THE HASHEMITE KINGDOM OF JORDAN

Ministry of Water & Irrigation

Water Utility Policy

Amman, Jordan
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FOREWORD

A Water Strategy for Jordan was prepared by the Minister of Water and Irrigation of the Hashemite Kingdom of Jordan and his staff. It was adopted by a joint session of the Board of Directors of both the Water Authority of Jordan and the Jordan Valley Authority.

The Strategy was then debated and approved by the Development Council of the Government, and later discussed and endorsed by the Council of Ministers on 29 April 1997. Under this Strategy, a series of policies are to be formulated and adopted by the appropriate bodies of Government.

The first such policy addresses the Water Utility. The policy was prepared by the Minister and his staff. It was then debated in a session of the Board of Directors of the Water Authority of Jordan and was approved. The document was then forwarded to the Prime Minster who asked it be examined by the Development Council. It was reviewed and debated by the said council on 23 July 1997, and the Council of Ministers approved it in its session on 26 July 1997.

The Water Utility Policy addresses most if not all of today's issues that are related to the water utilities, and spells out the policy towards them. It is understood that, while the Strategy goals are long term, the policies themselves are not as permanent. They would change with changing times and relevant factors.

It is hoped that the policies would serve the purpose with few amendments for a period not less than five years, expectedly more. They, nonetheless, respond to an urgent need at this time and serve to assist in the clarity of vision and transparency of government's intentions towards the water sector.

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Introduction

Water is a scarce and precious resource that is of vital importance to the continued socioeconomic development of the Kingdom. It requires careful planning based on long-term data of available water resources - surface water, groundwater including the deep aquifers, brackish water and appropriately treated wastewater generated from the urban areas. Limited available water resources must be used in an equitable way, taking into consideration various water rights, priority for reasonable domestic use, established socioeconomic development and other uses such as agriculture, industry and tourism.

1. The Water Strategy

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 will be based on comprehensive and reliable data, including data on water quantity, quality, and utilization. The supplies of surface water, groundwater, and treated wastewater, and their utilization will be carefully monitored. The importance of shared surface water supplies and groundwater aquifers demands careful and consistent assessment and monitoring of these resources. Other non-conventional water resources, particularly brackish water resources, will be assessed, as desalination becomes more economically feasible.

The full potential of surface water and groundwater shall be developed based on the economic feasibility and taking into consideration the relevant social and environmental impacts. Investigation works of deep aquifers shall be conducted to support development planning. The interactive use of ground and surface water with different qualities shall be considered, and assessment of the available and potential resources shall be conducted periodically.

A Water Strategy has been formulated by the Ministry of Water and Irrigation, and was adopted by the Council of Ministers on April 26th, 1997. The strategy stresses the need for improved resource management with particular emphasis being placed on the sustainability of present and future uses. Special care shall be given to protection against pollution, quality degradation and depletion of resources. Furthermore, the Ministry of Water and Irrigation shall continually aim at achieving the highest practical efficiency in the conveyance, distribution, application and use, and shall adopt a dual approach of demand management and supply management, with tools of advanced technology being increasingly utilized to enhance the resource management capabilities. The interactive use of multiple resources shall be targeted to maximize the usable flows, and maximize the net benefit from the use of a unit flow of water. In conjunction with this, there will be a targeting of the minimum cost of operation and maintenance with the cost of production of future industrial, commercial, tourism and agricultural projects being measured also in terms of their requirements of units of water flow. Performance efficiency of the water

and wastewater systems and the management thereof shall be monitored and rated, and the improvements on performance shall be introduced with due consideration to resource economics.

The Water Strategy ensures that the rightful shares of the Kingdom's shared water resources shall be defended and protected through bilateral and multilateral contacts, negotiations, and agreements. Peace water and wastewater projects, including the scheme for the development of the Jordan Rift Valley, shall be accorded special attention for construction, operation and maintenance. Due respect will be given to the provisions of international law as applicable to water sharing, protection and conservation, and those applicable to territorial waters. Bilateral and multi-lateral co-operation with neighboring states shall be pursued, and regional co-operation shall be advocated.

As part of the Ministry's efforts to manage the water resources more efficiently a long-range plan shall be formulated for the development of the resources, and a revolving five-year plan shall be extracted from it and updated as necessary. The revolving plan shall be compatible with those formulated for the other sectors of the economy. A parallel investment plan shall accompany the development plan.

2. Institutional Development

The Government will adopt the most efficient and effective means for optimizing national objectives in the water sector. Among the main requirements for facilitating and accelerating this achievement is an institutional framework compatible with the complexities of water sector issues 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.

A significant reorganization of the water agencies will be necessary to increase efficiency and responsiveness. In this context a thorough assessment of the institutional setting and constraint has been developed, and a program of implementation was adopted. The role of the Ministry of Water and Irrigation (MOWI) will be centered on planning, development of the sector, formulation of policy framework and on regulation of various activities related to the water sector. The restructuring program will produce an overall framework articulated by the following three entities:

The Ministry of Water and Irrigation (MOWI) will remain as a government entity responsible for sector governance. The role of the Ministry will center on providing policy formulation, decision making, centralized data collection, Geographic Information System, monitoring and national water planning for the water sector of Jordan. A comprehensive national water data bank will be established and kept at the Ministry of Water and Irrigation, and shall be aided by a decision support unit. Additionally, this

data bank will be supported by a program of monitoring and a system of data collection, entry, updating, processing and dissemination of information, and will be designed to become a terminal in a regional data bank setup.

The Water Authority of Jordan (WAJ) is moving to separate its bulk water supply and retail functions. The majority of the retail water delivery functions in the Amman Governorate will be managed by the private sector. BOT or similar private sector mechanisms will be considered for new bulk water supply and wastewater treatment facilities. The role of WAJ will change with the expected separation of bulk water from the retail supply, and the adoption of cost accounting methods based on Generally Accepted Accounting Principles (GAAP). WAJ will monitor retail supply contracts, and will become a smaller organization of higher caliber with a major role in the operational monitoring of a number of management contracts with private sector utilities and BOT providers. WAJ will manage the resources as well as those bulk supplies, which are not privatized. Furthermore, it will provide support to smaller retail distribution units, which are not operated by the private sector. The intention is that these units will be operated along commercial lines, with greater local autonomy and with higher stakes for the users.

The Jordan Valley Authority (JVA) has, over the past two decades, implemented a series of successive integrated social and economic development plans. Its activities, particularly in social infrastructure, have witnessed a slowdown over the past decade. The development of the Jordan Valley needs to be re-assessed, and the role of the JVA will be defined accordingly. Future development will have to take a course that builds on the achievements and charts new territories with more focus on such sectors as tourism, industry, manufacturing, advanced technologies, and others. The mandate of the JVA as stipulated in Law No. 19 of 1988 will be sustained. The private sector will be called upon to assume a proper role in development as well as operation and maintenance activities that are being restructured on a more commercial basis. Furthermore, cost accounting methods based on Generally Accepted Accounting Principles (GAAP) will be introduced. JVA's responsibilities will be enhanced as more momentum is gained by the integrated development of the Jordan Rift Valley (JRV) now being studied as a regional project.

3. Private Sector Participation

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. Although in the future, demand and competition are expected to increase for the available limited water resources, the government intends, through private sector participation, to transfer infrastructure and services from the public to the private sector, in order to improve performance and ensure the delivery of services to the population.

The role of the private sector will be expanded with management contracts, concessions and other forms of private sector participation in water utilities being considered and adopted as appropriate. The concepts of BOT/ BOO shall be entertained, and the impact of such concepts on the consumers shall be continually assessed, and negative impacts mitigated. The private sector role in irrigated agriculture shall also be encouraged and expanded. Emphasis will be placed on the social benefits in conjunction with the private investments.

4. Water Pricing and Cost Recovery

In view of the increasing marginal cost of supplying water in Jordan, the growing demand for water, the low rate of cost recovery and in line with the policy towards private sector participation and privatization, the Ministry will set municipal water and wastewater charges at a level which will cover at least the cost of operation and maintenance by the first quarter of 1998. The Ministry will also move towards the recovery of all or part of the capital costs of water infrastructure. Until the cost recovery is full, and the national savings reach levels capable of domestic financing of development projects, project financing will depend on concessionary loans, private borrowing and/or BOO and BOT arrangements.

The water tariffs mechanism shall be considered as a tool to promote cost recovery of water projects. However, profitable undertakings in industry, tourism, commerce and agriculture shall be made to pay the fair water cost. Moreover, the Ministry will attempt to set differential prices for water based on water quality, the end users, and the social and economic impact of prices on the various economic sectors and regions of the country. The Ministry will also attempt to regularly review and adjust water tariffs based on the costs of supply, operations, and the comprehensive analysis of economic data.

5. Human Resources

Although clear policies already exist concerning the terms of employment and benefit packages of government workers, more transparent procedures concerning recruitment and jobs' 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. In order to better prepare for the twenty-first century, a National Water Sector Training Strategy and implementable programs will be developed.

In light of the above, the Ministry of Water and Irrigation will endeavor to improve the capability of Jordan's human resources in the water sector and maximize their efficiency by giving priority to human resources development through continuous education, in-service training, career development, and short- and long-term training. In addition, the Ministry shall 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. Recruitment of new staff will be based on sound criteria thus ensuring that staff qualifications meet job requirements. Human resources performance will be continually appraised in order to upgrade capabilities, sustain excellence, and provide job security to qualified personnel. Incentives for excellence will be introduced in compliance with the needs for dedication, while over-employment will be trimmed to reach optimum employment levels compatible with efficient management.

6. Water Resource Management

Since the shortage of water resources in Jordan was first widely recognized in the early 1970s, 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 will be adopted to enhance water availability, suitability, and sustainability.

It is estimated that in the year 2000 the renewable freshwater resources available per capita in Jordan will be about 160 cubic meters per year. This is less than one third of the widely recognized "water poverty line" of 500 cubic meters per capita per year. This sobering observation requires that water be well managed and used as efficiently as possible, that demand be proficiently managed, that all available sources of water be developed, and that adverse impacts be mitigated through measures of environmental protection.

Surface Water

Development of the country's remaining limited 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.

Surface water potential in Jordan is estimated at 692 Million Cubic Meters per year. Because of the aridity in the eastern, southeastern and southern basins, and because of other economic and geographic constraints, only about 475 Million Cubic Meters of this potential can be developed economically.

In order to enhance the surface water resources, the Ministry of Water and Irrigation is implementing a comprehensive monitoring and assessment program for surface water quantity, quality, and uses, as well as establishing an integrated development and conservation program to increase the potential of surface water development in Jordan.

Since the surface water resources are extremely limited, the Ministry will optimize the development and use of this resource 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.

The Ministry is also pursuing 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.

Groundwater

The unsustainable abstraction of groundwater and the depletion of groundwater aquifers is one of the major problems facing the water sector in Jordan. The reaction to the abrupt surges in population levels has been over abstraction from groundwater aquifers. This was exacerbated by the lack of enforcement of regulations on private sector drilling operations, and the near absence of controls on licensed abstraction rates resulting in the rapid depletion of aquifers and culminating in increased pumping costs due to the drastic drop in the water table, as well as increased salinity levels. Groundwater aquifers are exploited at more than double their sustainable yield in the average. The sustainability of irrigation in the highlands and the Badia areas will be greatly endangered unless strict measures are taken to address this issue. As such, the Ministry is implementing a program that sets out legal and financial measures aimed at controlling and gradually reducing groundwater withdrawals with the final objective of maintaining the safe yield of aquifers. Measures will also continue to be taken to protect the groundwater resources from all sources of pollution.

In order to improve the groundwater situation in the Kingdom, the Ministry of Water and Irrigation is establishing an integrated program to assess the availability and exploitability of all resources at rates that can be sustained over long periods of time. The mining of renewable groundwater aquifers will be checked, controlled, and reduced to sustainable extraction rates. In conjunction with this, the Ministry is pursuing planned and controlled groundwater mining from promising, extensive fossil aquifers as an option to secure incremental supplies for municipal and industrial uses. The groundwater use will take place conjunctively with surface water in places where such joint use has the potential for increasing the available supply. There will also be improvement and centralization of groundwater data collection, analysis, and monitoring, as well as the strengthening of the enforcement of groundwater legislation and regulations. The Ministry will further encourage the application of applied research activities, including artificial recharge to increase groundwater supplies, and the employment of new technologies that will optimize the operation and development of groundwater systems and promote its more efficient and feasible uses.

Wastewater

The Ministry presently provides wastewater collection and treatment services to fourteen major populated areas. At present about 2 million people (about 50% of the population)

are served by sewerage systems and the effluent quantity is estimated at about 60 Million Cubic Meters per year, being reused primarily in agriculture.

In view of the increasing population and the social and economic development of the country, the amount of treated wastewater is increasing. It is estimated that by the year 2020 the volume of treated wastewater will be 200 Million Cubic Meters per year and as such, more wastewater projects are planned. As available freshwater resources become increasingly limited in Jordan, treated wastewater will play an ever more important role in the sector. To protect human health and the environment and to provide additional water supply that meets the approved standards for its use, the Ministry of Water and Irrigation will ensure that appropriate wastewater collecting systems and treatment facilities are provided for all sources of wastewater, wherever feasible. It will also ensure that wastewater is not managed as "waste" but is collected, treated, managed, and used in an efficient and optimized manner. The Ministry will also ensure that treated effluent complies with recently established national standards (JS893-1995) and that all treatment is to a quality appropriate for use in agricultural activities and other non-domestic purposes, including groundwater recharge. Appropriate wastewater treatment technologies shall be adopted with due consideration to sustainability, economy in energy consumption, and quality assurance of the effluent. Consideration shall also be given to the blending of the treated effluent with fresher water for suitable reuse.

In light of this, the Ministry is developing a wastewater master plan, which will establish targets for providing wastewater collection systems and treatment facilities to unserved areas throughout the country.

The Ministry is moving, through restructuring, towards establishing the institutional capability for monitoring, regulating and enforcing wastewater regulations. Industries will be encouraged to recycle part of their wastewater and to treat the rest to acceptable standards before it is discharged into the sewer systems or elsewhere. This will help to ensure that the treated effluent quality exiting wastewater treatment plants conforms to water quality standards for reuse.

Due consideration will be given to environmental issues and contamination of groundwater aquifers in the development of wastewater reuse systems, and standards will be set for the construction and management of septic tanks where it is not feasible to have sewerage collection systems and treatment facilities. In addition, the Ministry will 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.

Brackish Water

Besides wastewater reuse, brackish water, either for direct use or after 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. As such, when referring to statistics about brackish water, the quality, quantity and location of this resource need to be carefully studied in order to assess its potential for utilization.

In order to further pursue the brackish water option, the Ministry must first assess the potential of brackish water resources in terms of sound technical, economic and environmental feasibility in all groundwater basins within the Kingdom, and then conduct research and studies on desalination and on optimization of brackish water use in agriculture and industry. Brackish water resources will then be allocated, either desalinated or in their natural condition, to their best uses in order to provide additional water supply and to ensure water productivity and sustainability. They shall also be listed, along with seawater, for desalination to produce additional water for municipal, industrial and commercial consumption.

The Ministry has consistently encouraged 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. Therefore, technology transfer and the findings of advanced research in genetic engineering shall be introduced to the extent possible for this purpose.

7. Water Quality and the Environment

Jordan has witnessed some deterioration in its water quality in the last two decades due to industrial pollution, overuse of agrochemicals, drainage water, overloading of wastewater treatment plants, overpumping of aquifers, seepage from landfills and septic tanks, and the improper disposal of dangerous chemicals by certain industries. The added population pressure, exacerbated by successive waves of refugees and displaced people, has further degraded the effluent from the Khirbet As-Samra wastewater treatment plant and has resulted in the degradation of water quality in the King Talal Dam, requiring that its reservoir be closed to public access.

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 soils irrigated using effluent. Furthermore,

pollution of surface and groundwater due to seepage will result in the 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, enforcing standards for wastewater discharge to sewers, treated effluent and 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), and 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, or even affordable in some instances. 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 available resources are fully and efficiently 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 between many agencies and at many levels within 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 be 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 these standards easier. To ensure that these 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.

In order 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 Ministry of Water and Irrigation will survey and monitor all water resources for water quality, and ensure that water quality standards are consistently being met. Furthermore,

the Ministry will continuously evaluate and update standards and guidelines for drinking water quality, while simultaneously strengthening the enforcement of standards so that water supplies and wastewater do not endanger the public health.

Particular attention needs to be focused on adopting and enforcing effluent and sludge standards for municipal and industrial wastewater treatment plants and for discharge from laboratories, hospitals, slaughterhouses, and other businesses. Concerns for public health and the health of workers shall be a focus in the programs of reuse of treated wastewater. Laboratories shall, be maintained and properly equipped to provide reliable data needed to ensure safe supplies to the consumers.

8. Service Levels

Policy issues related to water distribution have to do primarily with questions of efficiency and investment. 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, expand them to cover areas not being served, and to improve technical and managerial capabilities.

Specific improvements in Jordan's water distribution systems include the removal of inadequacies in the various components of the existing systems, such as operational problems, metering problems, supply interruptions, under design of pipes, high operation pressures, and absence of pressure zones.

In conjunction with the above, the Ministry of Water and Irrigation will continue with the enhancement of the operation and maintenance of the existing distribution systems and reservoirs, and the rehabilitation of old and damaged components. Conjunctively, the Ministry will continue ensuring proper, safe, and high standards and specifications for pipe and other materials and for construction and operation and maintenance practices.

Since efficient water distribution systems are vital to conserve water, provide better services to consumers, and reduce water costs, the Ministry will improve the efficiency of water distribution through improved planning and strengthened technical, managerial, and financial capability of concerned institutions. The Ministry will also endeavor to meet water demands in the most effective and efficient manner, focusing on proper planning, improving operation and maintenance, and private sector participation, whenever possible.

Investments in municipal 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% of the quantity supplied in 1995.

The most important parameters developed for service level assessment include:

- Maintaining water quality in the networks to be within the standards.
- Frequency of summer water supply.
- Frequency of winter water supply.
- Response time for repair of network leakages, pressure loss, and sewer blockage.
- Reduction in waiting times for water and wastewater connections.
- Reduction in waiting times for the resolution of customer complaints.

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.

The priority criterion for project implementation, and for additional water allocation shall be based on economic, social and environmental considerations. A critical path shall be established for the allocation of each new source of water. Consideration shall be given to the sustainability of the allocation in the light of the national water balance situation and the economic, social and environmental opportunity cost of forgone alternative uses of water.

First priority will be given to allocation of the basic human needs, and as such, first priority is given to the allocation of a modest share of 100 liters per capita per day to domestic water supplies. Expensive additional water has municipal purposes as a first priority in allocation, followed by tourism and industrial purposes.

9. Public Awareness

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 nor 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, non-governmental 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 the 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 the private sector.

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. By supporting public awareness programs that encourage the conservation and protection of the Kingdom's limited water resources and observation of its regulations, the Ministry of Water and Irrigation can better achieve the Government's objectives in the water sector through the direct involvement of the people.

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 non-governmental and other organizations. Given the already collaborative relationships, at least at the policy level, it appears to be only moderately important. With regards to the public however, there needs to be an educational campaign put into effect to inform the public about the value of water for them and the well being of the country for the sustainability of life, and for the economic and social development. Likewise, facts about water in Jordan need to be disseminated such as the cost incurred to provide the service, and the mounting pressure of population growth on the water resources. Economic measures must also be adopted to reinforce public awareness.

10. Conservation and Efficiency Measures

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 both supply and demand. Generally, this can be addressed by enhancing the efficiency of use through the utilization of improved water saving technologies and management practices, and the behavior modification of current practices through, in part, public awareness programs. Water conservation by the Ministry of Water and Irrigation is expected to bring immediate and sizable water savings. Financially, conservation and efficiency measures will help to reduce the need for expensive water supply projects that are primarily designed to provide additional water.

Water conservation and efficiency improvement play a major role in mitigating the problem of water scarcity and shall be given the proper consideration in the Kingdom's water resources development and management programs. Therefore, the Ministry of Water and Irrigation will endeavor to undertake all the necessary measures leading to the establishment of comprehensive programs for water resources conservation, reduction of water losses, and improvement of water use efficiency in all sectors.

11. Investment

Nearly all of Jordan's available renewable water resources have been developed. Current use significantly exceeds the country's available renewable water resources, but still falls well short of meeting demand. Options for increasing the supply are limited, and development costs are increasing. Such options include rehabilitation and replacement of inefficient networks, wastewater reuse, shared water resources, and other non-conventional water resources, particularly brackish water desalination, and are all being considered. Development and implementation of these options will require large investments from the public and private sectors in the future.

Because of limited financial resources available in the water sector of Jordan, the process of setting investment priorities has taken on added importance. Criteria for prioritizing investments that take into account the current and expected needs of the country are currently being developed. There is also a need 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. The same criteria must be applied to the integrated development of the Jordan Valley. 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 will be sought. To the extent possible, private sector investments will be channeled to priority areas set by the Ministry. The investment criteria currently being developed are a means of assisting the Ministry in setting priorities for investment that will apply to both the public and private sectors. Economic evaluation methods such as cost benefit analysis and rate of return analysis have traditionally been used to rank investment options. The Ministry of Water and Irrigation will also take into consideration environmental, health, social and other issues relevant to the water sector in Jordan.

Due to the strategic importance of water for the social and economic development of the country, and considering the scarcity of financial resources, the Ministry of Water and Irrigation will place a high priority on integrated planning and optimal investment in the water sector, by both the public and private sectors, and establish appropriate criteria for ranking and selecting water projects. The updating of the National Water Master Plan,

currently being undertaken, will provide broad guidelines and the initial identification of future investments in the sector.