By the end of 1994, 27 of those dams had been built with a total reservoir storage capacity of about 250 MCM. It is expected that by the year 2010 additional reservoirs will have been built to increase that storage capacity to 366 MCM. Details on the use of water from these storage facilities is not known. Abstractions from the Yarmouk River are of concern to Jordan, a downstream riparian, because many of its population centers are in the Yarmouk basin.

In addition to the Jordan and Yarmouk Rivers, Jordan shares the following surface water basins

- With Syria surface water resources of the Wadi Hammad, Amman-Zarqa, and Azraq basins
- With Iraq the surface water generated in the Hammad basin
- With Saudi Arabia the Hammad, Sirhan, Jafr, Southern Desert, and Azraq basins

In none of these basins the surface water is utilized to a significant extent since there are only rare flood events. There do not appear to be any plans to develop the limited runoff in these regions.

The Jordan River constitutes the boundary with Israel and Palestine, and serves as an important shared resource and as a means of disposing of drainage water. The northern part of the Jordan Valley basin, the southern part of the Dead Sea basin and the Wadi Araba basin are shared with Israel. The southern part of the Jordan Valley basin and the Northern part of the Dead Sea basins are shared with Palestine.

Groundwater

Groundwater aquifers are also shared, sometimes involving huge quantities of nonrenewable water, but agreements dealing with sharing of these resources have not been reached.

- The sharing of groundwater with Syria consists of two aquifers. The B2/A7 aquifer, which underlies much of the Azraq Basin extending into Syria, where the 1995 abstraction was estimated at about 50 MCM and the basalt aquifer. Both of these are overpumped and are becoming depleted. A comprehensive sharing agreement is needed to manage these limited resources.
- The shared groundwater with Iraq covers only brackish groundwater.
- Jordan shares the D1S1 with Saudi Arabia. Known in Saudi Arabia as the Saq aquifer, it is a large groundwater resource with an areal extent of 106,000 square km, 20% in Jordan and 80% in Saudi Arabia. The current abstraction is about 70 MCM/year in Jordan and about 500 MCM/year in Saudi Arabia. The water of this aquifer is of good quality, but natural recharge is probably negligible.
- The aquifers underlying the Jordan River valley serve as important resources for all nations riparian to the stream, including Palestine. The aquifers connected with the Jordan River are shared between the riparian states, and competition for groundwater resources with Israel is particularly important in the Wadi Araba area where water will be needed for the city of Aqaba and for agricultural purposes.

Importance of the Issue

Clarification of water rights with neighboring countries is essential to the development of Jordan. Augmenting surface and groundwater supplies through agreements with neighboring and regional countries should be a major thrust of government policy. Bilateral agreements with Syria and Saudi Arabia on groundwater are of highest priority.

Current Policy Framework

The development of shared water resources was until very recently not based on water agreements, but rather followed an implicit mutual understanding between the concerned parties. The prevailing national policy practiced is "the maximum practical utilization of these shared water resources." Excess demands are met through the release of water stored in the reservoirs behind King Talal, Wadi Arab, and Ziqlab dams.

The situation of shared aquifers has become serious with excessive abstractions in the north and doubts about the feasibility of agricultural development in the south. Although there are no international agreements on groundwater, past practices are being reconsidered, and Jordan is now taking unilateral actions to stop issuing new drilling licenses and is considering other measures.

Policy Recommendations under Consideration

Jordan, as a participant in the Middle East Peace Process continues to discuss and develop agreements for sharing waters in the region. However, since not all of neighboring and regional parties have participated in this process, there are limits to the expected accomplishments. Bilateral negotiations should be pursued in particular to attempt to resolve groundwater issues.

Actions undertaken to Address the Issue

The peace treaty with Israel (Annex II, Water Related Matters) created the basis for increasing Jordan's share of regional water. Jordan is now planning for the utilization of this increased supply. For long-term development, extensive studies have been undertaken covering areas of storage, transport, regional cooperation and intersectoral allocation.

Dealing with shared aquifers is a complicated issue, and international agreements regarding this issue have not been reached. Actions have been taken at the national level, including comprehensive studies and investigations of these aquifers, the evaluation of present water uses, and the termination of further expansion of abstractions.

Policy Gaps

There are major gaps in the clarification of rights to Jordan's shared water resources. These include the lack of any international agreements on shared groundwater aquifers and the lack of participation by regional parties in discussions on shared surface water resources. Further negotiations and clarification of existing agreements need to be pursued. Some of these issues can be pursued on a bilateral basis, others require negotiations with concerned regional parties.

Constraints to Resolving the Issue

The greatest constraint to resolving the issue is the full participation by neighboring and regional parties in bilateral and multilateral talks and negotiations.

Strategy

To implement the policy, the MWI will pursue the following strategies:

- Establish the basis, including procedures, documentation and data, for supporting the MWI's positions on shared water and regional water resources.

- Given the high investment costs and the complexity in allocating those costs between sharing states, the international community should be requested to explore ways to provide major sources of funding
- Assist in the development of a shared regional water data bank

Action Plan

These strategies will require the following action

- The MWI should participate in a regional water data bank
- Develop a plan that defines the methods of cooperation and coordination

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WATER PRICING, COST RECOVERY, AND SUBSIDIES

In view of the increasing marginal cost of supplying water in Jordan, the growing demand for water, the low rate of cost recovery and the high level of government subsidy, and in line with MWI policy towards private sector participation and privatization, the MWI shall

- *set water and wastewater charges at a level the average of which to cover at least the efficient cost of operation and maintenance,*
- *recover all or part of the capital costs of water infrastructure based on the economic development indicator as a function of the average share per capita of JDP*
- *set differential prices for water based on water quality (fresh water, treated wastewater, desalinated water, etc), the end users, and the social and the economic impact of prices on the various economic sectors and regions of the country, and*
- *regularly review and adjust prices in light of changes in the cost of water supply and other factors*

Background

Probably no water sector issue in any country is more politically sensitive or socially contentious than is pricing. Water is both a consumption good (domestic water) and as a production good (irrigation, industry, tourism). Consequently, a water pricing policy has direct and indirect impacts on water producers, the producers of goods and services using water as an input, and the end users. Water users, whether they are urban households, businesses, or farmers, have benefited from long periods of high government subsidies which have kept the price of water artificially low and, in the agricultural sector, virtually free.

Price policies often stem from deliberate policies to keep products low and not tax those least likely to be able to pay. However, this approach is rapidly changing as governments, Jordan included, face two unsettling realizations: that the government needs additional revenues and that low pricing has led to the squandering of a precious and limited resource. Water prices, that more closely match the real costs of the resource and the related services, addresses both concerns at once, since it brings in additional revenues and unfailingly manages demand. The Government of Jordan has already taken the first serious steps in rationalizing water prices for municipal and agricultural use through schedules just going into effect.

Importance of the Issue

Water pricing is a critical issue in Jordan for several reasons:

- There is a serious water shortage in Jordan and so a critical need exists to utilize water as efficiently as possible in every sector and manage demand carefully.
- The water sector is characterized by large financial investments and government subsidies to water organizations. The GOJ has invested heavily in water projects for irrigation, municipal and industrial purposes, as well as wastewater projects. During the last two decades these investments exceeded 420 MJD.
- The issue is certainly among the most socioeconomically and politically sensitive of any facing the Government.

Previous pricing policies set water charges well below the cost of producing water, and no capital costs were recovered. Consequently, total long-term loans to MWI amounted to 205 MJD and accrued interest to 158 MJD by the end of 1993, while revenues were estimated at 2 MJD in 1995. Future investments are in question, pending a more responsible financial situation in the water sector.

Current Policy Framework

The main laws bylaws and regulations which are currently operational are -

- Law No 19 of 1988 Jordan Valley Development,
- Law No 18 of 1988 Water Authority,
- Bylaw No 54 of 1992 Administration Organization of the Ministry of Water and Irrigation, and
- Cabinet decision on irrigation water charges in the Jordan valley effective on 1 February 1995

The Economic and Social plan 1993-97 called for certain changes in the Government's approach to water pricing, cost recovery and subsidy The plan calls for

- progressive water charges,
- incentives for farmers to grow crops with low water requirements and
- technical and financial support to small farmers using water saving irrigation technologies

Actions Taken to Address the Issue

Based on a study of the recovery of operation and maintenance (O&M) costs of irrigation water in the Jordan Valley conducted by the GTZ in 1993 a new set of water charges was established by a cabinet decision in 1994 and implemented by JVA in 1995 It raised the average water charge from 6 to 15 fils per cubic meter Even at this rate, water is a small cost for farmers According to a recent study [7], water costs to farmers in the Jordan Valley represents less than 1% of production costs, while the productivity of water per cubic meter in some applications is over JD 1 26 [8] The first figure is in dispute, since others in the Jordan Valley Authority contend that water now represents 10% or more of the total production costs A GTZ study estimated that the 15 fils average charge would cover 70% of JVA's O&M costs In any case, even charging farmers the full cost of services is unlikely to be burdensome for farmers

In the municipal sector, water charges were recently increased by Cabinet Decision No 324 effective 23 March 1996 While charges in the lowest categories were not increased, water and wastewater rates charged by WAJ increased by an average of 13 2% Above 250 cubic meters per quarter, water supply charges to consumers throughout the country were increased from 600 to 730 fils per cubic meter and for sewage collection in this category from 250 to 300 fils per cubic meter In 1994 O&M costs were 42 MJD whereas income was 29 MJD WAJ estimates

that the new rates will increase revenues by about 4 MJD further annual increases are needed WAJ is also working on imposing charges for water produced from private wells and reduction of unaccounted for water which still averages 55% for the country

Policy Gaps

The following are particular areas of water pricing where deficiencies exist between existing policy and practice and the proposed policy

- There has been an absence of or low public participation in the formulation of water pricing policies Increased charges are not accompanied by efforts to inform users of the reasons for these
- The purpose, magnitude, duration and effects of subsidies have not been analyzed Since WAJ and JVA are not run as enterprises, there are no incentives to reduce subsidies through improved efficiency, improved revenue collection, or other means
- The methodology of pricing is not well-defined or agreed upon by involved parties A standardized methodology for determining water charges needs to be developed
- The effect of pricing on the sectoral allocation of water has not been analyzed
- The effect of water quality on the value of water in various uses has not been studied
- Pricing of irrigation water does not adequately reflect the value of water to consumers and hence does not encourage conservation or efficient production of agricultural crops

Constraints to Resolving the Issue

Constraints stem mainly from inadequate institutional structures, as manifested by the absence of an active policy and planning department at MWI the lack of trained staff in the area of policy formulation, the absence of a comprehensive system of public participation and, finally, the government tendency, for political reasons, to approve expedient compromises rather than appropriate and aggressive policies

Strategy

A policy and planning unit should be established and staffed with qualified professionals to be responsible for conducting studies and analyses related to water pricing and recommending to the MWI periodic adjustments of water prices

Action Plan

The strategy will require the following actions

- Form a team of professionals to conduct a study on water pricing policy that includes scenarios for pricing, cost recovery, and subsidy. The assumptions, definition of costs, valuation of assets, the implementation method, and the economic and social impacts should be analyzed for each scenario. The objective is to facilitate the choice of the most appropriate policy scenario by policy makers
- Establish a water pricing entity at the MWI to be responsible for data gathering and analytical components of a pricing policy
- Develop a computerized model for analysis and updating necessary data
- Study alternatives for achieving financial viability for the concerned entities in the water sector
- Prepare conclusions and recommendations in open forums so that all participants in the water sector agree to the plans

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WATER CONSERVATION AND EFFICIENCY MEASURES

Water conservation and efficiency improvement play a major role in mitigating the problem of water scarcity and shall be given priority in the country's water resources development and management programs Therefore, the MWI shall

- *undertake all necessary measures (technical, economic and regulatory) leading to the establishment of comprehensive programs for water resources conservation, reduction of water losses and improvement of water use efficiency in all sectors*

Background

The increasing gap between limited water supply and increasing demand in Jordan requires careful policies and programs to conserve and manage water properly. Water conservation is a means of enhancing water availability by managing demand. Generally, it falls into two categories:

- greater efficiency of use through improved water saving technologies and management practices, and
- behavior modification of current practices through, in part, public awareness programs

In Jordan, water conservation would bring immediate and sizeable water savings. It has been estimated that if irrigation efficiency alone improved by 10%, the savings would equal the water stored in King Talal Reservoir. Financially, conservation and efficiency measures can reduce the need for expensive water supply projects to provide additional water.

Water conservation is also a supply management measure. One technique, water harvesting, makes beneficial use of otherwise wasted flood water. Another example is the use of underground storage through artificial recharge of aquifers, which can significantly improve storage efficiency.

The stakeholders involved in this issue include the entire population and agencies such as

- Ministry of Water and Irrigation, JVA, and WAJ for carrying out conservation programs, putting regulations to water conservation, and coordinating activities,
- Ministry of Agriculture to provide irrigation extension services and information on water management,
- research institutions to conduct water management studies, including conservation and efficiency improvement,
- educational institutions to teach water conservation to school children,
- NGOs to carry out public awareness programs and organize workshops on water conservation,
- farmers to adopt irrigation practices and apply new irrigation systems that reduce losses of water and optimize its use,
- households to practice conservation measures and conserve water use, and
- industrial and tourist sectors to use water more efficiently

Importance of the Issue

In Jordan, water losses occur through evaporation, distribution system losses, and use and application. Most of the precipitated water that falls over the country is lost through evaporation from the soil surface and ponded depressions or is lost by going to the sea without being captured. It is estimated that out of 130 MCM of annual average desert floods, only 30 MCM are captured for beneficial use. Most of the rest is evaporated in desert depressions. There is potential for conserving this water by artificial recharge, water harvesting, and soil-water conservation measures.

As water flows into rivers or wadis, part of it is lost through seepage which may contribute to groundwater recharge, but losses in water quality and quantity may occur. Conveyance losses might also be reduced. An evaluation of the Jordan Valley irrigation systems revealed that the conveyance and distribution efficiency of the system was 80%, while water application efficiency was 60% for various crops and irrigation methods (Shatanawi 1987). In another study, the irrigation management efficiency in the central Jordan Valley for 1994-1995 ranged from 70% for open field high tech irrigation to 47% for drip irrigation in green houses to 76% for surface irrigation (ISPAN 1995). If the overall efficiency of 48% in the Jordan Valley could be improved to 60%, about 40 MCM could be saved to irrigate additional land or to improve the cropping intensity.

In the municipal sector, the unaccounted for water (UFW) in 1993 was estimated at 56%. UFW is the difference between the volume of water supplied to the municipal system and the volume billed to the users and includes water lost in leaks, illegal connections, non-functioning meters, and various unbilled uses. Although in the municipal sector water consumption reaches 93 lpcd on the average, it varies from less than 40 lpcd in rural areas to more than 400 lpcd in high level residential urban areas. Public awareness programs in Jordan have targeted urban users as a means of bringing water saving devices into widespread use and making the public more aware of Jordan's water shortage as a way of getting them to consume less.

Some Jordanian industries, such as the thermal electrical generating plant in Zarqa, conserve water by recycling cooling water. Other industries use excessive water during manufacturing. Jordanian industrial operations use 176% more water to make paper, 71% more to tan leather and 26% more to make beer and beverages than do the same industries in the United States (PRIDE 1992).

Current Policy Framework

In almost all aspects of water management, the aim is to conserve water. The laws and bylaws of MWI, WAJ, and JVA explicitly call for water conservation. For example, Law No 19/1988 gives WAJ the authority and responsibility to "regulate the use of water, prevent its waste and conserve its consumption".

A Water Policy Framework for Jordan (1994) was adapted by the Government based on the Five-year Development Plan (1993-1997). In this framework, conservation and efficiency policies were outlined as

- optimum utilization and conservation of water resources,
- raising efficiency and water saving at the user level, and
- promoting public awareness of the importance of water conservation

The Water Management Study for Jordan (PRIDE 1992) addressed water conservation issues as a means of enhancing water availability by managing both supply and demand. The report gave details of water conservation programs and listed the required steps for implementing them.

The Jordan Agricultural Sector Reviews Irrigation Agriculture (Qasem et al 1993) suggested policies and strategies to optimize development and performance of irrigated agriculture. The following policies are related to the efficient use of water for irrigation:

- maximizing the efficiency of water storage, conveyance, distribution and on-farm application,
- maximizing the economic net return of water used in irrigation, and
- the conservation of water and soil quality, and proper treatment of recycled water, especially effluent from wastewater treatment plants, to produce quality water consistent with standards used in irrigation.

The Water Sector Review (World Bank 1995) recommended a revision of water tariffs to encourage conservation. In order to raise irrigation efficiency, the review recommended:

- JVA propose and publicly discuss a policy of periodic tariff adjustments and quota revisions to promote efficiency of water use,
- support for a program to raise the efficiency of irrigation in the Jordan Valley, and
- the conversion of open irrigation channels in the Jordan Valley to closed pipes.

There are a number of recommendations for rationalization of water use, water conservation, and efficiency improvement that have been proposed based on the results of conferences, seminars, and workshops. In a study prepared for ALESCO (Shatanawi 1995), the following recommendations were extracted from these meetings:

- enhance public participation through public awareness,
- encourage the use of equipment and methods that save water,
- give highest priority to donor projects that conserve water, and
- support research and development and promote training in the field of water rationalization.

Actions Taken to Address the Issue

The issue of water conservation has been taken seriously by the Government and donor agencies to alleviate the country's water crisis. The following are the most important actions that have been carried out to resolve this issue:

- The rehabilitation of King Abdullah Canal and the conversion of the irrigation network from open canals to pressurized pipes, was implemented or supervised by JVA
- New pricing policy and tariff system for irrigation water was put under implementation in October 1995
- The Ministry of Water and Irrigation announced a new tariff system for municipal water in March 1996
- Many studies and projects, including the hydraulic study for Greater Amman, are being carried out for the rehabilitation of municipal water distribution networks
- Most of the treated wastewater is recycled and used for irrigation
- The Water Quality Improvement and Conservation Project is being implemented with the support of USAID. Two major components in this project aim at water conservation and efficiency improvement. They are the public awareness program and the irrigation management activities
- Ongoing research and training activities contribute to water conservation. These activities include an irrigation water management study in the Central Jordan Valley, a study on irrigation water requirements, and farmer training on irrigation management

Policy Gaps

Major policy gaps include the following

- There is a lack of advisory services and knowledge transfer of water management to farmers
- The management and operation of water and irrigation projects and systems are not according to design criteria
- Low charges for water in public irrigation projects do not provide incentives for farmers to conserve water. Therefore, the farmers cannot be expected to take an active role in water conservation
- The government has placed a high priority on increasing water supply through new projects, while limited financial resources have been allocated for the maintenance of existing water distribution and irrigation systems

Constraints to Resolving the Issue

The most important constraints to resolving the issues are the following

- financial resources are the most limiting factor because, for example, the rehabilitation of the Amman water distribution network will cost approximately \$300 million,
- hesitancy and difficulty faced in modifying existing laws to support water conservation,
- political and social impacts as a result of enforcing pricing structures, and
- time required to upgrade the system and to improve the skills of people working in the water sector

Strategy

To implement water rights policy, the MWI will pursue the following strategy

- Adopt a long term program for capturing, developing and utilizing all technically, economically and environmentally feasible water resources
- Establish programs to improve the municipal and industrial distribution systems and to reduce losses
- Establish programs to raise irrigation efficiencies and increase water charges considering water availability, land use, and equity

- Establish programs for water quality improvement to insure pollution prevention and water conservation
- Initiate a national soil and water conservation program
- Enforce and update legislation concerning rational use of water and groundwater abstraction and use in the high land areas
- Adopt a program for periodic water tariff adjustments to encourage rational water use
- Enhance public awareness entity to encourage the use of water saving devices and transfer them to users

Action Plan

These strategies will require the following actions

- Study the potential for using flood and surplus waters for artificial recharge and water harvesting
- Review the possibilities of allocating low quality water for industrial purposes and encourage recycling of water as long as it is feasible
- Conduct surveys to determine types of losses in the water distribution network
- Improve the management and operation skills of managers and technical employees in the municipal sector
- Improve information provided to farmers through extension services
- Provide support to research institutions to enhance their activities related to the determination of crop water requirements, irrigation water management, and optimum water use
- Refer to action plans under pollution prevention and wastewater management and reuse policy profile
- Prepare soil and water conservation and water harvesting projects for different river or wadi basins
- Review relevant laws and regulations in order to promote water conservation
- Refer to action plans under water pricing profile related to the establishment of pricing structure
- Refer to action plans under public awareness policy profile

- Take necessary action to support the Ministry and concerned agencies to implement public awareness programs

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INTERSECTORAL WATER ALLOCATION

*The MWI has the responsibility to allocate water among different uses and users
The MWI shall*

- *place first priority in new water resources allocation on meeting the reasonable needs of the population for domestic consumption,*
- *allocate available water resources to other sectors on the basis of the following criteria existing water rights, socioeconomic development, social security, economic productivity, employment generation and environmental issues*
- *periodically review intersectoral allocation to ensure that it is appropriate*

Background

The central policy issue in the water sector of any country is the allocation of the resource to meet different subsectoral demands. In water short countries like Jordan, in which the combined water demands of all sectors exceed the available renewable resources, the issue takes on special significance. The distribution of water to municipalities, agriculture, industry, or tourism often is at the expense of water sorely need by other sectors. The determination of water allocation policies, therefore, is closely linked with national priorities concerning the direction of the country and must be set at the highest levels of Government.

An intersectoral water allocation policy framework must address the following questions:

- Which water management objectives should the MWI pursue to maximize the overall economic benefits to the nation?
- On the basis of which criteria should the rights to use water be allocated, in terms of quantity and quality, to users in the various sub-sectors?
- Which procedures should the MWI to manage and allocate the water resources of the Kingdom?
- Which institutions should be responsible for intersectoral water allocation and for the administration of water rights?
- What importance should be given to constraints imposed by public health requirements and by socioeconomic, financial, and environmental sustainability?

Importance of the Issue

Perhaps no other policy issue in Jordan is more important than intersectoral water allocation. Due to the limited water resources, decisions relating to the allocation of water affect both the public welfare and the country's growth. With the highest priority placed on domestic use, the agricultural and industrial subsectors may be restricted as a matter of policy.

Current Policy Framework

The Water Authority Law

The law establishing WAJ bears directly on intersectoral water allocation as follows:

- All water resources available within the boundaries of the Kingdom, whether they are surface (waters) or groundwaters, regional waters, rivers or internal

seas, are considered to be State owned property and shall not be used or transported except in compliance with this Law

- (WAJ) shall regulate the construction of wells, and license well drilling rigs and drillers
- (WAJ) shall issue permits to engineers to perform public works
- (WAJ) shall regulate the use of water, prevent its waste, and conserve its consumption

Given that water throughout the Kingdom is clearly state owned, it would seem from the above that WAJ's authority is largely restricted to development and regulation, but its control over the issuance of permits for constructing wells appears to give it decision-making over allocations, on a location-specific basis

The Jordan Valley Development Law

The law establishing JVA bears directly on intersectoral water allocation as follows

- JVA shall carry out works related to the settlement of disputes arising from the use of water resources
- The waters acquired by means of projects constructed by JVA, which were not used for irrigation purposes prior to the declaration of a water settlement, in accordance with the land and water settlement law in effect, shall be considered Government property. Such waters may be sold, leased, or otherwise disposed of in the way as may be decided by JVA
- JVA shall have full authority in the allocations or usage of all surface waters or groundwaters, which are developed by authority of JVA
- When JVA constructs an irrigation project, it shall first consider the rights to water registered in the Water Register, and any excess water shall be considered Government property

Although specific allocations are not made to JVA, clearly it has discretionary authority over sources it has developed itself, unlike WAJ

MWI Enabling Legislation

The bylaw establishing MWI bears directly on intersectoral water allocation as follows

- The Ministry shall set forth a water policy and submit it to the Cabinet of Ministers for approval

- The (Ministry's) Directorate shall undertake policy and strategy formulation, assist in formulation of water policy, formulate and evaluate water strategies and prepare plans for water resources development

The Ministry's primary activity is in the area of policy development rather than allocations

The Economic and Social Development Plan 1993-1997

The following excerpts from the current five-year plan refer to actions related to intersectoral water allocation that the Government is expected to be undertaking. The plan was published and is generally accepted as reflecting Government policy for the indicated period

- The Government shall channel available quantities of water towards the best possible uses, taking into account the opportunity cost of water
- The Government shall restructure the public sector institutions in the field of water use
- The Government shall adopt a tariff system that reflects real production costs and that takes into consideration different consumption patterns
- The Government shall develop a program for groundwater utilization that will ensure its non-depletion

The five-year plan contains important and widely agreed upon guidelines but few specifics for an actual direction

Actions Taken to Address the Issue

No formal policies have yet been instituted to formalize allocation of water from one sector to another. Rather, the Government has made decisions on an ad hoc basis to reallocate water to what may be interpreted as higher valued uses. Among these are decisions to reallocate water from irrigation (Jordan Valley) or environmental uses (Azraq) to domestic purposes. See Annex A for a discussion of the Water Policy Framework for Jordan, which includes sections which address intersectoral water issues

Policy Gaps

The Policy Framework

A deficiency in the area of water management policies is that there is no comprehensive framework of policies that guide the operations in the various subsectors of the water sector. The existing water policy framework is a compendium

of policies and statements of intent, scattered over many other sectors and originating from various authorities and decision makers

The Institutional Framework Separating Functions

There is an absence of a clear separation between policy and planning functions and water and wastewater operations in the Government. In practice, this means interference with the market forces of a free economy, which if sufficiently efficient and self-regulating, will ensure that water will be used to the maximum economic benefit of all. However, realistically, pure market principles do not operate freely anywhere in the world. Political and socioeconomic constraints are always a part of the decision-making process.

Although the 5-year plan spells out that "the Government shall restructure the public sector institutions in the field of water use" restructuring is still at an incipient stage. Consequently, confusion remains about the roles that the existing institutions play and about their power and willingness to implement the objectives spelled out in either the plan or other policy documents.

The Legal Framework Water Rights

There is confusion about the authority for the intersectoral allocation of water by issuing water rights. In addition, there still exists in Jordan a significant body of customary water rights, which are not part of the existing water legislation. Some aspects are illustrated below.

- Law 18, 1988 entitles WAJ "to acquire water rights by purchase or acquisition," but it is silent on the power to create such water rights, for instance by issuing water use permits. Reportedly, the well construction permits issued by WAJ have also been used to control the purpose and the quantity of the abstracted groundwater, thus making WAJ a de facto issuer of water rights. At the same time WAJ represents the domestic water users, placing it in the awkward position of being both the issuer and receiver of water rights for groundwater.
- It is not clear who has the authority to issue water use permits, and thus create water rights, in Jordan. It is also not clear whether the power of WAJ to "regulate the use of water" means that it has the authority to implement intersectoral allocation, although it is closely associated with the municipal sub-sector.
- Law 19, 1988 states that JVA may acquire water by means of projects, but the law is silent on the exact mechanism of acquisition, or on whether such acquisition constitutes a water right. Sub-issues requiring clarification include whether farmers in the Jordan Valley have any water rights, if purchasing water from JVA implies rights, whether allocations, and if sales are mutually exclusive.

Constraints to Resolving the Issue

There are no specific constraints on resolving or clarifying the issue of intersectoral water allocation, other than the fact that due to the general situation of water scarcity in Jordan, water is a very political issue and any action to clarify the Government's position on intersectoral allocation would likely be quite politically sensitive

Strategy

To implement the policy, the MWI will pursue the following strategies

- Intersectoral allocation should be embedded in a clear and comprehensive guidelines, that will eliminate confusion
- The Water Council will establish, implement, and evaluate an intersectoral water allocation program

Action Plan

These strategies will require the following actions

- Develop data, information, and standards for the reasonable water needs of each economic activity
- Introduce abstraction penalties for groundwater as compensation for depletion or deterioration of the resource. The penalties should be related to the quantity of water abstracted and be the same for all users without discrimination or preferences
- An entity should be assigned to establish and manage a centralized water data bank, with the understanding that both governmental and private entities, with recognized responsibilities should have free access to the data
- The MWI should enforce the terms of all existing licenses and permits and shall enforce the provisions of the legislation in effect
- At times of scarcity and draught season the MWI should ration the available water resources in harmony with its allocation policies

Annex A

Main Points of the Water Policy Framework for Jordan

In late 1994 the Government entered into negotiations with the World Bank for the purpose of securing a loan for an agricultural sector adjustment. As part of these negotiations the Government accepted a 9-page statement, entitled, Water Policy Framework for Jordan, which spelled out policies related to intersectoral water allocation. Although the statement was not published as a cabinet-approved decision, it is commonly accepted as reflecting Government policy as of late 1994, particularly since it was reportedly based on the principles enunciated in the current five-year plan. The following phrases were excerpted from that statement:

- Consistent with public ownership, the allocation and use of water will be determined to promote the public good in accordance with the objectives of national policy.
- The system of water rights will acknowledge traditional and existing rights, provide for clear rules governing appropriation, expropriation, and reallocation of allocated rights, and allow for transferability subject to meeting the objectives of the national policy.
- First priority in the allocation of the nation's water resources will be given to meeting the reasonable needs of the population for domestic consumption. Second priority will be given to industry, tourism and other service sectors, subject to the enforcement of effective management plans by the public and private entities concerned. Third priority will be given to agriculture. Strict controls will be placed on use in all other sectors consistent with an approved environmental management plan.
- The Government seeks to implement an appropriate recommendation and restructuring program subject to the outcome of a comprehensive institutional study and the process to which it gives rise.
- The Government recognizes a distinction between the management of the national resource and delivery of water services, and the desirability of separating the regulatory functions associated with the former from the operational functions associated with the latter.
- With respect to the management of the resource Government will retain full responsibility, adopting approaches to management and regulation that recognize the unitary nature of the resource, the pervasive existence of externalities and the close interaction of quantity and quality issues.
- The Government will centralize water resources data collection and processing, within the framework of proposed institutional reform.

- The Government will in the short term restrict (the) issue of groundwater licenses to high-priority industrial, tourism, and university projects, enforce the terms of all existing licenses, and terminate the operations of all unlicensed wells
- The Government will in the longer-term modify licenses to ensure that overall pumping amounts are consistent with approved groundwater basin management plans
- The Government will refine the real-time management of surface water resources with a view to implementing its allocation policies in an efficient manner, while recognizing the rights of existing users through a systematic rationing system
- The Government will implement allocation policies in a nondiscriminatory way, in particular by issuing no further permits for crops that use large volumes of high quality water
- The Government will strengthen and maintain the groundwater basin management unas the primary groundwater regulation, management, and control bodies
- The Government will prepare systematic basin management plans for each groundwater basin, establishing allowable pumping limits to ensure sustainable yield
- The Government will levy a resource charge on private industrial wells and thereafter introduce a similar charge on private agricultural wells
- The Government will regulate private water deliveries in urban areas consistent with resource management objectives and regulation of the quality of water used for drinking and domestic uses
- The Government will encourage cropping patterns that provide a high return to water, or which can make use of brackish water and/or treated wastewater, taking into account other constraints (soils, input costs, marketing etc)

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National Water Master Plan (in progress) Annex H GTZ and MWI

WATER DISTRIBUTION

Efficient water distribution systems are vital to conserve water, provide better services to consumers, and reduce water costs. The MWI shall

- *improve the efficiency of water distribution through improved planning and strengthened technical, managerial, and financial capability of concerned institutions, and*
- *endeavour to meet water demands in the most effective and efficient manner, focusing on proper planning, improving operation and maintenance, private sector participation, whenever possible*

Background

Policy issues related to water distribution have to do primarily with questions of efficiency and investment. Water distribution systems are the conveyance networks or water lifeline of the country. The general objective of any water distribution system is to distribute water to consumers in adequate quantity and quality and at the required time to meet the demand in the most efficient manner. National efforts are required in Jordan to improve existing systems and expand them to cover areas not being served and to improve technical and managerial capabilities.

Specific improvements in Jordan's water distribution systems include

- removing inadequacies in the various components of existing systems, such as operational problems, metering problems, supply interruptions, under design of pipes, high operation pressures, and absence of pressure zones,
- optimizing the operation and maintenance of the existing distribution systems and reservoirs and rehabilitating old and damaged components,
- ensuring proper, safe, and high standards and specifications for pipe and other materials and for construction and operation and maintenance practices,
- updating and redesigning certain components as needed to cope with increasing water demand, and
- ensuring adequate supplies to areas and populations not served by piped water

In Jordan, as elsewhere, systems for domestic and agricultural use are separated, the systems exhibit different problems and require independent attention. Major problems with the municipal water supply sector include

- the lack of coordinated planning for rural and urban areas,
- heavy and unplanned for concentrations of population and industrial and commercial activities in urban areas,
- widely scattered populations within and outside planned residential areas,
- underdesign of the systems with inadequate consideration future water demands,
- the aging of networks, particularly in major cities,
- use of improper pipe material and layout practices,
- inadequate maintenance, and
- a lack of updated plans for the distribution networks in the major cities

These problems have led to a high level of unaccounted for water and leakage losses. The issue of systems losses is contentious in Jordan. Some argue that significant levels of water can be saved if the leaks are addressed and stopped. Others contend that the estimates are exaggerated and savings will be minimal.

In the agricultural subsector, the main problems in the public irrigation water distribution network, which is mainly in the Jordan Valley, are as follows:

- expansion of irrigable areas beyond the conveyance capacities of the existing distribution networks,
- design parameters for pipes based on the assumption farmers would use sprinkler systems which has not occurred,
- lack of enforcement of laws and regulations to stop illegal water abstractions, leading to inequitable water distribution that has disrupted system operation,
- pumping and conveyance overloading in certain areas while other areas experience water shortages resulting in low conveyance and irrigation efficiencies, and
- network overloading making it impossible to operate filtration units, resulting in the abandonment of water saving sprinkler and drip irrigation systems by many farmers.

In view of the above problems the irrigation system in the Jordan Valley has not operated as designed, sacrificing efficiency and causing economic loss. Additionally the system has not been operated on a 24-hr basis as it should be to accommodate modern irrigation methods.

Importance of the Issue

Investments in networks are inadequate. Although the level of services in the water supply sector in Jordan is fairly high, with service to 97% of the population in the urban areas and 83% in the rural areas, distribution systems are still far from optimal and efficiencies are still low. The unaccounted for water in the municipal networks was estimated to be 55% in 1995.

In the Jordan Valley the overall irrigation efficiency of 57% in 1994 was raised to 68% in 1995 after significant improvements. In addition, and because of operational problems and water shortages, about 16% of the total developed agricultural area is not regularly supplied with irrigation water.

Current Policy Framework

There is no well established policy for water distribution in Jordan. Although the Water Authority of Jordan mandate is to provide safe piped water for every house within the existing and planned urban area, there is no policy for water supply in unplanned areas.

In the Jordan Valley irrigation sector, water distribution is based on requests by farmers which are related to the crop and area planted. Water shortages are shared by farmers, and water quality is not assured. Buying or trading for additional water is officially illegal but commonly done.

The Jordan Valley Authority's mandate is to develop the largest possible area of irrigable land for the amount of water available, to develop water resources and water distribution networks, and to equitably distribute irrigation water to farmers. A recent policy statement by the MOA calls for maximizing the value of production per unit of irrigation water supplied. Potentially contradictory policy guidelines need to be made consistent so that the Government's objectives are met.

Actions Taken to Address the Issue

In the municipal water supply sector, there is an increasing percentage of unaccounted-for water. The present practice in managing the distribution system is to invest in new projects and provide service to new areas. Investments in rehabilitation are not sufficient, and income from water charges have not met O&M costs. Inadequate metering and poor law enforcement are also contributing causes to poor system performance.

In the irrigation subsector, the JVA has taken actions to improve performance, such as converting from gravity to pressurized distribution system and automated operation of the system.

Policy Gaps

Insufficient efforts and investments have been made to increase the efficiency of existing systems. Inadequate attention has been paid to upgrading technical, managerial and operational staff, particularly at the governorate level.

Inadequate attention has been paid to how water distribution practices can contribute to meeting Government's objectives. If, for example, the objective is to maximize the value of agricultural production per unit of irrigation water, then distribution rules may need to be modified to encourage more efficient production. Without a clarification of objectives, however, irrigation distribution practices may continue to encourage inefficient production practices.

Collection of data through field measurements, analysis, and applying results to operations and maintenance of the water distribution system is lacking, primarily at the governorate level. The main task of the staff in these offices is to distribute water, they are not generally involved in the overall management and administration of distribution systems. The capability of these staff members needs to be upgraded through training, and they need to be given more autonomy.

Generally, there has been a lack of enforcement of laws and regulations in both municipal and irrigation water distribution. Initially, irrigation planning in the Jordan Valley did not

coordinate with the future municipal water demand. Recently, with water scarcity and rapid population growth in the valley, requirements to reallocate irrigation water to municipal use has adversely affected agriculture.

Constraints to Resolving the Issue

The following is a summary of factors which restrict improved performance of water distribution systems in Jordan:

- low investments in increasing the efficiency of existing distribution system and inadequate cost recovery,
- low water prices and diversion of revenues to the general budget,
- insufficient authority given to regional offices in comparison to their responsibilities,
- lack of high level technical and managerial staff capabilities, particularly in the area of analyzing hydraulic data on water distribution systems,
- inadequate technical equipment for monitoring and data collection,
- inadequate planning for water distribution networks,
- absence of the role of the private sector,
- insufficient investment in rehabilitation,
- limited capacity of existing networks to meet present and future demands,
- inadequate and insufficient coordination with municipalities on planning and expansion of residential areas, which results in additional costs and confusion for subsequent implementation of the distribution system, and
- competition and conflicts between municipal, industrial, and agricultural sectors

Strategy

To implement this policy, the MWI will pursue the following strategies:

- Improve system efficiency and performance by removing the inadequacies in various components of the water distribution system
- Improve water supply services

- Develop a water shortage response program for times of drought or emergency
- Increase management staff capabilities and efficiency
- Enhance financial viability and accountability to order to achieve financial autonomy, and ensure the entity's independence and sustainability

Action Plan

These strategies will require the following actions

- With regard to system efficiency and performance
 - replace old pipes,
 - reduce operating pressures,
 - improve designs and specifications of network pipes
 - improve supervision of construction of pipe networks
 - improve operation and maintenance practices, and
 - provide adequate flow control and flow control devices and instrumentation
- With regard to water supply services
 - maintain adequate water supplies with the right quality and quantity, delivered at the right time,
 - provide maximum flexibility for the system, both at the country and local levels, in the transmission and distribution networks, and in the storage facilities
 - reduce O&M costs and optimize the treatment cost of water
 - promote metering of all water supplied, and
 - consider private sector provision of services
- With regard to a water shortage response program for times of drought or emergency
 - identify, assess and develop potential backup sources, including brackish water for blending purposes,
 - plan for and improve back-up power supplies, and
 - develop plans and train staff for distribution during various drought or emergency situations
- With regard to increase management staff capabilities and efficiency
 - give high priority to staff training and development through continuous on-the-job training,
 - apply institutional reforms and remove administrative inconsistencies, and

- provide incentives and motivation to improve morale, efficiency, and dedication of the existing staff, and improve recruitment of high-caliber staff who can overcome complex distribution problems efficiently and promptly
- With regard to enhanced financial viability and accountability to order to achieve financial autonomy
 - develop new sources of funds to supplement the traditional national budgetary allocations,
 - allocate water revenues to cover costs for the improvement of water distribution systems
 - improve metering and collection of revenues

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WATER RIGHTS

Well-defined water rights and water uses represent an essential requirement for optimal water sector management the MWI shall

- *take necessary actions to ensure full enforcement of laws and bylaws concerning water and water rights and prevent illegal practices*
- *Clarify water rights related to shared water resources with neighboring countries in order to establish national water policies and plans on a sound basis*
- *Introduce modern technologies and conservation measures and any required modifications to safeguard the optimal use of the water rights*
- *Periodically review the efficient use of water for irrigation the land for which water rights were allocated*

Background

Like many other countries, Jordan faces serious water shortages and is seeking to formulate and implement policies that can resolve these problems. High costs and low returns of public sector water investments, high rates of unidentified losses of water, fragmented management of water resources as well as deteriorating water quality are factors which complicate the situation and reveal the weaknesses of water utility management including allocation procedures. Optimizing the allocation of available water among different uses to meet current and future domestic demand, in addition to the requirements of sustainable development, is a major target for policy action. Studying the potential for creating a tradable water rights system which leaves to market mechanisms certain allocation and investment decisions is part of this ongoing effort.

Water supply can be increased by improving the application efficiency of existing resources and by developing new resources, including recycled or treated water. In any case, efficiency plays a central role. Competitive markets in tradable water can increase efficiency and flexibility by inducing users to take into consideration the full opportunity cost of their water and hence to conserve and economize so the saved water can be used or sold. A farmer, for example, may sell his water right (wholly or partially) to a more efficient farmer (or bidder) in a market transaction which raises the income of both as it optimizes water productivity or water use efficiency. Large scale savings in the agricultural sector can add substantially to water available for all sectors.

Some developing countries, like Chile and Mexico, have shifted from highly centralized and regulated management systems to market-oriented economies with competitive markets in tradable water rights. Positive results have been reported from both countries (Rosegrant and Schleyer 1994). The process, begun in Chile in 1973, and in Mexico in 1990, has involved several important steps including

- redistribution of land and water under agrarian reform,
- review of legislation to support market orientation with clear definitions of land and water property rights,
- liberalization of the economy, including freeing agricultural production and marketing from central intervention,
- involvement of users associations in management and conflict resolution functions, and
- addressing various details relating to conveyance, distribution, measurement and quality protection.

Although the experiences of other countries constitute a rich source of insights and notwithstanding the theoretical support based on rationality and optimality analysis, a shift toward market allocation is a step which requires careful analysis of its costs and benefits with reference to social, economic, legal as well as physical realities that exist in each country. High

levels of competition among sectors in Jordan, associated with overall water shortages, place special responsibilities on the government to regulate any market activities in water and water rights to ensure sustainable development for all sectors and regions

For the purpose of this profile, a water right means a legal right to take and use water, normally subject to certain terms and conditions. This right is granted by the owner of water or any authorized party. Rights holders can be real or legal entities. A water market on the other hand, is an organized medium for the open and competitive exchange of water rights. Thus, tradable water rights refer to rights which have a market where they can be exchanged. Water markets could be among countries of a region, among regions and sectors within a country or among users within the same sector or region.

Several questions have to be answered in the process of studying the pertinence of this policy option to the situation in Jordan. What benefits can be expected from creating a tradable water rights market? What are the alternatives for achieving the same ends? How can tradable rights effectively and equitably be allocated among users? What is the extent and what are the limits of trading these rights? What legal and institutional frameworks are needed for making water markets a viable option?

As water users, all citizens of Jordan are stakeholders with respect to policies on water rights and markets. The parties most directly related to this policy issue, however, are the following:

- Government and semi-government agencies involved in providing water to users. These agencies are responsible for safeguarding the public interest in granting and supervising the use of water rights. The government is solely responsible for establishing and maintaining the criteria for allocating available water among and within sectors.
- The legislative, judicial, and other authorities responsible for setting and enforcing the relevant laws, rules and regulations needed for the organization and functioning of a tradable water rights system.
- Water users including households, farmers and various business groups who are directly affected by any policy decision concerning water rights. Those, and their representatives and associations as well as the general public should be encouraged to participate in policy decisions concerning this issue.

Importance of the Issue

The government has for a long time carried out the functions of developing water resources and distributing water to various domestic, agricultural, and industrial users. The government has also shouldered the responsibility of establishing sewerage and waste water treatment systems and securing the necessary investment financing.

Intensifying water shortages and associated allocation problems in addition to financial and managerial constraints, are prompting the public sector to reform its water management system and to seek less expensive, more efficient and development oriented approaches to solving the country's water problems

The need to introduce improved and well suited approaches to solving Jordan's water problems has given this policy issue a special importance

Current Policy Framework

Existing water rights in Jordan were originally established by informal agreements among farmers sharing a water resource but were later formalized by Law No 38 of 1946 named the Land and Water Settlement Law. This law required the registration of water rights pertaining to any piece of land at the Land and Survey Department in a special water register unifying water rights with the ownership of irrigable land. Early water rights are still effective in villages and areas without public sector development. Registered water rights are expressed in shares of the available resource rather than in fixed quantities.

Several laws were later promulgated to organize the water sector and related services, but the most relevant covenants to water rights are found in the Water Authority Law No 18, 1988, the Jordan Valley Authority Law No 19, 1988, and the Ministry of Water and Irrigation Bylaw No 54, 1992. In accordance with these laws and the bylaw, the Ministry of Water Irrigation, including WAJ and JVA, carries the full responsibility for all the water and sewerage systems in the country.

Except for the special status of registered water rights, all surface and ground water resources are considered state-owned property and no water sale, grant or transport is allowed by any party without prior approval by the government. In addition to its responsibilities for all aspects of water and sewerage management and use, the Ministry of Water and Irrigation is also responsible for setting a water policy that reserves the rights of the Kingdom in all its water resources, including the development, maintenance and use of these resources.

Domestic and industrial water is provided for all population centers in accordance with WAJ and JVA regulations. Some well owners sell water to private distributors who in turn sell to users and consumers. This is the only raw water market that exists in Jordan and despite its weak regulation and control it has been a helpful source in peak demand periods. The bottled water industry on the other hand is based on water rights approved by MWI but governed by business laws under the Ministry of Industry and Trade (and licensee from the Ministry of Health).

Irrigation water is provided to farmers in the Jordan Valley by the JVA in quantities and shares based on registered water rights. In cases of water shortages rationing is administered on the basis of original rights and crop requirements. Most irrigation water outside the valley comes from ground water. WAJ regulates well drilling and supervises ground water uses by well owners who have the right to irrigate their farm holdings from their wells.

The government intends to impose upper limits on abstractions made from private wells and a mechanism to enforce it is currently under consideration. The first steps in this direction include the validation of well licensing and the installation of water meters on licensed wells. Currently operating wells, as far as licensing is concerned, are of three types: old licensed wells (before 1970) without any restriction on quantity or type of application, later licensed wells with specified types of application but with or without quantity restrictions and the non-licensed but still operating wells indicating implicit official acquiescence. The agricultural sector is the main user of water in Jordan, using over 70% of total supply. Under all circumstances, irrational use of water and pollution or misuse of resources are illegal and punishable acts.

Existing legislation provides basic ownership protection for well and water right owners. Private rights are referred to in the legislation as deposition rights, utilization rights or ownership rights. The content and extent of such rights, however, are not always clearly defined.

The transfer of a water right can be made only jointly with the transfer of land ownership. Land can be either owned or trust land or government land. Owned land can be either privately owned or communal land. Any type of land may have water rights associated with it.

As is the case with land ownership, water-rights ownership can be expropriated if necessary (against compensation) in accordance with the acquisition law in effect. Several early laws and bylaws dealing with water have been overruled by more recent ones leaving in force old provisions which do not counteract the new legislation. Ambiguities and gaps, however, exist in current legislation and raise many serious questions. Examples are

- What happens if the government damages a stream or spring benefiting non-registered or registered users?
- What rights do well owners have whose wells fail due to prolonged abandonment?
- What rights do land owners have to construct small dams or pits to capture rain water flowing through their lands?
- How could a well license be terminated?
- What rights does a legitimate well owner have against another owner of a nearby well when some actions of the latter affect water quantity or quality of the first owner's well?
- How will water rights be allocated to users of recycled water?

The 1994 Water Policy Framework for Jordan, based on the principles of the National Five Year Development Plan 1993-97, has received preliminary acceptance from the Government of Jordan as a policy framework. The following statements from the report are of direct relevance to water rights and water markets

- Rights to the use of water (by all entities) will be subject to clear and stable criteria designed to encourage them to act in accordance with the objectives of national policy
- The system of water rights will acknowledge traditional and existing rights, provide for clear rules governing appropriation, expropriation and reallocation of allocated rights, and allow for transferability subject to meeting the objectives of the national policy
- The government will enforce mechanisms for restitution in accordance with the law and legislation will be reviewed and amended as necessary
- A strong and coherent framework is needed for the implementation of the proposed water management policies. Such a framework in its broadest sense comprises laws, regulatory structures, government and public institutions, and all the elements that are associated with these
- With respect to provision of water services, government policy is to decentralize responsibilities to autonomous public entities and to consider in the context of the institutional review the potential for further delegation to user groups and the private sector

The status of water rights in the Kingdom needs to be reviewed and updated. Clear and comprehensive legal coverage is necessary to specify the rights and obligations of all concerned parties (the government, the right holders and any affected third party), with respect to all water resources and in various uses.

Actions Taken to Address the Issue

No action other than the current efforts of MWI has so far been taken towards the formulation of a policy concerning water rights and water markets. Some recent studies have addressed the issue, but have led to no specific actions.

Policy Gaps

The main gap is the absence of a clear policy concerning this issue. Private rights to water from all sources and for all uses need to be clearly defined by law. Tradability cannot be contemplated in the absence of a legal framework which regulates the form and content of tradable water rights. The use of treated wastewater is a recent, but growing, development in Jordan. There is an urgent need, therefore, for regulating the applications and the rights to utilizing this new source.

Constraints to Resolving the Issues

The major constraints to establishing tradable water rights are the following

- Existing laws and regulations prohibit the sale of water by private entities as a principle, although exceptions exist, i.e., some well owners and water tankers
- The establishment of water markets requires a thorough review of water and water related laws and regulations would require some fundamental amendments. This is a lengthy process complicated by diverse and often conflicting interests
- Developing an effective water market requires a parallel reorientation of institutions, staff and physical water systems
- A market in tradable water rights can without adequate legal controls, cause sectoral imbalances and user equity problems. Non-market economic, social or political factors as well as inequities in sectoral returns to water might reduce the effectiveness of such a market
- Water quality concerns, environmental considerations and the hard to reverse nature of any policy allowing trade in water rights, mandate a cautious approach towards this policy issue

Strategy

To implement the policy, MWI will pursue the following strategy

- Clarify water rights related to shared water resources with neighboring countries in order to establish water policies and plans on a sound basis

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HEALTH AND WATER STANDARDS, ENFORCEMENT, AND MONITROING

To ensure the safety of drinking water supplies, to prevent chemical, biological and physical pollution of water resources, and to maintain efficient wastewater systems the MWI shall

- *continuously evaluate and update standards and guidelines for drinking water quality,*
- *strengthen enforcement of standards so that water supply and wastewater do not endanger public health,*
- *adopt and enforce effluent and sludge standards for municipal and industrial wastewater treatment plants and for discharge from laboratories, hospitals, slaughterhouses, and other businesses,*
- *survey and monitor all water resources for water quality, and ensure that water quality standards are consistently being met, and*
- *improve analytical services by seeking technical assistance and analytical quality guidance to water data providers and users*

Background

Water quality criteria are physical, chemical, and biological characteristics which reflect tolerances and requirements for use of the resource in various sectors. For domestic uses, they reflect human health considerations and people's intangible sense of aesthetics. When these values are incorporated into enforced standards, the result will be water that is both aesthetically pleasing and reliably safe. Water of this standard is the right of all citizens and the responsibility of the Government. However, meeting these standards can be complex and difficult.

Treated effluent from wastewater plants offers a different set of challenges. The performance of many of the plants is inadequate, resulting in an effluent of low quality. This effluent may have an adverse effect on public health due to the presence of pathogens or the accumulation of toxins in plants irrigated using effluent. Furthermore, pollution of surface and groundwater due to seepage will result in deterioration of the water quality of some water resources and will limit their use for drinking purposes.

The quality of treated effluent and the performance of the wastewater treatment plants are greatly affected by the influent water quality which may be of domestic or industrial source. Thus, adopting and enforcing standards for treated effluent and for water for other uses is essential.

Jordan, as well as many other countries, has adopted international water quality standards or guideline values developed by the World Health Organization (WHO), the United States Environmental Protection Agency (EPA), or others. This acceptance has been a simple and safe way of setting water standards policy. However, these standards are often stringent, based on "the worst case assumptions" or conditions, which may not be relevant to local conditions. To achieve a desirable water quality, it is not always necessary to adopt these standards.

When water is extremely limited, as is the case in Jordan, water standards must be carefully examined to assure that it is fully utilized. Thus, the standards adopted should consider national priorities, economics, and availability of water supplies, as well as health and other environmental implications.

Implementation of standards and their enforcement require facilities and expertise which involve significant costs. Enforcement, particularly, requires commitment and coordination from many agencies and at many levels in the government. It should be emphasized that considerations of policy and convenience must never be allowed to jeopardize public health.

In developing standards for drinking water, it is intended that when these standards are implemented, the safety of drinking water supplies is ensured. Adopting and implementing standards for treated effluent will result in minimizing health hazards, as well as other environmental risks, such as biological and chemical pollution of surface and groundwater. Adopting standards and guidelines for water used in irrigation in cooperation with the Ministry of Agriculture, increases the availability of water that can be used in irrigation. Setting standards for treated effluent according to its end use will have an economic impact and makes the

implementation of standards easier. To ensure that standards are achieved, an effective monitoring program has to be adopted. Such a program requires that analytical methodology, equipped laboratories and qualified personnel be provided.

Standards, monitoring, and enforcement of the nation's water supplies have an impact on all consumers of water. The main national institutions that are concerned with this issue are

- Ministry of Water and Irrigation which is responsible for development and implementation of standards for different uses,
- Ministry of Health which is concerned with monitoring drinking water quality, wastewater effluent, and water for special purposes,
- Ministry of Agriculture which must help to determine the use of water for irrigation and the use of agrochemicals and their potential effect on water quality,
- Ministry of Municipal Affairs which does environmental monitoring,
- Department of Standards and Measures which has a major role in developing standards,
- The private sector, including NGOs and industry representatives, which has to be committed to ensure that water quality standards are achieved for public health and environmental protection, and
- Universities and research institutes which are concerned in carrying out research and studies necessary for standards development, analytical procedures development, and training curriculum development.

Importance of the Issue

The following are specific reasons and examples which point out the importance of standards, monitoring and enforcement at the present time

- Jordan has witnessed a deterioration in its water quality in the last two decades due to industrial pollution, overuse of agrochemicals, agricultural runoff, inefficiency of wastewater treatment plants, overpumping of aquifers, seepage from landfills and septic tanks, and improper disposal of dangerous chemicals by certain industries. These have had an adverse effect on human health, exposing the population to epidemic diseases and toxic substances.
- Effluent from the Khirbet As-Samra wastewater treatment plant has resulted in the biological and chemical pollution of King Talal Dam. Fecal coliforms have exceeded the recommended standards and heavy metals, including lead, mercury, and chromium, have

been reported. This contamination could have a negative impact on health, especially since King Talal Dam water is being used for irrigation of the central Jordan Valley after being mixed with the King Abdullah Canal (Yarmouk River) waters. The hazards associated with the accumulation of heavy metals as well as organic pollutants are well established.

- Although the agronomic benefits of reusing treated wastewater in irrigation are high, due to yield increases as a result of high levels of nutrients such as nitrogen, phosphorus, and potassium, reuse involves the possible exposure of workers and consumers of agricultural products to pathogens. Wastewater effluent may contain a wide spectrum of pathogens such as *E. coli*, *Salmonella sp.*, and *Shigella sp.*, as well as intestinal nematode eggs. Many researchers have correlated the occurrence of some diseases to the use of wastewater in agriculture.
- Irrigation wastewater may contain various pollutants, including synthetic organic compounds, which are potentially hazardous to public health. Some of these compounds such as pesticides, insecticides, herbicides, phenols, and PCBs are being used on a large scale in Jordan. Reuse of irrigation wastewater may involve exposure to high risks.
- Wastewater treatment plant effluent is usually disinfected by chlorination. In the presence of organic substances, such as phenols, chlorination results in the formation of chlorophenols, among other substances, which are the precursors for dioxins which are known to be carcinogenic.
- Seepage from septic tanks to groundwater has been reported in many drinking water supplies and has limited their use for drinking purposes.
- Inadequate disposal of dangerous chemicals has resulted in health hazards.
- Overuse of agrochemicals and agricultural land runoff endangers the safety of some water resources.

Current Policy Framework

The current framework includes the following standards and recommendations:

- Standards for drinking water, bottled water, industrial effluent, wastewater treatment plant effluent, effluent used in irrigation, and sampling procedures have been developed and updated.
- Although MWI is the main body responsible for water quality monitoring, many agencies claim responsibility for water surveillance and its adequacy for human consumption.

- The 1991 National Environmental Strategy for Jordan made many recommendations regarding the preservation of safe water resources
- The new environmental law issued in 1995 states that the Council of the Public Establishment for Environmental Protection is responsible, in coordination with all concerned agencies, for issuing standards for water for different uses, monitoring water resources, providing facilities for this monitoring, and for enforcement of standards to industry, trade, and any other business. The law also sets penalties for violators

Policy Gaps

Policy gaps include the following

- The relationship between MWI and the Ministry of Health is not well-defined, and roles need to be clarified
- There are no guidelines for developing standards. For each contaminant, guidance should be provided that includes information on environmental chemistry, fate, toxicity of the principal chemical form, transformation among forms and bioaccumulation. Standards for drinking water do not take into account viruses and some organic substances which are potential hazards to health. Also, values for some organic substances are specified haphazardly without any reasoning why these substances are considered and others are neglected
- No clear monitoring and enforcement programs have ever been adopted in the water sector
- There are no specifications for septic tanks and land fills to minimize seepage into groundwater
- Medical laboratories, chemical labs, fuel stations, hospitals, slaughterhouses are not identified as sources of pollution by the Government
- There are no standards for the disposal of dangerous chemicals
- No standards exist for special uses of water, such as medical uses, food industries, and recreation
- In determining the most critical organic pollutants to be specified in the adapted standards, the agrochemicals usually used in Jordan have to be considered
- Many chemical substances which result from water chlorination are not specified in the standards

- Standards for irrigation water and marginal water use and specification of the types of crops that can be irrigated using water of different qualities should be developed and adopted cooperatively by MWI and the Ministry of Agriculture
- Standards for sampling procedures consider sampling techniques and sample preservation but do not consider requirements for personnel who collect the samples
- Analytical methods, as well as a proper quality control/quality assurance programs, are not adequately provided. Although the central WAJ laboratories have already participated in comparison quality control tests with some international agencies, this issue has to be stressed and implemented in all laboratories dealing with water quality monitoring

Actions Taken to Resolve the Issue

Reevaluation and updating of standards for different purposes have resulted in

- an updated version of standards for drinking water,
- standards for treated effluent for different uses has been adopted in 1994 and reevaluated in 1995,
- establishment by the Ministry of Water and Irrigation of two water quality laboratories, one in the north and the other in the south, in addition to the existing Amman central lab,
- legislation to implement the standards now in process,
- sludge specifications are now being considered,
- upgrading wastewater treatment plants, and
- consideration of construction of environmentally safe landfills
- Legislation has been passed to enforce the standards in the form of the new environmental law, Law of Environmental Protection, No 12 of 1995

Constraints to Resolving the Issue

Major constraints include the following

- Many institutions claim direct or indirect responsibility for monitoring water and wastewater quality, so responsibilities are not clear

- There is a lack of coordination between the different authorities resulting in overlap and dilution of responsibility, inefficiency, and duplication
- Laws and legislative procedures are required to implement the standards
- Expertise capable of suggesting and implementing efficient monitoring programs is needed
- Adequate funding and support from high authorities is needed for effective monitoring and enforcement programs
- There is a lack of public awareness concerning different sources of water pollution

Strategy

To implement the policy, the MWI will pursue the following strategy

- Establish an entity in the MWI responsible for water standards for all uses. The responsibilities of such a department would be to
 - develop and evaluate standards of water for different uses,
 - evaluate standards for industrial effluent and treated effluent from wastewater treatment plants,
 - adopt and implement standards for treated effluent according to its end use,
 - direct research in the area of wastewater reuse and industrial wastewater treatment,
 - coordinate with other concerned institutions for establishing monitoring and enforcement programs to ensure that water quality standards are consistently being met,
 - to prevent pollution at the source, help industries in treating their effluent and encourage water recycling
 - evaluation of environmental impact assessments for newly established industries and wastewater treatment plants wastewater reuse in agriculture, and
- Identify a national body responsible for laboratory accreditation, quality assurance/quality control programs in the water and environmental laboratories in the country, and provide technical assistance to ensure the highest quality analytical services

- Upgrade wastewater treatment plants to prevent health hazards
- Contact all industries that violate the standards of industrial effluent and provide technical assistance to help them establish adequate practices to treat their wastewater

Action Plan

The strategy will require the following actions

- Hold workshops for all concerned institutions to discuss how, where, and who is going to be involved in the proposed Department of Standards
- Take necessary actions to immediately adopt quality assurance/quality control programs in laboratories working in the water and environmental sectors
- Carry out research on the impact of reusing treated wastewater in agriculture and on new approaches for treating industrial wastewater

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WATER POLLUTION PREVENTION AND CONTROL

Water in Jordan is subject to pollution caused by uncontrolled groundwater abstraction, improper management of municipal wastewater, increased industrial, agricultural, and other services. In order to protect water quality and the environment the MWI shall

- *undertake necessary measures to prevent and control water pollution through enforcing legislation, public awareness and incentives, and*
- *seek bilateral and regional cooperation in pollution monitoring and control when appropriate*

Background

The accelerating deterioration of water quality in Jordan is a major issue of increasing concern. Therefore, in addition to efforts directed to issues related to increasing the available supply of water, efforts need to be intensified towards maintaining suitable quality water on a sustainable basis to meet human health, economic, and environmental needs. This profile addresses the issue of water quality in Jordan and suggests suitable policy measures for prevention and control of water pollution.

Pollution is any change that occurs to the natural, chemical or biological characteristics of water that restricts its suitability for the intended use (WAJ Law No 18 of 1988). Water pollution prevention (WPP) is the use of materials, processes, or practices that reduce or eliminate the creation of pollutants or wastes at the source. It includes practices that reduce the use of hazardous or non hazardous materials, energy, water or other resources, as well as those that protect natural resources through efficient use (USEPA 1991).

Water pollution control (WPC) includes physical, chemical, and biological processes that destroy or detoxify wastes into harmless or less toxic substances. These are often referred to as end of pipe processes because they usually treat wastewater as it is discharged from a factory or other facility.

The following are water pollution prevention and control (WPPC) policy objectives, presented in a hierarchy of preferred approaches for management:

- Pollution should be prevented or reduced at the source whenever feasible.
- Pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible.
- Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible.
- Disposal or other release into the environment, should be employed only as a last resort and should be conducted in an environmentally safe manner.

WPPC will help enhance water quality, improve human health, minimize waste, and will also provide means to conserve and to reuse water. The WPPC policy deals with the following sources of pollution:

- **Municipal Pollution** Municipal pollution sources are either point or non-point. Examples of point sources are household sewerage, effluent from industrial plants, leaking septic tanks and sewers, and underground gasoline tanks. Wastewater treatment plants are the typical pollution control method for municipal point source pollution. Major sources of non-point pollution include stormwater runoff, refuse/solid waste.

drainage, chemical and petroleum spills, soil erosion, agrochemical, livestock feeding/manure waste, and septic tank pumping and leaching

- **Industrial Pollution** Industrial manufacturing processes potentially generate pollutants throughout the manufacturing process. Pollution is also generated from above and underground chemical and wastewater storage tanks and through the disposal of wastes
- **Agricultural Pollution** The most important pollutants found in the run-off from agricultural areas are sediments, animal wastes, plant nutrients, forest and crop residues, inorganic salts and minerals and pesticides. Excessive application of fertilizer or pesticide on agricultural land creates a major non-point source of pollution
- **Domestic (Household) Pollution** Many common household products become hazardous wastes when they are disposed in household wastewater. Such common products include motor oil, household cleaners, paint and pesticides. Domestic pollution prevention efforts focus on consumer awareness of 1) environmentally sound technology selection when trying to choose among alternative products and 2) consumer awareness and community programs for the proper disposal of used or excess household products and chemicals which will eliminate contaminants from entering the waste stream

Importance of the Issue

Pollution of Jordan's ground and surface water supplies is one of the most important issues facing the water sector. Groundwater is the major source of drinking water in Jordan, and groundwater aquifers and springs are rapidly becoming contaminated by a variety of point and non-point sources, including leaking septic tanks and sewers, chemical storage tanks, agricultural runoff, and industrial operations. Bacteria and toxic chemicals seep into ground and surface water from various polluting sources.

Some of the recent trends affecting WPPC issues are

- increase of pollution as industries and agricultural activities expand,
- inadequate land use planning, and poor allocation of land for domestic, agricultural and industrial purposes,
- population growth and higher densities of population,
- growing awareness of pollution and environmental issues,
- expectations of new environmental regulations on developers and producers, both public and private,

- declining economic performance,
- changes in management philosophies and the need for greater productivity and efficiency, and
- decreasing quality of water shared with neighboring countries

Current Policy Status

According to Article 6 of Law No 18,1988 (Water Authority Law), the Authority shall

- develop the potential water resources in the Kingdom, increase their capacity and improve their quality, protect them from pollution, and
- study, design construct, operate, maintain and administer water and public sewerage projects including collecting, purifying, treating, disposing and the use of any other method of dealing with water

According to the Economic and Social Development Plan 1993-1997 the Government shall

- conserve water resources and the environment, and protect them from pollution, and
- modernize surface water, groundwater, and the water quality monitoring networks

The Environment Law was passed in late 1995 and states the following in its preamble

“To achieve economic and social development, this law is based on sound environmental management of environment components Thus, activities shall be avoided and materials shall be disused that cause environmental threats, if this is possible without affecting any social and economic interests in the Kingdom Also, activities that are proven to result in environmental pollution threats shall be stopped, if this will resume the natural environmental balance ”

Article 16 states, "The Corporation, with regard to the water sector, in coordination with the authorities concerned shall issue general specifications of water for all uses and monitor water resources with respect to its quality and find necessary means to achieve this "

Article 25 states, "It is prohibited to dispose, store or discharge any materials harmful to the environment whether solid, liquid, gaseous, radioactive or thermal close to water resources and within a distance specified, with some exception for some materials within certain standards " water pollution prevention

Actions Taken to Address the Issue

Several actions have been undertaken relating to the construction of domestic and industrial wastewater treatment plants, the setting of standards, regulations and guidelines, and the establishment of monitoring of water and wastewater programs. In terms of industrial pollution prevention practices, actions that have been or are being undertaken include the following

- Water Quality Improvement and Conservation Project (WQIC) is implemented in cooperation between USAID and the Ministry of Water and Irrigation. This project has a major component which deals with industrial wastewater discharge prevention. Activities in this component included audits for pollution prevention/ waste minimization, feasibility studies and demonstration projects.
- Industrial Pollution Control Project in Jordan. The project has been implemented by the World Bank and the Ministry of Planning. The project has a component dealing with the minimization of wastes generated by industrial plants.
- Several environmental assessments have been conducted for a number of industrial facilities (yeast industry, lead acid batteries, etc.) funded by USAID and implemented through the World Environment Center.

In terms of agricultural pollution prevention, efforts include

- Ministry of Agriculture efforts through its Forestry Directorate to increase the forest area,
- projects implemented through to the Ministry of Agriculture to use integrated pest management programs and also activities for quality control of pesticides and their residues on plants, and
- the National Project for Jordan Soil Map and Land Use implemented by the Ministry of Agriculture.

Policy Gaps

A national policy should be developed creating a hierarchy of preferred waste management approaches. The approaches should address source reduction, recycling, treatment and disposal, all to be conducted in an environmentally safe manner.

The major policy gaps are the absence of the following

- a strong policy statement to reflect the GOJ's commitment to WPPC,

- a mandate for water pollution prevention and control through direct regulations (e.g. WPPC audits, performance standards including Best Available Technology (BAT) or Best Conventional Technology (BCT), percentage reduction in waste generation, banning certain chemicals, for example ABS, and management practices,
- a policy to provide funding assistance (incentives, tax breaks, subsidies) to industries to encourage WPPC practices,
- a policy to increase the technical ability of and information flow to managers and technical personnel of wastewater generating industries,
- a policy to improve public awareness, and
- a policy to create a single or lead organization responsible for monitoring and enforcement of WPPC programs

Policy Recommendations Under Consideration

A national policy should be developed creating a hierarchy of preferred waste management approaches. The approaches should address source reduction, recycling, treatment and disposal to be conducted in an environmentally safe manner.

Ministry of Planning, Ministry of Municipalities and Rural Affairs and the World Bank are working on a National Environmental Action Plan of Jordan.

Constraints to Resolving the Issue

Several constraints need to be addressed with regard to WPPC policy issues, including a lack of

- governmental cooperation,
- an effective and coherent program of action,
- governmental mandate,
- government incentives,
- funding where capital requirements are needed,
- management commitment within industry possibly related to lack of regulations, and

- information on existing in-house practices and means to improve these

Strategy

To implement water rights policy, the Government will pursue the following strategy

- Establish an Environmental and Quality Unit that would be the coordinating point within MWI for the formulation and implementation of a National Water Quality program and preparing the required legislation

Action Plan

The responsibility of the unit would include the following

- Survey resources (staff, budget, equipment, authority, responsibility) of existing pollution prevention and control organizations. Develop a strategy for possible integration of existing pollution prevention infrastructure
- Evaluate staffing, equipment, budget and enforcement authority required to complete and implement the functions of the integrated entity
- Develop strategies, programs and targets of WPPC activities
- Develop a unified set of laws and regulations
- Establish a comprehensive water quality monitoring system for industries and wastewater treatment plants with defined objectives in coordination with other agencies involved in water monitoring
- Coordinate the analysis of data, the interpretation and identification of hazards, and undertaking necessary action
- Ensure the proper technical, financial, and legal resources to achieve results
- Enforce effluent standards for industrial and municipal discharges through the introduction of the concept of liability and that polluters pay for clean up of damages to natural resources (promote prevention, discharge remediation as a cost of business)

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COASTAL DEVELOPMENT

Recognizing the special importance of the coastal areas of the Dead Sea and the Gulf of Aqaba as potential centers for the development of tourism, and taking into consideration the planned development of special industries in these areas, the MWI shall

- *give high priority to the integrated development and management of water resources in these areas in order to meet the expected demand,*
- *take the necessary steps to ensure the control of the Dead Sea water to protect present and future investments on its coast,*

Background

Jordan's coastal regions include the east coast of the Dead Sea and the land adjacent to the Gulf of Aqaba. Of related interest is the inland strip that is the Wadi Araba Valley which connects the two coastal regions. With the normalization of relations with Israel, these areas have taken on greater economic significance, particularly for tourism development, but both the Dead Sea and the Gulf of Aqaba are fragile environments which need to be protected in the event of massive investments for recreational and industrial development. While the development of both areas has important implications for water distribution, coastal development is treated here primarily as an environmental issue.

In these two coastal regions, the water related policy areas are concerned with

- water use in the coastal environment,
- environmental protection of coastal water resources,
- investment for developing the coastal areas tourist and industrial potential, and
- wastewater treatment and reuse

Importance of the Issue

The preservation of Jordan's coastal waters, as an environmental resource with high tourist income potential, is of extreme importance to the country. Incompatible land uses in the Aqaba region and conflicts with environmental objectives makes this a difficult issue to resolve. Water scarcity and water quality concerns in the coastal areas are major concerns. The number and variety of agencies and interests involved contribute to the difficulty. The proximity of neighboring countries in both Aqaba and the Dead Sea make this a regional issue, as well, where solutions must be sought in close coordination with neighboring countries.

The Gulf of Aqaba is a unique resource containing a rich variety of marine life of important tourist and scientific value. The Gulf's waters have more than 200 varieties of coral and 1,000 species of subtropic fish. Aqaba, the country's only outlet, has experienced a rapid municipal and tourist expansion over the last fifteen years. The city population of 55,000 in 1990 is estimated to be 119,000 in 2000 and from 1987 alone, tourism jumped by 85 percent. In addition to the associated stress on the infrastructure, there are considerable sources of industrial pollution. Due to the heavy concentration of industry at the port city of Aqaba, frequent incidents and conditions exist which lead to contamination of groundwater and the coastal waters. These include

- spillage of chemicals at the port during loading and transport operations,

- leakage of liquids, such as petrol and insecticide materials, from storage tanks of industrial projects,
- sewage leaks from inadequate and uncontrolled septic tanks,
- inadequate disposal and treatment facilities for industrial wastes, and
- inadequate and inefficient operation of the Aqaba sewage treatment plant resulting in the contamination of domestic groundwater supplies and coastal areas

In addition, ships visiting the port have been the cause of oil spills and may release waste into the Gulf

Jordan's other coast, the eastern Dead Sea region, has been identified as a high priority tourist development area with major attractions being the Dead Sea, therapeutic thermal springs, and archaeological sites. The region faces the following water related environmental concerns

- Water of drinking quality is extremely limited in the area and could pose a constraint to tourist development
- The Dead Sea is the final destination of wastewater effluent originating from Jerusalem, Amman and settlements throughout the Jordan River catchment. Water quality, particularly at the mouth of the Jordan River, is a concern
- There is concern about saline brine and wastewater resulting from salt pond operations
- Polluted irrigation return flows into the Jordan River and degraded water quality
- A lack of sewerage systems in the area results in raw effluent flowing into wadis and surface and groundwater contamination
- Wastewater from the Arab Potash Company and tomato processing factories at Alardah and Ghor Safi discharge effluent which degrades water quality

Entities involved in the development and protection of these regions include

- The Ministry of Municipal, Rural Affairs, and the Environment which oversees the implementation of laws and regulations concerning urban and regional planning,
- The Public Establishment for Environmental Protection (PEEP) which was recently created by the Law for Environmental Protection, Law No 12, 1995 which serves as an enforcement agency,

- The Ministry of Health which protects the public against environmental health hazards from water and wastewater,
- The Ministry of Water and Irrigation which, through the JVA, is overseeing Dead Sea coastal development,
- The Ministry of Industry and Trade which is responsible for developing water and wastewater standards,
- The Ministry of Agriculture which regulates grazing and wildlife reserves,
- The Ministry of Tourism which develops and protects tourist and recreational sites,
- Local bodies in the Aqaba region, the Aqaba Regional Authority for environmental monitoring the Aqaba Municipality with administrative authority, and the Aqaba Port Authority for port operation and maintenance, and
- The Royal Scientific Society which monitors development, the Royal Society for the Conservation of Nature which promotes nature conservation and environmental protection, and the Marine Science Station in Aqaba which conducts scientific research and monitors factors affecting the Gulf's ecology

Current Policy Framework

A number of laws, regulations, and plans shape the policy framework for coastal development

The current five-year plan calls for a number of actions relevant to coastal resources development and management in Jordan

- The Government shall channel available quantities of water towards the best possible uses, taking into account the opportunity cost of water
- Private ownership of state-owned lands shall be extended for the purpose of establishing tourist projects
- An independent specialized authority shall be established to regulate and manage environmental affairs
- Transboundary pollution shall be controlled through establishing appropriate standards and criteria
- Further natural reserves shall be established

- Environmental management programs shall be formulated and an environment information system set up
- An authority shall be created to preserve the cultural heritage, to be funded from bilateral and multilateral sources

Regulations are in place which control the discharge of industrial waste into the gulf, regulations are in place concerning port and shipping activities, and articles of existing laws, including the Agricultural Law No 20 of 1973 seek to control damage to coral reefs and fishing. The new environmental law updates those last parameters dramatically, but consistent enforcement is as yet untested.

Actions Taken to Resolve the Issue

In 1976, a study commissioned by the Aqaba Regional Authority first proposed the creation of a marine park and nature preserve along seven kilometers of the coastline. Since then other reserves have been established at Aqaba and along the Dead Sea.

The development of coastal areas is addressed indirectly through the recently promulgated Environmental Law No 12, 1995 which focuses on contamination of the Gulf of Aqaba and destruction of coral reefs. The law sets monetary and prison penalties for captains of ships or other carriers that discharge pollutants into coastal waters, people who destroy reefs, and others who dispose of wastes in the vicinity of water resources.

Plans to conduct a study of tourism development of the east coast of the Dead Sea include an environmental impact assessment.

Policy Gaps

Although recent laws and regulations have helped to set some limits to actual pollution of coastal resources, policies remain unclear about the extent to which coastal development is desirable and the form it will take.

Policy Recommendations under Consideration

The new environmental law proposes the creation of a Higher Council for the Protection of the Environment to oversee the work of PEEP which is to include representatives from governmental and nongovernmental organizations as members.

Constraints to Resolving the Issue

The greatest constraint to resolution is that a balance still needs to be found between development of these coastal areas and the fragility of the environments

Strategy

To implement the policy, the MWI will pursue the following strategy

- Support existing departments or sections within the relevant ministries to improve coordination and ensure integrated development of the water resources along the coasts of the Dead Sea and the Gulf of Aqaba
- Assure that all proposed development activities are supported by environmental analyses which thoroughly identify and quantify all impacts of proposed developments on water resources in the coastal areas
- Improve coordination with neighboring countries on the development of the coastal areas to assure compatible development by all parties

Action Plan

The strategy will require the following actions

- Conduct frequent coastal area coordination meetings with representatives from all water related agencies
- Initiate a study of the management of the Dead Sea region which will assess the hydrology and socioeconomic development potential and be conducted in cooperation with concerned parties
- Conduct public awareness and environmental educational programs to minimize pollution caused by tourists and industries in Aqaba and the Dead Sea
- Investigate means to control the Dead Sea water level
- Conduct research to determine safe levels of effluent discharges into the Dead Sea and Gulf of Aqaba
- Prepare a detailed survey of all coastal water resources, of different qualities and for different potential users, as part of an overall development plan for these areas
- Establish systems to improve monitoring of wastewater discharges in coastal regions

- Hold meetings between concerned water agencies in Jordan and neighboring countries to coordinate water resource planning for coastal regions

Annex A

Tourism Development Project Along the East Coast of the Dead Sea

Existing Conditions

There is, at present, little development along the east coast of the Dead Sea. There is one hotel, one public entertainment area, and a few military posts. However, plans are being considered to further development, which will put a strain on the local resources of all kinds.

The following environmental problems are now found in the area:

- the Jerusalem sewerage system effluent flowing into the area,
- the sewerage systems of settlements along the Jordan river,
- Saline wastewater resulting from the salt pods,
- discharge of wastewater into the Jordan river from the King Talal Dam,
- Zarqa River discharges,
- polluted irrigation return flowing into the Jordan River,
- septic tank discharges at the Dead Sea rest house,
- lack of sewerage systems in the area,
- The Arab Potash Company, and
- tomato processing factories at Alardah and Ghor Safi

Added to the above, the following problems are anticipated:

- waste and sewerage waters resulting from the Dead Sea eastern shore tourist development project,
- exploitation of brackish waters from springs for agricultural uses,
- boat use on the Dead Sea, and
- further concessions to the Arab Potash Company

These problems may be mitigated if

- all effluent from sewerage treatment facilities is recycled or reused for irrigating agricultural land,
- factory owners are obliged to install treatment plants for the removal of heavy and poisonous metals,
- brackish water desalination plants are installed to supplement the already scarce water resources in the area, and
- additional concessions to industry is made contingent on compliance with environmental regulations

Development Plans

A two-phased tourism development project has been proposed to develop the coastline, which is to be divided into 23 zones spread over an area of 5 x 58 Km. The short-term project develops the area to needs as of 2000, and long-term plans extend programs to the year 2010. The area would be considered a regional nature park. Components of the project include cultural and medical tourism, discovery circuits, and youth facilities. The project area includes several thermal springs, some wadis flow uncontrolled into the Dead Sea. The project would use some of that water for domestic, commercial, and agricultural purposes.

According to the project design, the natural environment would be maintained and fully protected. All tourist activities are to be planned and controlled in such a way that in the developed area there will be no put pressure on wildlife or damage to natural elements. Traditional architectural techniques, layouts, and interior designs, as well as materials (stone and wood) will be utilized for low-rise buildings to insure better integration into their surroundings.

A northern part the park would be developed in conjunction with the future urbanization of Suweimeh. In the central part, it will be developed as part of a new permanent settlement in the Zara Main area.

The development area is rich in archaeological sites that back to different eras. Construction of facilities will avoid damaging those sites and tourist activities will be planned to be conducted without infringing on the rights of visitors to enjoy the archaeological features of region.

The highway will be transformed into a scenic parkway. Developing the area adjacent to both sides of the road imposes safety hazards that need to be addressed by designating reduced-speed zones, or by providing safe crossings for pedestrians at selected locations.

All domestic sewage and liquid wastes generated by tourists and other facilities are to be treated before reuse or disposal, possibly by small-scale treatment plants. The introduction of other artificial scars to the landscape, such as overhead electrical lines, will be prohibited, underground power supply shall be provided to all development facilities. Solid wastes generated from developing the area for tourism and agriculture are to be collected and disposed of in an environmentally sound manner.

Water requirements in the area will need to be examined carefully because of the limitations on quality and quantities available.

Annex B

Development along the Gulf of Aqaba Coastline

The development of the Aqaba Region, home to the only coastal city in Jordan, relies on the abstraction of groundwater resources, which are threatened by the effluent water from Aqaba Sewage Treatment Plant. That treatment is being carried out by means of oxidation ponds built on sandy soil, using a physical treatment process. Chemical and bacteriological analyses carried out on water samples taken from wells located in the palm tree area revealed pollution by NO₃ and NH₄. Moreover, water levels are rising in those wells due to infiltration from upstream, thus indicating pollution of the Aqaba underground water resources.

In addition, since groundwater moves toward the shore, the above pollutants will reach the Gulf of Aqaba and harm living organisms, which in turn will discourage tourism. This is a serious negative economic impact for Jordan, which depends on income from tourism.

Due to the heavy concentration of projects and port activities in the Gulf of Aqaba, several frequent incidents have occurred, such as

- spillage of chemicals during loading and transport operations, which may lead to those chemicals being washed away by rain water,
- leakage of liquids, such as petrol and insecticide materials, from storage tanks of industrial projects, and
- leaking sewage from septic tanks

All of these incidents lead to contamination of groundwater and of the coastal waters.

To insure noncontamination of coastal water resources and to ensure public safety, it is important to abide by the following recommendations:

- The efficiency of the sewage treatment plants should be improved in order to render the effluent non-polluting, and to place it within permissible specifications. The improved performance of the treatment ponds throughout the various treatment stages could be achieved through a redesign of the ponds.
- Conditions and specifications for the construction of septic tanks should be adopted to ensure that leakage of sewage from those tanks to the groundwater will be limited.
- Sewage and industrial wastes should be disposed of away from the preserved and protected water at a distance of at least six kilometers from the coast.

In order to abate existing pollution, it is important to carry out continuous and periodic monitoring of the magnitude and extent of that pollution. The responsibility for this rests equally with the Water Authority of Jordan, the Aqaba Regional Authority, and the owners of factories in the area. The Water Authority of Jordan is also responsible for carrying out the necessary physical, chemical, and bacteriological analyses, as well as for checking the levels of carcinogens and heavy metals. The Aqaba Regional Authority is responsible for installing a laboratory for measuring and monitoring coastal and sea water pollution. Factory owners need to be compelled to install at their factories treatment facilities to ensure that the effluent complies with permissible levels of pollutants.

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THE INSTITUTIONAL FRAMEWORK

Recognizing that the water sector comprises several institutions, sometimes with overlapping interests the MWI shall

- *through appropriate measures, give the MWI institutions the necessary regulatory and policy execution functions in the water sector,*

Background

Water is not only a basic factor of production in Jordan, it is also a basic human need. Social and economic changes, accompanied by rapid population growth during the past few decades, have increased demand and intensified competition among users for the country's very limited water supplies. As a result, the economic value of water has been rising steadily and water quality, which has been deteriorating, has become a critical consideration for all uses.

Both the availability and the quality of water are major factors affecting social and economic development, public health, and the environment. The challenges posed by this situation are bound to grow over time. These factors, in addition to the public ownership of the water resources, make it imperative that the government plays an important role in the sector.

Historically, the government role has included a wide range of functions, including resource assessment and monitoring, planning and allocation, development and distribution, and the evaluation of investments in the sector. By virtue of its supervisory role in safeguarding the national interests, the government has been reluctant to relinquish or delegate any of its water sector management or service functions to the private sector. If private sector management is to be introduced, the government will need to retain a strong regulatory role.

The government should adopt the most efficient and effective means for optimizing national objectives in the water sector. Among the main requirements for facilitating and accelerating their achievement is an institutional framework compatible with the complexities of the water sector and a management system that best serves them. The performance of the water sector, like that of any other sector, depends heavily on the strength of its institutions. Institutional restructuring and the introduction of private sector involvement, must, therefore, be supported by adequate legislation, efficient law enforcement, and strong human resources development.

Importance of the Issue

There is general agreement that a significant reorganization of the water agencies will be necessary to increase efficiency and responsiveness. This reorganization of the institutional framework is considered to be among the most pressing issues in the water sector. Both donors, including the World Bank, CIDA, and USAID, and the Government of Jordan have devoted considerable time and energy to the restructuring of the major water resource institution in the country—the Ministry of Water and Irrigation and to the two primary operational entities—the Water Authority of Jordan (WAJ) and the Jordan Valley Authority (JVA).

Current Policy Framework

Separate laws and bylaws have been promulgated creating the three major water entities in the country The Water Authority of Jordan, the Jordan Valley Authority, and the Ministry of Water and Irrigation

The Water Authority Law

The 1988 law establishing WAJ contains numerous statements and policies defining its role in the water sector It gives WAJ several regulatory and water sector management powers, while at the same time entrusting it with water supply service responsibilities, similar to those normally carried out by water and sewerage utilities

The Jordan Valley Development Law

The 1988 law establishing JVA provides the legal basis for its activities in a variety of fields, including water resources development in the Jordan Valley As such, it provides the basis for duplication of efforts and potential confrontation with WAJ, while at the same time endowing JVA with powers to intervene in institutional matters of various other ministries and departments in areas not related to water

The Ministry of Water and Irrigation Enabling Legislation

The 1992 by-law establishing MWI is essentially institution-building enabling legislation, creating an entity to incorporate the two already existing autonomous authorities into a new institution and an administrative umbrella The by-law does not transfer any substantive powers from them to the ministry

The Economic and Social Development Plan for 1993-1997

The following are excerpts from the current five-year plan and indicate actions that are expected to be undertaken during the period

- The Government shall enhance its regulatory and supervisory roles
- The Government shall activate the private sector in the area of infrastructure and basic services and increase private sector participation in the management and ownership of public sector institutions on an equitable and well-considered basis
- The Government shall restructure public sector institutions in the field of water use
- The Government shall develop existing institutions in the field of (water) production and distribution with a view to turning them into autonomous organizations operating on sound commercial principles

The plan projects a view of Government which is primarily regulatory and supervisory, works with both public and private sector entities, and operates in the sector according to sound financial principles

Actions Taken to Address the Issue

Canadian International Development Agency

The Government has undertaken, with assistance from the CIDA, a fundamental review of water sector institutions with the objective of restructuring these institutions. A result is an agreement by the Government to accept the following principles as a basis for restructuring

- The new arrangement will provide strengthened policy development and water planning capabilities
- The governance functions will be separated from the water service delivery functions
- The wholesale operations (national infrastructure) will be separated from the retail (local) service delivery functions
- The commercial orientation of the water service delivery activities will be increased by investments in training and in the capability to manage water systems
- Mechanisms will be established to facilitate inputs into policy formulation from other institutions, from the public and from industry
- Financial viability will be a major characteristic of the detailed design of water sector facilities

The MWI is presently considering a restructuring proposal drawn up in line with these principles

The World Bank

As part of ongoing negotiations with the World Bank a "Water Sector Review" was prepared which assessed the institutional framework of the sector and suggested several modifications. No action was taken on these recommendations, and since they may still be under consideration they are discussed below

Policy Gaps

Interministerial Coordination and implementation of Agreements

A major reason for the lack of clear policies in the water sector, apparent duplication of efforts, and lack of coordination among government entities is the absence of a senior level council which includes representatives from ministries involved in the sector. Among the ideas being seriously considered at present is the creation of a Water Council, which provides overall coordination in the sector at the highest national level, and a Water Advisory Council, directly responsible to the Minister of Water and Irrigation, for carrying out the agreements reached at the Higher Water Council. Both councils would include representatives of all concerned ministries and the private sector.

The Institutional Framework for MWI

The current framework includes three linked entities with primary responsibilities, and several other agencies with secondary responsibilities. The three have overlapping functions and responsibilities, and the powers of the Ministry of Water and Irrigation are not clearly superior to those of WAJ and JVA. The polarization of responsibilities in the authorities, without an effective coordinating capability above them, has undermined their ability to deal effectively with integrated and long-term planning and management.

The Separation of Functions

Water resources assessment, policy, and planning functions are not clearly separated from water and wastewater services. In practice, the "regulators" also represent many water users, thus creating a very awkward conflict of interest.

Although the five-year plan states that "the Government shall restructure the public sector institutions in the field of water use," no such restructuring has taken place. Consequently, there is much confusion about the roles that the existing institutions play and about their power and willingness to implement the objectives spelled out either in the plan or in other policy documents. Moreover, it is not clear whether the expression "in the field of water use" really means what it says, or whether it is intended to mean "in the field of water resources management and development." In Jordan, as elsewhere, the final water use is generally the private sector.

The Regulatory Role

Although the Government will continue its regulatory and supervisory role in the water sector, confusion exists about which institution is authorized to perform it. Perhaps the most important regulatory function of the Government is the allocation of water uses by means of issuing water rights or permits, but there remains a lack of clarity concerning what entity has primary authority.

Policy Recommendations under Consideration

The policies referred to above have been incorporated in legislation or in formal governmental pronouncements. Subsequently there have been efforts to modify those policies, partly in connection with negotiations with the World Bank for a loan for an Agricultural Structural Adjustment Program. Following these negotiations, the Bank issued a statement entitled, the "Water Policy Framework for Jordan", which spelled out policies related to institutional restructuring. Although the statement was not published as a Cabinet-approved decision, it is commonly understood to reflect Government policy as of late 1994, particularly since it was reportedly based on the principles enunciated in the current five-year plan. The following phrases are excerpted from that statement:

- The Government seeks to implement an appropriate reorganization and restructuring program subject to the outcome of a comprehensive institutional study and the process to which it gives rise
- The Government recognizes a distinction between the management of natural resources and delivery of water services, and the desirability of separating the regulatory functions associated with the former from the operational functions associated with the latter
- With respect to the management of the resource, the Government will retain full responsibility, adopting approaches to management and regulation that recognize the unitary nature of the resource, the pervasive existence of externalities and the close interaction of quantity and quality issues
- The Government will centralize water resources data collection and processing, within the framework of proposed institutional reform
- The Government will regulate private water deliveries in urban areas consistent with resource management objectives and regulation of the quality of water used for drinking and domestic uses

Constraints on Resolving the Issue

The major constraints to restructuring the institutional framework of the water sector in Jordan appear to be

- the sensitivity of the issue,
- the reluctance to accept change and to make institutional decisions, and
- the weakness in enforcing policies and principles geared to resolving the issue

Strategy

To implement these policies, the MWI shall

- carry out periodic restructuring of the water sector in keeping with principles accepted by the Government in November 1995,
- separate the regulatory and supervisory roles (including monitoring, evaluation, and planning) from implementation and operational roles, and
- Improve efficiency by eliminating or minimizing duplication, and upgrading human resources skills and capabilities

Action Plan

These strategies will require the following actions

- p Create within the Ministry of Water and Irrigation a Water Advisory Council directly under the Minister, including representatives of line agencies and the private sector
- Provide plans and a schedule for the reorganization of the Ministry of Water and Irrigation
- Revise water sector legislation to be consistent with any restructuring

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STAKEHOLDER PARTICIPATION

Water is a strategic resource which affects the public in a wide variety of ways. Stakeholders are those individuals or groups which have an interest in activities in the water sector. For the purpose of developing and optimizing the use of this vital resource economically, socially and environmentally, the MWI shall

- *adopt measures to ensure the active participation by stakeholders in the planning through the Water Council and operation of the water sector activities, whenever possible*

Background

Stakeholder participation, meaning joint involvement and shared responsibility between line agencies and users, is essential to Jordan's water sector. Stakeholder participation

- recognizes that inefficient system operation is in some measure the result of users' having little or no role in resolving critical water-related issues,
- requires a revision of relationships, with users in system operation and the MWI shifting from a management to a regulatory role,
- acknowledges that water users can be active players in water systems, and that those systems work better when users are involved, and
- affirms that the MWI will continue to play a critical but diminishing, role in system operation, particularly in delivery, and the recovery of costs

Stakeholder participation in the agricultural subsector is expected to be quite different from that in the domestic water supply subsector. In the former, stakeholder participation will mean the transfer of actual system management responsibilities to users so that they may manage water distribution, resolve conflicts, and possibly recover costs for O&M which they might control themselves. In the latter, stakeholder participation is likely to mean participation as end users in pricing, water conservation practices, or pollution prevention techniques. Domestic users may be made a part of these discussions, but they will not manage even lower reaches of water supply systems, as farmers might. However, in water and wastewater systems, private sector entities may be established. When pushed to the limit, stakeholder participation is privatization, where the physical assets of irrigation systems are transferred to farmers or the physical assets of water supply systems are sold to profit-making entities.

As governmental institutions in Jordan's water sector play a greater regulatory, rather than a management, role, as the government seeks to shift the financial burden of system operation and maintenance to users, as inefficiencies in system operation become more prominent and of greater concern, and as increased water conservation and pollution prevention become public banners, stakeholder participation in Jordan will rapidly increase. The challenge to the Government is to identify profitable areas now for involvement by the public and mechanisms to involve them productively.

Importance of the Issue

As mentioned above, this issue is exceedingly important for a number of reasons

- As the Government shifts from a heavy management role to a regulatory role, stakeholder participation must increase. This shift will require greater stakeholder participation and responsibility for the management of systems and new initiatives.
- The Government is adjusting pricing policies and schedules for both agricultural and domestic water. These changes in pricing would be more successful and seem less coercive if the end users are involved in the process.
- The Government is recognizing the financial burden of managing the Jordan Valley irrigation system. Transferring management responsibility to farmers for water distribution would result in more efficient operations.

Current Policy Status

According to Water Authority Law No. 18 of 1988 and the Jordan Valley Development Law No. 19 of 1988, MWI entities are responsible for all water systems. There are no provisions in any of the laws affecting the water sector which give a role to stakeholders in management or except at the household or farm level. Law No. 18 contains a list of offenses and penalties for users, but there are no provisions through which users may manage water above the turnout or vehicles through which users may petition the government or seek recourse, except as a normal course through the courts.

Some councils have been established with the membership of nongovernmental entities. For example, the recently promulgated Law of Environmental Protection established a Council of Environmental Protection which includes the president of Jordan Environment Society (JES) and the president of the Royal Society for the Conservation of Nature. However, representatives of other involved entities in the private sector, including the Chamber of Industry, are not included.

Actions Taken to Address the Issue

The Water Quality Improvement and Conservation Project has conducted a study in the Central Jordan Valley concerning participatory irrigation management and offered options for implementing a program to shift management responsibilities to farmers on an experimental basis.

Policy Gaps

At present, there are no policies in place which support stakeholder participation.

Policy Recommendations Under Consideration

The World Bank-prepared Water Policy Framework for Jordan concludes with the statement that the Government will “involve stakeholders in policy discussions at the various levels of government through public hearings, discussion meetings, committees and other participatory programs”

Constraints to Resolving the Issue

The greatest constraint is the skepticism of government officers that stakeholder participation is unlikely to improve system efficiency, expand conservation practices, reduce the financial burden on the government, or result in users working together cooperatively. On the other hand, there is skepticism among users that the Government will actually turn over substantive management responsibilities to them.

Strategy

To implement the policy, the MWI will pursue the following

- Build understanding and consensus within MWI, JVA, and WAJ on bringing users into participatory and provide training for staff to assume their new roles
- Involve public awareness programs in expanding stakeholder participation in both rural and urban areas
- Explore the opportunities for participatory irrigation in the Jordan Valley by having JVA experiment with different approaches

Action Plan

These strategies will require the following actions

- Conduct workshops for participants in the water sector, particularly government entities, to explain and discuss stakeholder participation and its benefits. Follow-up with study tours to other countries which have had success at introducing these programs
- In the Jordan Valley, introduce participatory irrigation management on an experimental basis by
 - making bulk sales to the head unit on selected lines,
 - having farmers manage water distribution along the line, ending the need for farmers to confirm deliveries individually,
 - assisting users in resolving potential or actual conflicts on the line,

- introducing irrigation extension information, working with farmers to produce
 - seasonal cropping plans, based on water and soil classification
 - assigning JVA staff to work closely with lateral groups
 - Provide sensitization and training to both farmers and JVA staff
- Conduct a “benefit audit” which will examine the financial, economic, social, and institutional benefits of any proposed stakeholder participation programs
 - Develop a detailed implementation plan and budget for any stakeholder participation program, including the proposed participatory irrigation management effort

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RESEARCH AND DEVELOPMENT

Research is a key element for water sector development The MWI shall

- *support applied research related to water issues and problems with implementation by research institutions in the country in an integrated and sustainable manner, and*
- *allocate adequate budget for applied research on water issues*

Data, information, and documents shall be made accessible to the researchers The findings of the research shall be documented, published, and made available to decision makers, researchers, and to the public, as appropriate

Background

Research and development can play a critical role in addressing the country's water shortage by determining the best management approach to reduce environmental pollution, and minimize the gap between supply and demand. However, research in the sector is presently done without coordination and outside a framework of national priorities and objectives. Research results are scattered, and often are not published, adequately documented, or easily accessible to other researchers, decision-makers, or the public.

Research is required in a wide variety of areas related to water. Continued research is needed in irrigation management, including the determination of optimal and economical water requirements, improved irrigation technology, and suitable practices and crops for different qualities of water. There is also a need for diagnostic studies to determine the causes of water losses and the varied efficiency of distribution systems. There is potential for enhancing water supplies through water harvesting of desert floods, artificial recharge, and by testing appropriate technology for cloud seeding. Irrigation technology transfer and development is progressing, related in part to the success of the drip irrigation industry in the country.

Since desalinated water is increasingly considered as an important future water resource, studies should be oriented towards testing different technologies and studying the potential of using renewable energy. Environmental impact studies and water desalination studies should be carried out in parallel.

Domestic wastewater is and will be reused for agriculture and will be a significant source of water in the future. Studies are needed to determine the environmental impact of its use on soil, plants, and conventional water resources. There is a major risk of pollution by industrial wastewater, since industrial activities on major basins has increased by more than 50% in the last few years and is expected to increase more in the near future. Research should be coordinated with the industrial sector for testing and selecting on-site treatment plants and utilizing pollution prevention technologies.

A number of parties to participate in research, and responsibilities need to be clarified among them. A proposed Water Council would set national priorities and coordinate efforts across government entities and between the public and private sectors, ministries would identify problems and provide funding, universities, research centers, and the private sector would undertake research and develop technologies.

Importance of the Issue

Research and development projects have among the highest rates of return, but Jordan has not invested significantly in research. Public and private sector investment has not exceeded 0.35% of Jordan's Gross National Product while in other developing countries the level reaches 1%. Determining national research priorities and providing adequate funds are important policy issues still to be resolved.

Current Policy Framework

The laws establishing WAJ and JVA include a mandate for research and studies. Both theoretical and applied research on water are to be carried out by WAJ, and JVA is empowered to conduct studies for evaluating water resources. However, no policies exist which establish a decision-making process for identifying and reaching consensus on national priorities.

The Agricultural Policy Analysis Project (Qasem et al. 1993) has developed the following policy statements:

- Strengthen the national capacity to develop and apply information on crop water requirements, irrigation scheduling, and management appropriate for different agroclimatic regions of the country.
- Strengthen the national capacity to generate, evaluate, and disseminate information on water saving technology.
- Strengthen the methods of information dissemination to promote public awareness of water use efficiency, water quality, and conservation of watersheds.

The Higher Council for Science and Technology (HCST 1995) recommended the following statement on research and development:

- Relying on scientific research and development is a cornerstone of development of water and irrigation activity, and activating, directing and intensifying research and development towards technical and administrative problem-solving is closely related to the gross national income.

The National Agricultural Strategies (MOA 1994) carried out by the National Center for Agricultural Research and Technology Transfer (NCARTT) identified national priorities for irrigation and irrigated agriculture, including improving water use efficiency, utilizing non-conventional water resources, and intensifying cropping patterns.

Policy Recommendations Under Consideration

Many policy recommendations have been made and are in circulation. None has been implemented. The following four appear to be the most widely accepted:

- The MWI should rely on research and development for alleviating water problems in Jordan by the adoption of strategies that will address issues of water management, assessment of resources, enhancement of supplies, technology transfer, pollution prevention, and water quality.

- The Government should strengthen the national capacity in research and development in water, promote dissemination of information on water saving technologies, and strengthen the national capacity to generate and evaluate information needed for water management and assessment
- The Government should adopt a research strategy for each institution and should establish a national coordinating body
- There is a need for developing and strengthening a national research and development water center

Actions Taken to Address the Issue

Research in the water sector in Jordan has been limited to date. Applied research is being carried by government institutes like NCARTT, while basic and applied research has largely been carried out by universities and research centers. The Royal Scientific Society has worked on technology transfer and monitoring systems.

Governmental support for research and studies is declining. The resources of the Higher Council for Science and Technology, which coordinates research and provides funds for the water area, are limited. In 1995, HCST funded NCARTT to carry out a JD 15,000 three year study on the use of marginal water in agriculture. The University of Jordan has not received any funds for research in water or environment from the Ministry of Planning for the last five years.

On the other hand, Universities and research institutes relied on their own resources or funds from international agencies to support their graduate and research programs.

Policy Gaps

The following are areas where policies need to be developed

- Research should be included on the priority list of the National Development Plan. Even the small budget allocated for research in the budget has not been used.
- Existing policy recommendations address narrow strategies rather than offer guidelines to achieve national goals. They call for establishing new bodies of research or coordination rather than working on strengthening the existing institutions.
- Although, there are more than ten research institutions working on water issues, there is no clear program for cooperation or coordination and there is no distinction among them. The transfer of information among these institutions does not exist or is limited to informal relationships.

The participation of the private sector, especially the industrial sector, is limited, relying on the local institutions for problemsolving or providing funds for research. An existing bylaw of the Ministry of Industry and Trade calls for allocating 1% of corporate net profits for research. The bylaw appears never to have been honored.

Constraints to Resolving the Issues

The major institutional and resource constraints for research and development in the water sector include the following:

- There are only limited financial resources in the sector and research must compete with other demands for funds.
- The MWI has had difficulty defining or agreeing upon a research agenda.
- Jordan lacks trained personnel in the fields of information systems, computers, remote sensing and geographical information systems.
- Agencies dealing with policy and implementation do not readily cooperate with those that do research and development.
- The link between research and dissemination is very weak.

Strategy

To implement the proposed policy statement, the MWI will pursue the following strategy:

A national water research program should be established. This program will identify gaps and orient applied research according to priorities and deal with issues in a sustainable manner taking into consideration ongoing research activities.

Action Plan

This strategy will require the following actions

- Establish a unit in the MWI to plan, coordinate and monitor all research related to water in the country
- Identify areas of research and prioritize them
- Prepare data, information, and documents related to applied research. Also, review and assess ongoing research activities in the water sector, and document their findings and make them available for interested parties
- Review relevant laws and regulations and identify roles and responsibilities of private and public sector research institutions
- Encourage the participation of the private sector in research programs in the water sector

Priority Research Areas

Suggested research topics include

- diagnostic studies to identify water losses and determine municipal water distribution efficiency,
- increasing efficiency of water use in agriculture, optimum irrigation water requirements, water management, and salinity control (leaching requirements),
- appropriateness of different kinds of farmer organizations and community development approaches for creating irrigation user groups,
- the suitability of irrigation methods to conserve water and reduce losses,
- water quality and pollution control, including domestic water quality, determining suitable water quality for agriculture and pollution prevention of water resources,
- assessment of recycled water on plants, soil, human health, and the environment,
- enhancement of water resources through water harvesting, artificial recharge of ground water, cloud seeding and fog harvesting,
- fertigation on economically important crops,

- new technologies for brackish and saline water desalination and evaluation of renewable energy for this purpose,
- intersectoral water allocations and evaluation of the economic use of water, and
- improving the quality of industrial and treated wastewater

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HUMAN RESOURCES DEVELOPMENT AND TRAINING

In order to improve the capability of Jordan's human resources in the water sector and maximize their efficiency, the MWI shall

- *give priority to human resources development through continuous education, in-service training, career development, and short- and long-term training,*
- *strengthen the existing national water training center and provide it with the necessary support in order to identify, encourage, promote, and organize human resources activities and training needs, and*
- *ensure that recruitment of new staff is based on sound criteria and meeting clear qualifications and provide job security and longevity to qualified personnel*

Background

The two major water sector line agencies in Jordan, WAJ and JVA, have a combined staff of about 9,500 employees serving a population of 4.3 million. The proportion of public sector staff to population is roughly three times international averages. At the same time, the proportion of university graduates in WAJ and JVA is only 8%, and roughly three-quarters have less than a high school degree. The employee profile of the two agencies is likely to remain stable for the foreseeable future. Government employment is secure since it is a deliberate means of combating unemployment. Given the stability in personnel, the most promising means of increasing agency staff efficiency and responsiveness in water development, management, and protection is through active programs in human resources development (HRD).

HRD is a planned and systematic process for determining how best to prepare, assign, and utilize people to fulfill required functions. It entails planning, education, training, and management of public sector employees. Human resources development aims at improving employee well-being and satisfaction through benefits, long-term education, staff incentive programs, career ladder and succession planning. Training improves performance by strengthening employee knowledge and improving procedures, structures, and management. Training is an important management tool for motivating staff and improving organizational performance. Other solutions, such as better supervision, adequate incentives, availability of the right tools and equipment, and decent working conditions, are also critical in improving performance.

Importance of the Issue

Human resources development is of considerable importance to Jordan as a policy issue for several reasons:

- Jordan's worsening water shortage requires a public sector staff of the highest caliber to address the country's problems in innovative and effective ways. New expertise in water rights, pricing, geographical information systems, modeling, and public awareness, among many others, will be required.
- As present line agency responsibilities are decentralized or privatized, the nature of public sector work will change, and staff must be able to adapt accordingly. For example, in order for farmers in the Jordan Valley to play a role in water management, line agency staff in the headquarters and particularly in the directorate offices will need to be trained in management techniques to work collaboratively with them.
- New areas of concern are already emerging within the water sector which will require both technical and management skills to respond. Primary among these is a greater focus on environmental issues for both WAJ and JVA, as public concerns about water quality and pollution grow and the agencies become more aggressive in regulation and enforcement.

Certainly, clear policies already exist concerning the terms of employment and benefit packages of government workers. More transparent procedures concerning recruitment and terms of reference are required. Further clarity is also needed concerning national priorities for technical and management skills and the means through which they will be transferred. A national water sector training strategy and implementable program are needed now in order to prepare for the next quarter century.

Current Policy Framework

At present, policies for human resources development are set by the Civil Service Commission and are applied consistently across all sectors, but problems abound. In general, training and career development is not linked to promotion. The only institutionalized in-service training is done at the Jordan Institute for Public Administration and is required for promotion to special grades according to civil service bylaws.

In the water sector, efforts at HRD have been fragmented and scattered. In 1984, WAJ established a training center aimed at identifying training needs and organizing and presenting courses to upgrade technical skills in the operation and maintenance of the water distribution and sewage networks. In practice, the center did not achieve its objectives, except for conducting a limited number of courses for WAJ employees. In 1988-89, a study by USAID recommended an institutional and human resources development policy for WAJ and JVA, but these recommendations were never implemented. The main recommendation was the development of an expanded training section to carry out human resources development for WAJ and JVA.

Action Taken to Address the Issue

The water sector of Jordan is composed of diverse interests. Currently, there is no clear policy concerning human resources development and training. However, the Ministry of Water and Irrigation has established a human resources development and training unit. It also plans to establish a National Training Center. The plans for establishing this center are progressing well. The objectives of the center are to

- improve the quality, efficiency, and relevancy of services and training activities currently offered,
- serve all training and manpower development needs of the MWI and ultimately serve international training needs, and
- become increasingly self-sustaining financially in order to reduce the need for donor funding for training.

Policy Gaps

The need for human resources development and training policy has not been fully recognized by the Government. Existing laws, bylaws and civil service regulations have constrained the implementation of needed reform programs.

Policy Recommendations under Consideration

No policy recommendations appear to be under consideration. Efforts have been programmatic, focusing on specific training courses rather than strategic guidelines for strengthening a national capacity in the sector.

Constraints to Resolving the Issue

Among the greatest constraints are the following:

- difficulty modifying existing laws and bylaws,
- civil service regulations which stifle initiative, and
- limited financial resources.

Strategy

To implement the policy, the MWI will pursue the following strategies:

- Develop a national human resources development and training strategy in the water sector to address water sector issues for the next quarter century, which will identify major technical and management skills needed.
- Coordinate activities and clarification of responsibilities among the different educational and training institutes in the country.
- Consideration of the revision of civil service regulations and standards concerning recruitment and promotion to encourage performance.

Action Plan

The strategies will require the following actions

- Establish a human resource development directorate in MWI, which would be responsible for identification of staff training needs and career development
- Review, modify, and coordinate all training programs in the water sector to ensure that they are consistent with the national strategy
- Review plans for the MWI training center, as the focal point of human resource development activities in the water sector

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PUBLIC AWARENESS

An effective means of achieving the Government's objectives in the water sector is through the direct involvement of the people. The MWI shall

- *support public awareness programs to encourage the conservation and protection of the Kingdom's limited water resources and observation of its regulations*

Background

Public awareness is primarily a means of informing and educating water users about the seriousness of the water situation in Jordan. In so doing, it is a tool for managing water demand and can be used to help rationalize water consumption and encourage conservation at the household, business, or farm level. Public awareness programs could substitute for other demand management methods, including raising water prices, introducing water saving devices, and rationing water supply, which may be less acceptable to the general public. Public awareness is also a means of directly confronting the degradation of the resource by having end users understand its implications and seeing themselves as caretakers who can protect the quality of water, neither contaminating it themselves or permitting others to pollute it. It also has critical institutional components, since public awareness must be carried out within some organizational setting which involves budget allocations and determination of roles for Government, nongovernmental organizations, and the private sector.

Carrying out public awareness programs is important to Jordan for a number of reasons. There is a general lack of understanding and concern about the value and scarcity of water resources. Any significant changes in how water is conserved or protected will require public support and participation. Public awareness programs seek to conserve and protect water resources through understanding the water situation and the shortages and scarcity of the resource. They raise community understanding and support for water allocation among competing subsectors, and improve the likelihood of the public's helping to develop and accept new policies. By providing information which seeks behavioral modifications, these programs may assist in reduction of illegal water connections and the general misuse and damage of water measurement devices. There is also a need to increase understanding of water conservation issues in Jordan among policy-makers and in the private sector.

Importance of the Issue

There is every indication that the Government believes that public awareness programs are a successful way of reaching the Jordanian populace as a way of modifying undesirable behavior and reinforcing positive efforts. Within the Ministry of Water and Irrigation, an active public awareness program is rapidly gaining acceptance. Policy implications are related primarily to how the Government will collaborate with nongovernmental and other organizations. Given the already collaborative relationships, at least at the policy level, it appears to be only moderately important.

Current Policy Framework

The MWI has decided that public awareness is important to Jordan to encourage water saving and conservation. According to Article 5 of the bylaw No. 54 of 1992, a Directorate of Public Services (awareness) shall be established in the MWI, and according to Article 14 of that bylaw, the directorate will be responsible for conducting studies, formulating public awareness programs, and developing educational media for the purpose of water saving at homes and farms. The MWI bylaw does not mention staffing or budget for the directorate.

Actions Taken to Address the Issue

Current public awareness efforts are focused through MWI which is understaffed in this area. The Directorate of Public Services has carried out public awareness programs similar to the programs carried out by WQIC Project, including lectures, leaflets, radio and TV spots and slogans but has only one employee. Other administrative departments in JVA and WAJ deal with customers to answer their inquiries and are not true public awareness units.

In 1994, MWI and USAID created a public awareness program under the Water Quality Improvement and Conservation Project in cooperation with the Jordan Environmental Society (JES). Programs include lectures, workshops, seminars, special water days and other popular events, behavioral research and training, and training through public awareness campaigns.

Active nongovernmental participants in public awareness programs in the water and environment include JES, HCST, and the Royal Society for the Conservation of Nature.

Policy Gaps

Areas where approaches still need to be clarified are at the operational level rather than the policy level, since the Government has decided that public awareness is important to the water sector and should be actively pursued. These gaps include:

- whether the targeted audience for public awareness programs ought to be all water users, urban or rural, or those involved in industry or agriculture,
- if the programs should be centralized in MWI or also housed in WAJ and JVA or in other ministries as well,
- the role of nongovernmental organizations and relations with the Government,
- the level of budgetary allocations and staffing priorities, and
- the kinds of programs to be carried out, their objectives, and how their performance will be monitored and assessed.

Policy Recommendations under Consideration

Recommendations have focused largely on the institutional setting for water sector public awareness programs. Current thinking supports the creation of an office of public awareness in MWI.

Constraints to Resolving the Issue

Resolution of an institutional home or homes for a public awareness unit will be part of any larger reorganization of MWI. It is unlikely any of the programmatic issues can be adequately addressed until then.

Strategy

To implement water rights policy, the MWI will pursue the following strategies:

- Establish a permanent public awareness and water conservation program in MWI, to include the existing Directorate of Public Services
- Promote and demonstrate water saving systems and devices as part of the public awareness program to be adopted by users

Action Plan

These strategies will require the following actions:

- Conduct workshops and seminars for policy makers in all GOJ departments interested or concerned with water
- Create a training program for ministry personnel and NGO staff on how to design and carry out public awareness campaigns
- Determine the means to carry out public awareness programs on TV, radio, media, workshops seminars and who will do them

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CRITERIA FOR INVESTMENT IN THE WATER SECTOR

Due to the strategic importance of water for the social and economic development of the country, and considering the scarcity of financial resources, the MWI shall

- *place a high priority on investment in the water sector, by both the public and private sectors, and*
- *establish appropriate criteria for ranking and selecting water projects, based on economic, financial, social, and environmental factors*

Background

Nearly all of Jordan's available renewable water resources have been developed. The total water demand, which was 1500 MCM in 1995, significantly exceeds the country's available renewable water resources. Options for increasing the supply are limited, and development costs are increasing. Options include wastewater reuse, shared water resources, and non-conventional water resources, particularly brackish water desalination, all are being investigated. Development and implementation of these options will require large investments from the public and private sectors in the future.

Because of limited financial resources in the water sector in Jordan, setting investment priorities is of critical importance. Criteria need to be developed for prioritizing investments that take into account the current and expected needs of the country. There is a need also to expand domestic water supply and wastewater systems in urban areas and to expand water supply and provide wastewater systems to smaller towns and villages that are currently unserved. New water schemes continue to be identified, and there is a serious need for periodic rehabilitation of existing schemes.

Traditionally, the public sector has invested heavily in the water resource development, and water investments comprise a major share of Jordan's external borrowing. Although public sector investments will continue, private sector investment needs also to be actively pursued. To the extent possible, private sector investments need to be channeled to priority areas set by the Government. Investment criteria need to be developed, which apply to both the public and private sectors. Investment criteria are a means of assisting the Government to set priorities for investment. Economic evaluation methods have traditionally been used to rank investment options. Techniques such as cost-benefit analysis and rate of return analysis are well developed and widely accepted. More sophisticated multi-objective planning techniques have also been developed.

Analytical techniques are limited when evaluating factors, such as human health and the environment, which are not easily quantified or given monetary values. For example, for an irrigation scheme the value of agricultural production and costs of construction can be estimated. The value of land lost due to environmental degradation or the value of exposure to health hazards are more difficult to quantify. All analytical techniques require quantification or the placing of "weighting factors" on these elements.

The Government needs to carefully develop investment criteria which adequately take into consideration environmental, health, social and other concerns relevant to the water sector in Jordan. It should be remembered that decisions may well be politically motivated as well.

Importance of the Issue

Investment in the development and rehabilitation of water resource systems is urgently needed. Criteria need to be developed for prioritizing investments so that benefits from scarce investment capital are maximized.

According to the current five-year plan, investments in the water sector will shift towards the private sector, with the government serving primarily as a regulator. Newly established water supply companies or entities will be expected to be self-supporting, operating without the benefit of Government subsidies, with revenues covering operating costs and depreciation and providing a reasonable profit for the investor.

In order to maximize the benefits of private sector investments, the Government should direct these investments according to well developed criteria. There is a need to establish an investment prioritization policy which sets criteria for action, whether by the government or through the private sector, and effectively channels investments to the highest priority projects.

Current Policy Framework

No policies or regulations exist on prioritizing investment in the water sector, nor have criteria been developed for that purpose. The five-year plan states the following general priority:

"The Government shall channel available quantities of water towards the best possible uses, taking into account the opportunity cost of water."

Although the "best possible uses" have not been clarified in the plan, it is likely that these uses will be identified on the basis of the best possible contribution to the overall socioeconomic development of the country.

Policy Recommendations under Consideration

The World Bank, in the "Water Policy Framework for Jordan," identifies investment as an important means of meeting water demands. According to multi-objective criteria, projects are prioritized as follows:

- modernization and upgrading of water supply systems,
- wastewater treatment and reuse projects, and
- new municipal and industrial water supply projects.

The Water Policy Framework for Jordan states the following as elements of prioritizing investment in the water sector:

The high cost of new water resource development in Jordan places a premium on careful planning, evaluation and phasing of investments in water resources development. The Government intends therefore to update the 1977 Water Master Plan as a guide to future investment programming and with a view as far as possible to meeting long-term water demands in an economically optimum fashion. Projects will be prioritized according to multi-objective criteria "

"Priority will be given to modernizing and upgrading water supply systems. Given their environmental benefits, wastewater treatment projects will be given high priority, and programs will be developed to utilize treated wastewater in irrigation. Government recognizes, however, that even if full advantage is taken of conservation and reuse programs, additional water supplies for municipal use will still be required to meet anticipated demands. Given financing and implementation constraints, precedence among new supply projects will be given to projects which make a significant contribution to meeting rising municipal and industrial demands "

Actions Taken to Address the Issue

Updating of the National Water Master Plan is being undertaken. It will provide broad guidelines and the initial identification of future investments in the sector. Further analysis will be required to define and prioritize projects for investment purposes.

Policy Gaps

Presently, there is no policy for investment in the water sector. There is a need to establish a coordinated and integrated investment program that takes into consideration priorities and the availability of funds.

Although the government has indicated support for private sector investment in the water sector, mechanisms are not yet in place that will encourage investment. Investors need to be assured that they will be allowed to pursue reasonable profits, while the government needs to be assured that the water system infrastructure will be adequately maintained by investors.

Constraints to Resolving the Issue

Major constraints include the following:

- There is confusion about the existing institutional framework of the water sector. Therefore institutions expected to implement the objectives can not be expected to act effectively.

- The present management of the water sector does not separate policy and planning functions from water and wastewater systems operations. An impartial entity needs to be involved in establishing and implementing an investment prioritization policy.
- Confusion persists about intersectoral allocation of water and there is no clear set of priorities as a basis for such allocation. Such priorities will need to be established prior to developing investment criteria in the water sector.

Strategy

To implement the policy, the MWI will pursue the following strategy

- Establish an economic analysis unit within the MWI to be responsible for establishing criteria for investment in the water sector and applying those criteria to proposed development and rehabilitation projects.

Action Plan

The strategy will require the following actions

- Develop comprehensive criteria for investment in the water sector based on economic, financial, social, environmental, geographic, demographic, and other factors.
- Develop specialized criteria applicable to private sector investments.

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REHABILITATION

In order to realize the economic, financial, and social benefits of water projects, prolong their operational life, and reduce the cost of their rehabilitation, the MWI shall

- *ensure that water projects are appropriately designed, constructed, maintained and monitored,*
- *ensure that rehabilitation of water systems forms an integral part of water resources development and management programs and that rehabilitation projects are carried out in a timely manner,*
- *develop and apply investment criteria in deciding on the implementation of rehabilitation projects, and*
- *encourage participation by users and in particular by the private sector in rehabilitation and upgrading projects whenever possible*

Background

Jordan has invested heavily in basic infrastructure particularly in the water sector. Construction of the country's water infrastructure came through projects which were implemented over an extended period of time, many with foreign assistance. Normally each project passes through what is termed the "project cycle". The cycle starts with project identification, prefeasibility, design, feasibility and ends with the construction of the facility or system. Upon completion of construction the facility or system is operated and maintained through its useful life. Rehabilitation of water systems has been "projectized" as well, often with documentation which is prepared to meet the requirements of external funding organizations.

For the purpose of this profile, the terms rehabilitation and upgrading are used interchangeably since for water projects there are generally elements of both the rehabilitation and upgrading of systems to meet using demands or for other reasons.

Rehabilitation is often seen as a means of extending the useful life of a project. Some water systems may require rehabilitation earlier than foreseen by the original planners. This may result from inadequate attention to operations and maintenance or be the result of design or construction flaws. A common issue is that, for budgetary or other reasons, water agencies may defer regularly scheduled maintenance, repairs, and replacement of equipment and instead develop a project which then restores, and in many cases, upgrades a system. During the period when maintenance is deferred, service to customers may deteriorate and the strain on equipment and infrastructure may be greater than if routine maintenance had occurred.

Some projects such as many water systems, have long lifespans during which relevant new technologies and innovations become available. Rehabilitation in order to modernize and upgrade technology may be desirable because of resultant lower operating costs or higher efficiencies.

Water systems are often designed and constructed with inadequate participation of water users. Examples include the location of public water distribution points and irrigation outlets. Rehabilitation offers an opportunity to upgrade water systems and make them more user friendly. It also provides an opportunity to improve management, such as through improved zoning of water distribution networks and improved irrigation control and measurement structures. Water users and other stakeholders familiar with the operation of the systems can provide valuable input to the rehabilitation process. These suggestions, when incorporated, can result in improvements in efficiency and improved relations with customers.

Importance of the Issue

Rehabilitation is important to achieving the full benefits of water resource projects. It is a recurring requirement due to the aging of infrastructure and equipment. Rehabilitation is also an opportunity to upgrade to more efficient equipment and technologies, decrease operations and maintenance costs, and better meet increased population and per capita demands. Rehabilitation

may become less important where water systems are run on commercial basis and operations and maintenance funds are met through earned revenue

At the end of 1994, cumulative capital expenditure in the water supply and wastewater sector amounted to 569 MJD with a net book value of 411 MJD after deducting depreciation allowances. Investment in domestic water distribution networks amounted to 317 MJD, representing 56% of total investment expenditures. Other investments included drilling and equipping wells, water storage, pumps, drilling machines and equipment, irrigation and dams, water meters and wastewater treatment plants.

Rehabilitation projects are used to

- increase the storage capacity of dams,
- convert from open channel distribution to pipes in the Jordan Valley,
- upgrade the municipal water system in the Greater Amman Area,
- rehabilitate and upgrade King Abdullah Canal,
- upgrade wastewater treatment plants, and
- upgrade equipment

The main objectives of rehabilitation of water systems are to

- attain the original or revised benefits of the project,
- reduce leakages and water losses,
- increase the efficiency of water distribution and use,
- expand or enlarge existing facilities such as water dams to increase storage,
- expand and upgrade wastewater treatment plants to handle increased inflows, to reduce undesirable environmental effects and to improve the quality of treated wastewater, and
- replace obsolete technology and equipment

Key factors related to rehabilitation are proper design and construction and adequate operations and maintenance. These factors are important in realizing project benefits and maximizing returns to the beneficiaries in particular, and to the economy in general.

Current Policy Framework

The Economic and Social Development Plan for 1993-1997 is the Government's major document identifying rehabilitation priorities. These priorities include

- upgrading and development of mains and secondary networks for domestic water,
- replacement of surface distribution networks by piped system in the Jordan Valley, and
- improvement of the quality of treated wastewater for use in crop production

Policy Recommendations under Consideration

Although the government does not have a general policy regarding rehabilitation, it regularly funds and seeks donor funding for rehabilitation projects

Actions Taken to Address the Issue

Rehabilitation projects have been carried out for the construction of King Talal Dam, the North Ghor Conversion Project, upgrading Khirbet Al-Samra wastewater treatment plant, and rehabilitation of the Greater Amman area. Some rehabilitation projects are now being implemented such as the King Abdulla Canal Project, while others are planned, such as the rehabilitation and upgrading of wastewater treatment plants and domestic water networks in Irbid, Salt, Ramtha, Mafraq, and other parts of the country

Policy Gaps

One of the major gaps concerning rehabilitation is that investment in some rehabilitation projects is made without detailed analyses of their impact and without consideration of other options for solving the issue under consideration. One example is the rehabilitation of the Zarqa water network which had as its main objective the reduction of unaccounted for water from 57% to an acceptable level of 15% - 20%. Upon completion of the project the reduction in the unaccounted for water was marginal, indicating that leakage was not a main component of the unaccounted for water. The main factors were then identified as the practices of water users, lack of proper enforcement, lack of public awareness, and the coordination with local councils and voluntary organizations and groups

Constraints to Resolving the Issue

The following is a summary of the main constraints to resolving issues related to rehabilitation

- lack of trained manpower,
- inadequate monitoring and evaluation techniques,
- lack of As Built Drawings and inadequate information on constructed systems,
- lack of equipment, spare parts and tools, and
- inadequate operations and maintenance budgets

Strategy

To implement the policy, the MWI will pursue the following strategy

- Prepare rehabilitation plans for all existing water projects indicating their expected dates of implementation. Include rehabilitation plans in all new infrastructure projects relating rehabilitation to operation and maintenance
- Establish a system for improved review and control of the design, construction, operation and maintenance, and monitoring of water resources projects and systems

Action Plan

The strategy will require the following actions

- Prepare rehabilitation plans which include an assessment of the hydraulic performance of water distribution networks and identification of needs, the present live storage of major dams, the present and future yield capacity of the groundwater wells and identify appropriate rehabilitation techniques, and the performance of irrigation systems and identify priority rehabilitation needs
- Review present methods for review and control of design and construction. Review specifications and guidelines for the design, construction, maintenance and monitoring of water projects. Recommend improvements in the process
- Require that documentation for all new water projects includes an analysis of future rehabilitation requirements, based on past experience. Estimate the relationship between operations and maintenance expenditures and the frequency and degree of rehabilitation

- Develop participatory methods to include water users and other stakeholders in project design, construction, operations and maintenance, and rehabilitation activities whenever possible

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PRIVATE SECTOR PARTICIPATION AND PRIVATIZATION

Due to budgetary constraints and the high investment required for water sector expansion to meet increased demand and in order to improve efficiency in the administration and management of the water sector, the MWI, while maintaining its regulatory role, shall

- *consider private sector participation and/or privatization of water sector activities which are judged to be economically, financially, socially and technically feasible*

Background

It is widely accepted that government-owned enterprises are not characterized by efficiency of operation. In the water sector, public sector ownership and management often results in low financial performance, poor quality and quantity of products, and low reliability of services. Privatization, the transfer of infrastructure and services from the public to the private sector, is one means of improving performance, and it is strongly encouraged by international development agencies in countries suffering from chronic budgetary constraints.

Privatization is not new to Jordan. Two private sector companies distribute more than 70% of the electric power produced in the country. There are private sector activities in the fields of health care and medical treatment and energy, exemplified by the Petrol Refinery Company. Other publicly owned utilities, including transportation and communications, have been identified as targets for privatization. The water sector activities of supply, distribution and wastewater treatment are also frequently mentioned.

Importance of the Issue

The water sector is among the largest in Jordan. It is the largest sector in terms of public expenditure (about 30% of total scheduled in the 1993-97 development plan) and is responsible for a major share of Jordan's national debt. Due to the growing demand for water from many quarters, new and sizable investments are continuously required. The government is committed to securing water services at affordable prices and acceptable standards. It is also committed to extending these services to remote and less developed areas. Past performance indicates low levels of efficiency in the management of water resources. In the future, demand and competition will increase for the limited resource. Privatization, by attracting private financial resources and improved administrative capabilities, is one means of increasing that efficiency.

Current Policy Framework

No policies exist on private sector participation or privatization in the water sector. Virtually the entire water sector of Jordan is publicly owned and operated. Minor exceptions include construction contracting, provision of equipment and materials, water selling by privately owned wells or tanks with government approval, and bottled water industries.

The current five-year development plan (1993-1997) mentions the following as elements of any privatization initiative:

- securing a proper climate for private sector investment,
- activating the private sector role in the area of infrastructure and basic services,

- adopting a tariff system that reflects real production costs,
- restructuring public sector institutions in the field of water use, and
- enhancing the regulatory and supervisory role of government agencies

At the conclusion of phase one of a three-phased study for the restructuring of the water sector being carried out by CIDA, in cooperation with MWI, the government agreed to a set of principles intended to improve performance and efficiency in the water sector and provide positive inputs to more participation of the private sector. Important among them were approved principles in commercial orientation and financial viability in the management of the water sector.

Actions Taken to Address the Issue

There appear to have been no actions to date on this issue.

Policy Recommendations Tabled or under Consideration

The only recommendation officially considered so far regarding this issue has been those proposed by CIDA which are supportive of private sector participation.

Policy Gaps

Despite the greatly increasing involvement of the private sector in economic activities of the country, no policy concerning privatization has yet been officially adopted for the water sector.

Constraints to Resolving the Issue

Unlike opportunities for the private sector in public transport, communication and energy, prevailing conditions in the water sector seem to be less attractive. The reasons are as follows:

- The government has long committed itself to charging nominal prices for water for domestic use and for irrigation in order to keep prices at an affordable level.
- Most water sources are remote while urban and rural population centers are dispersed. Due to the Government's commitment to deliver water services to all inhabitants, huge investments are required giving generally low returns.

- In big and diversified economies, incentives for the private sector are often based on tax rebates and other measures. Given Jordan's economy, incentives for the private sector to make sizable investments might be inadequate.
- There are concerns that privatization may cause higher prices and unemployment. Addressing these fears and doubts is a serious challenge to the Government.
- The capability of the Jordanian capital market to finance the required investments might represent a potential constraint.
- As a new approach to water sector administration, privatization requires extensive and innovative legal measures.
- There is a perception that privatization is less attractive as the basis of a reform program than are commercialization, decentralization, and upgrading of existing water sector management.

Strategy

To implement water policy, the MWI will pursue the following strategy

- Investigate the capabilities of the local capital market and assess the possibilities of private sector financing in the water sector activities.
- Review experience in Jordan in privatizing other sectors to identify lessons learned that can be applicable to the water sector.
- Establish criteria and standards for water quality, water concessions and other legal, institutional, social and economic considerations to form the basis for application.

Action Plan

The strategy will require the following actions

- Conduct an in-depth study of privatization in Jordan to explore the extent of its applicability to the water sector, identify water sector functions that can be profitably privatized, and outline legal and institutional requirements for privatization.
- Hold workshops for representatives of the concerned government agencies, the private sector, water users to discuss opportunities and options for privatizing the water sector.

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