

# Planning Jordan's Water Future

Lessons Learnt from the  
Water Sector Planning Support Project







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## FOREWORD

Jordan is known to be one of the most water scarce countries in the world, where water shortage has become of a permanent nature, meeting water demands a challenge and managing water resources imperative. Today, we cannot rely solely on surface water and groundwater to satisfy the demands of the population. We also need to look at alternative resources, including non-renewable groundwater, until desalinated sea and brackish water are made available. Reclaimed wastewater is another option and is already being used.

These challenges for Jordan, and the Ministry of Water and Irrigation as the planning body in the water sector, are the main focus of the Second National Water Master Plan for Jordan, supported by the Water Sector Planning Support Project. This time, and with the help of our GTZ partners, our National Water Master Plan is a dynamic plan. This is the first National Water Master Plan that has been conceptually developed and produced locally by the Ministry of Water and Irrigation and is based on integrated water resources management principles. In addition, it addresses water sector issues in a holistic manner, including resource and demand management, institutional, legal, socio-economic, and environmental and trans-boundary considerations. Not only is this plan important in terms of integrating existing and proposed water supply plans with due regard to sustainability, it is also timely as we are engineering new and innovative approaches to water management and project financing.

We hope that the information in this brochure, outlining lessons learnt during the course of the development of the National Water Master Plan, within the framework of the Water Sector Planning Support Project, will help interested experts, decision-makers and citizens to gain a deeper insight into the challenges of such a planning exercise, a prerequisite for common efforts in tackling them.



Eng. Sa'ad Bakri  
Secretary General  
Ministry of Water and Irrigation



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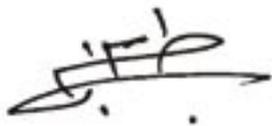
## INTRODUCTION

After 11 years of work, the joint Jordanian-German cooperation project “Water Sector Planning Support” between the Ministry of Water and Irrigation (MWI) and the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), funded by the German Ministry for Economic Cooperation and Development (BMZ), has come to an end. After such a long period of time it is important to wrap up the themes and experiences of the project and to consider the lessons learnt by its different contributors. This brochure summarises the impact and findings of the “Water Sector Planning Support” project.

The main objective of the project according to the project agreement, was to improve water sector policies and planning in Jordan in order to provide better services to water users. During the course of the project a new digital National Water Master Plan (NWMP) was developed, which contains the framework, data and tools to allow the MWI to make water policy and strategy decisions that are based on systematic and realistic scenarios. This will help to guarantee the sustainability of Jordan’s water resources management. In a region where the future limitations and potential conflicts regarding water allocation are increasingly under the spotlight, the MWI is now in a good position to pursue integrated water resources planning.

Under the project, medium and long-term strategic water allocation plans have been developed based on the digital NWMP, its software tools and a water information system database. The data holdings of the MWI have been significantly improved, both quantitatively and qualitatively. The digital planning tools developed by the project are supporting the MWI in the future updating of the NWMP while training on the NWMP software tools and their application has enabled MWI staff to generate new scenarios for alternative planning. The newly created National Water Master Planning Directorate will have the necessary competence to follow up this task.

One key to the success of the NWMP as a national planning document is the institutionalisation of the NWMP recommendations in all project planning and investment decisions in the water sector. The ultimate goal of the NWMP, to reach a water balance by 2020, can only be achieved if regional planning takes the national perspective into consideration. This goal is vital for the life and wellbeing of Jordanians, and with the joint Jordanian-German cooperation project now at an end, we are confident that it can be reached.



Eng. Suzan Taha  
National Water Master Plan Director, MWI



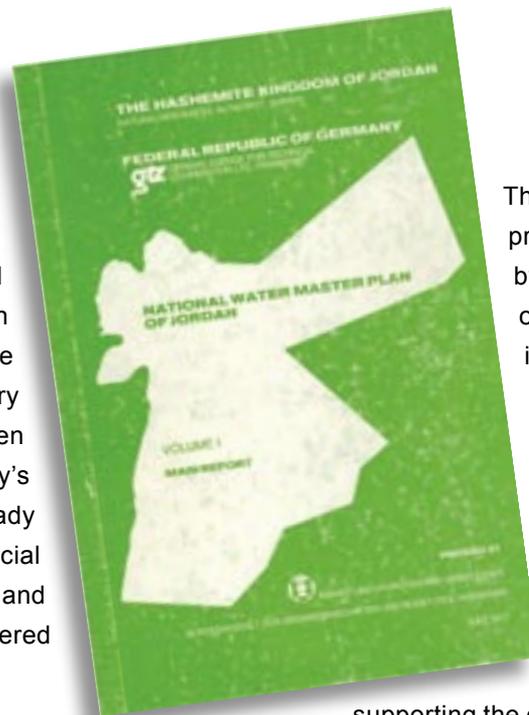
Dr. Philipp Magiera  
Team Leader, GTZ

## PROJECT HISTORY

The taps in Jordan are still running but if the current trend of water consumption, over-extraction, continued leakage and unbalanced allocation in the country goes on unchecked, it is just a matter of time before the water shortage situation facing the country evolves into a more critical problem, and even to a major disaster. As most of the country's conventional water resources are already utilised, in theory at least, almost every official and citizen in Jordan is aware that drastic, and even painful, measures must be considered starting now

To deal with such a serious prospect it had become imperative to establish a new comprehensive framework and propose national guidelines within which all components of the water situation are outlined, analysed and addressed. The process has involved identifying available water resources, forecasting future demand, monitoring population growth, maintaining industrial development, listing priorities and finding alternatives and substitutes for the declining resources. The ultimate task was similar to drafting a state budget: finding a way to strike a balance between revenue and expenditure, actual resources and volume of consumption and between reality and virtual reality.

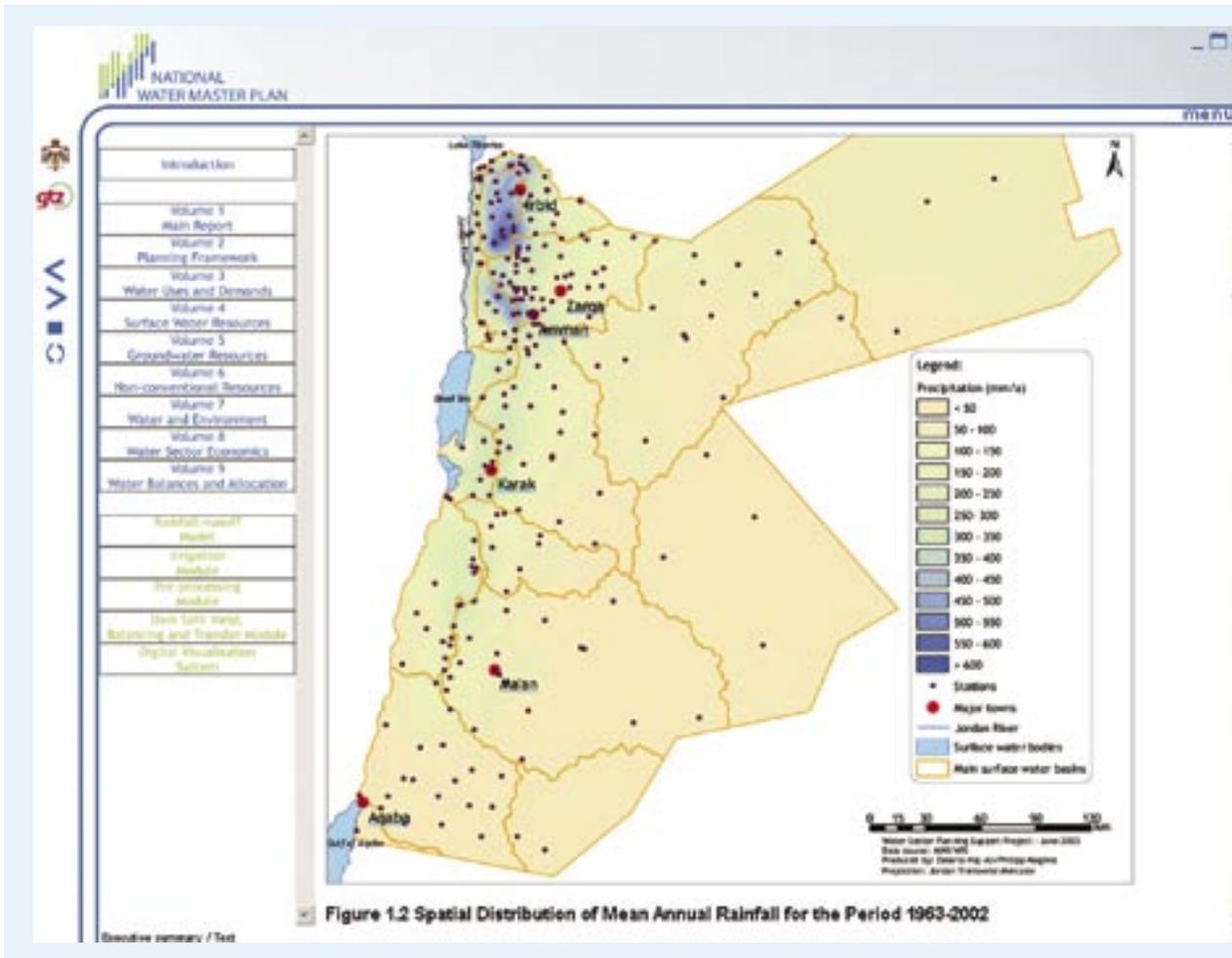
Project activities started in summer of 1993, at a time when the project was called "Strategic Planning Unit at the Ministry of Water and Irrigation". In the beginning, the project aimed to build capacities and support the operation of a Strategic Planning Unit within the MWI. The scope of the unit was to improve strategic planning capabilities and to raise the efficiency of water resource management.



The first years of the project were governed by the differing views of succeeding Ministers of Water and Irrigation on the usefulness of the Strategic Planning Unit and in 1996 this led to a change in project approach. The project first concentrated on

supporting the development of strategy and policy papers that formed the basis of Jordan's Water Strategy and Policies. The development of a National Water Master Plan then came increasingly into focus, with the first option being an update of the NWMP of 1977, which was originally developed with GTZ support.

Once it became clear that a mere update of a static paper document would not satisfy Jordan's requirements for future integrated water resources planning, it was decided that a new digital NWMP should be developed, making full use of the support that software modules are able to provide during planning exercises. The idea was to create modules that would serve the long-term needs of the water sector and that would support the continuous updating of the NWMP. By that time, the project objective was finally formulated as "*Water users benefit from improved policies and actions based on appropriate data and impact analysis*".



Software development had started in 1997 and the focus of project work from 2000 onwards was the finalisation of the digital planning tools, the integration with the Water Information System (WIS) database at the MWI, training of staff and the improvement of data quality and data flows. In order to test the NWMP modules for scenario development of future water demands close cooperation was sought with the *Study on Water Resources Management in the Hashemite Kingdom of Jordan* funded by the Japanese International Cooperation Agency. In 2001, the MWI decided to create the National Water Master Plan Directorate, which took over the task of finalising the NWMP and now plays the role of the Strategic Planning Unit that the project sought to create from its outset.

In 2004, the NWMP was finalised and presented to the public during the *International Water Demand Conference* by the Minister of Water and Irrigation, Dr. Hazim El-Naser. Through the publication of a series of brochures, workshops, a short film and the posting of the summary NWMP on the MWI's website, the project also sought to bring the findings and recommendations of the NWMP to the attention of all stakeholders in the water sector and the interested public.

The project closed at the end of August 2004. Against continuing poor odds, the Jordanian Government, represented by the MWI, and GTZ are joining forces to face the challenge of keeping the taps running in Jordan, at least for the near and foreseeable future.

## PROJECT PARTNERS



### MINISTRY OF WATER & IRRIGATION (MWI)

The Ministry of Water and Irrigation (MWI) is the official body responsible for the overall monitoring of the water sector, water supply and the wastewater system. It is responsible for their related projects, planning and management, the formulation of national water strategies and policies, research and development, information systems and procurement of financial resources. Its role also includes the provision of centralized water related data, and the standardization and consolidation of data.

The MWI was established in 1992 under a bylaw issued by the executive branch of the Government under the Jordanian Constitution. The establishment of the MWI came in response to Jordan's recognition of the need for a more integrated approach to national water management.

The MWI embraces the two most important entities dealing with water in Jordan:

- The Water Authority of Jordan (WAJ): in charge of water & wastewater systems.
- The Jordan Valley Authority (JVA): responsible for the socio-economic development of the Jordan Rift Valley, including water development and the distribution of irrigation water.

This position with respect to the WAJ and the JVA reinforces the MWI's leading role as Jordan's ambassador on water issues with its sister organisations WAJ and JVA.



The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH is an international cooperation enterprise for sustainable development with worldwide operations. It provides viable, forward-looking solutions for political, economic, ecological and social development in a globalised world. GTZ promotes complex reforms and change processes, often working under difficult conditions. Its corporate objective is to improve people's living conditions on a sustainable basis.

GTZ works mainly for the German Federal Government. Its main client is the German Federal Ministry for Economic Cooperation and Development (BMZ). Currently, GTZ is implementing some 2,700 development projects and programmes in over 130 countries. GTZ has its own offices in 67 of these countries (including Jordan), and in 2003 its turnover was almost 900 million €. Of GTZ's approximately 10,000 employees, some 1,000 people are employed at the Head Office in Eschborn near Frankfurt am Main.

GTZ was established in 1975 and is organised as a private company owned by the German Federal Government. Ever since it was founded 30 years ago, it has been actively involved in the promotion of Jordan's social and economic development. GTZ's initial work focus was broad, ranging from projects in agriculture and forestry to the promotion of the health sector as well as academic and vocational institutions. However Jordan's increasing modernisation and changing needs have prompted GTZ to concentrate its efforts on a few key areas and since 2001, its focus has been on the water sector.

## BACKGROUND ON JORDAN'S WATER PROBLEMS



Jordan is a young, developing and aspiring nation but one of its main handicaps has been the scarcity of two natural resources vital to the nation's survival, namely water and energy. To make up for this shortage, Jordan has focused on developing its human potential and has paid special attention to fostering good relations with friendly developed nations.

The water shortage in Jordan can be attributed not only to the scarcity of existing water resources such as wadis, rivers and underground water bodies, all of which depend on short-lived winter rainfall, but also to one of the fastest growing populations in the world, and in some cases to poor water use practice. The problem is further compounded by the fact that its water resources are unevenly allocated among the four consuming sectors: agriculture, municipalities, tourism and industry. Agriculture takes the lion's share, using 65 per cent of all available water.

In the middle decades of the 20th century agriculture was considered one of the main pillars of the national economy and the allocation of water for this sector was taken for granted. With a population that did not surpass the two million mark during that period, it was understandable that providing irrigation water for cultivable lands was given a priority second only to the provision of drinking water. However, the sudden influx of refugees and displaced persons fleeing turmoil zones in the region such as Palestine in 1967, Kuwait in 1991 and Iraq after 2003, accompanied by considerable interregional worker migration, improved health services and the persisting high birth-rate,

have generated significant new claims on the steadily diminishing water resources. Consecutive low rainy seasons and drought, especially during the late 1990s, further accentuated the problem of water scarcity.

The geographic location and topographic formation of Jordan have to do much with its meagre water resources. The country is divided into three major geographical regions: the Jordan Rift Valley to the West where a sub-tropical climate prevails during most of the year. Average rainfall in this region during the rainy season, from October to late April, is around 350 mm/a in the northern section of the valley, 200mm/a in the Dead Sea area in the middle and 50mm/a in the Southern Ghors and Wadi Araba area to the south. To the east of the valley are the northern and southern highlands. Rainfall in the north, around the Ajloun area can reach 600mm/a, accompanied by frequent snowfalls in winter. To the east of these highlands stretches the Badia and southern desert that make up more than 80 per cent of the total area of Jordan. Here the annual rainfall rarely exceeds 100mm/a.

Due to high temperature and sunny days all year round, even in winter, more than 90 per cent of the total rainfall estimated at 8215 MCM/a, is lost via evaporation. The remaining 10 per cent is used to meet the country's need for water. About 5 per cent of the rainfall infiltrates into the ground to replenish the aquifers and groundwater bodies while about 3 per cent makes the flood flow.

Other important sources of water are those shared



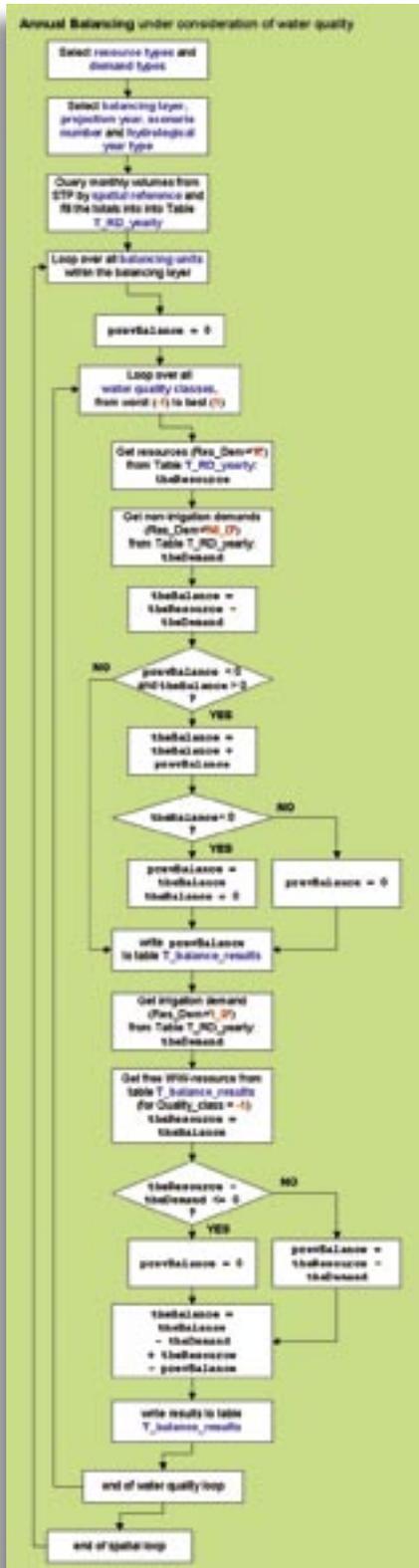
with neighbouring countries such as the Yarmouk River in the northern most point of the Jordan Valley. It originates from Syrian territories and is then diverted to Jordan through the 110 km long King Abdullah Canal (KAC). Shared groundwater basins also exist: The Basalt aquifer shared with Syria yields about 70 MCM/a. The Disi fossil groundwater in the south shared with Saudi Arabia will last for 50 years if the annual extraction does not exceed 125 MCM/a. Water extracted from this basin is so far mainly used to irrigate corporate farms in the south of Jordan.

Following the signing of a peace treaty between Israel and Jordan in 1994, Israel recognized Jordan's legitimate rights in their two trans-boundary watercourses. Consequently Jordan receives its share from the Yarmouk River, and additional water from the Jordan River and Lake Tiberius, through a pipeline feeding into the King Abdullah Canal.

Sustainable groundwater yield for extraction in Jordan is estimated at 260 MCM/a while baseflow provides nearly 220 MCM/a. Jordan's renewable natural water resources range between 800 to 850 MCM/a in total.

These figures are obtained at monitoring stations built near and around the wadis, meteorology stations, wells, springs and wastewater treatment plants.

## APPROACH TO NATIONAL WATER MASTER PLANNING



According to the United Nations<sup>1</sup>, the primary objective of a Water Master Plan is to establish a basic framework for:

- Orderly and integrated planning and implementation of water resources programmes and projects; and
- A rational water resources management consistent with overall national socio-economic development objectives.

The NWMP thus provides a framework for the future development of the water sector, helps assess future impacts of measures on the water budget and proposes solutions for achieving a balance between water resources and demands, assuring the availability of sufficient water supply to all users.

The actual water use is determined by the available water resources and the actual water use efficiency. Water demand in Jordan is greater than the actual water supplied, thus creating a water supply deficit. In order to reduce this deficit and to secure adequate (quantity and quality) long-term water supply for all uses, fulfilling socio-economic, financial and environmental sustainability, the government has three options to consider: (a) Increase available water resources; (b) Improve water use efficiency and/or, (c) Decrease water demand. Accordingly, policy adjustments, development strategies and action plans can be made. These options were all part of the development process of the NWMP.

The NWMP provides the guidelines that originate from balancing water demands and resources. In order not to overuse the available resources, especially renewable groundwater, Jordan's water demands need to be tailored in accordance with what water can be made available at reasonable cost and with the lowest possible environmental impact. The principles governing the balancing and allocation routines in the NWMP all originate from the Water Strategy and Policies of the MWI. The most important concerns are:

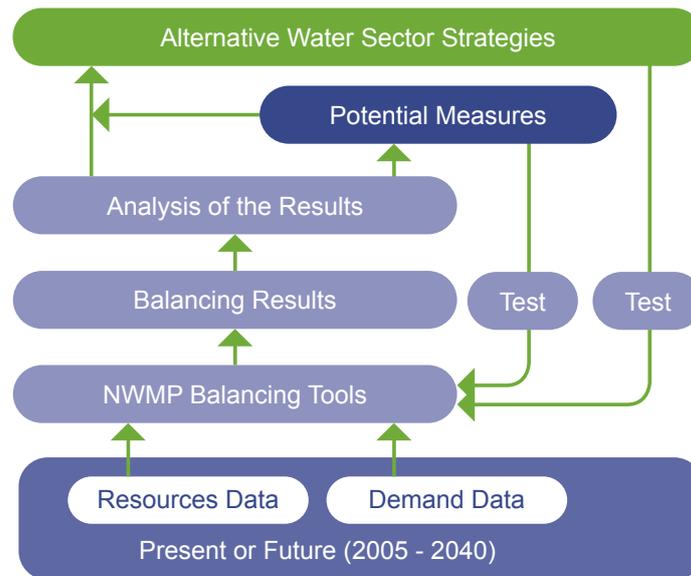
- First priority to drinking water, then tourism, industry and irrigation
- Assurance of a minimum of 100 l/c/d of water supply to all citizens, independently of their place of residence
- Full reuse of all treated wastewater
- Mainstreaming of demand management in all planning and operations
- Reducing the extraction of renewable groundwater to sustainable levels
- Increasing efficiency of management and operations

The key element of successful water resources management for the future is the institutionalisation of the development corridor outlined by the NWMP. All institutions within the Jordanian water sector are to adhere to the recommendations and demand figures for their future planning for the management and operations of water supply and sanitation systems.

<sup>1</sup> Guidelines for the preparation of National Water Master Plans, Water Resources Series No. 65, UN, N.Y. 1989

## THE DIGITAL NATIONAL WATER MASTER PLAN

### Digital Version of the NWMP

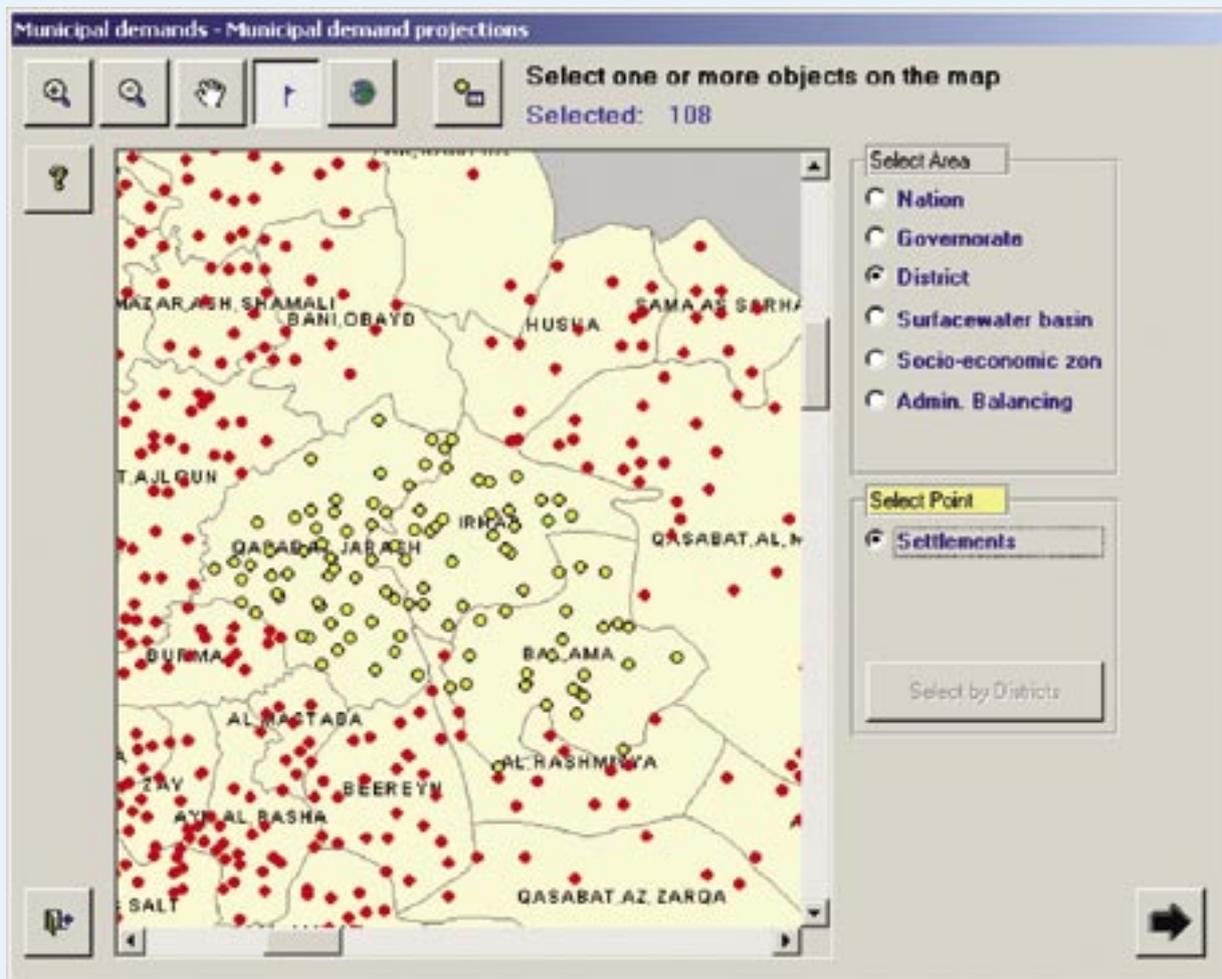


The NWMP 2004 is not an ordinary plan on paper. It is an interactive, flexible, easily updated toolbox that has been custom-built for the needs and purposes of Jordan and the MWI. The digital NWMP was designed and implemented in order to enable the MWI to carry out nationwide water balances based on the most recent data and various development scenarios, and therefore to support efficient water sector planning.

The digital NWMP 2004 is available only on CD and is composed of nine volumes that tackle the various aspects of water in Jordan: resources, ecology, economics, uses, demands, legal aspects, balancing and allocation. The NWMP is a digital plan containing documents, tables, charts, figures and maps that are all accessible through an HTML interface on any web browser. This allows for maximum flexibility in continuous updating and customization as well as extraction and modification of text components, charts, tables and data. As single chapters or elements of the Master Plan can be easily updated according to the latest data, the entire NWMP can be kept up-to-date.

A collection of digital planning tools, the NWMP Tools, were developed to prepare the projections, balances and allocations. The tools consist of (a) Interactive modules for the projection of water resources and demands; (b) A database for storing projected demand and resources data (part of the Water Information System of MWI); (c) A balancing module to balance the resources and demand for the entire country or selected parts of it. The nodules, which run through a GIS application, are linked to the central water database of the MWI and thus allow for the regular updating of the NWMP.

The digital NWMP Tools can also be used to monitor and analyse the current water management situation and assess water resources and demand projections on a continuous basis. These tools assist in evaluating reasonable options and strategies to reverse water imbalances and in managing and developing Jordan's water resources. Other uses for the tools include the performance and evaluation of daily water management tasks.



Thus, the NWMP is more than a traditional master-planning document. Being digital (database dependent) and GIS based, the NWMP tools can be easily updated whenever new data become available or new boundary conditions necessitate, thus allowing for the necessary regular updating of the NWMP. These conditions permit more flexible responses to new water sector challenges and to spatial variations in development. In addition, the use of GIS as a basis for the NWMP permits easy display, visualization and analysis of the spatially related data.

The interactive and modular features of the digital NWMP Tools enable the development and refinement of the modules by the user, thus ensuring sustainable use of the planning tool. Other advantages include:

- Transparency in water balancing through separate data tables linked to each module. Various development scenarios can easily be tested.
- The possibility for permanent enhancement of the digital planning tools as new modules and algorithms can be incorporated/integrated into the tool.
- Definition of responsibilities in data acquisition and processing.
- Provision of know-how to process demand and resources data.

## MAIN RECOMMENDATIONS OF THE NWMP



### DEMAND ON WATER

In light of the changes in lifestyle and the increase in per capita income, especially in urban centres in Jordan, water demand for household and tourism has more than doubled during the last two decades. In 1985, total consumption of water by these two sectors stood at 116 MCM/a. By 2002 these figures had jumped to 249 MCM/a. The current rate of population growth, including foreign labour, is estimated at 2.9 per cent and, according to the Department of Statistics, Jordan's population will double in the 20 years starting from 1998.

Water consumption for municipal and tourist purposes currently exceeds the billed amounts of water. This can be attributed to illegal uses, unbilled water such as tanker and hydrant point water, inaccurate meter reading and so forth. Additional water is lost through faulty pipelines. This so-called Unaccounted for Water, which is due both to inefficient administrative procedures and physical losses, stands at 50 per cent nationwide. Network rehabilitation, such as building better infrastructure, is expected to save between 15-20 per cent of this loss by 2020, which is equivalent to 100 MCM/a.

### PUBLIC AWARENESS

The level of awareness of the gravity of this problem varies from one person to another. Ask any Jordanian this: "What is more important in life: water, mobile phones or cigarettes?" The answer will of course be "water". What is not so obvious is the attitude of the citizen towards the real value and cost of these commodities. For example, the average smoker pays JD 45 per month for his or her smoking habit. The average user of a mobile phone spends a minimum of JD 15 per month. Do average citizens know how much they pay for drinking water per month? Most people still take the availability of water for granted. They get upset when they have to pay a relatively higher amount of money for the quarterly bill for the water that is delivered to their doorsteps. The fact of the matter is that during the last few years the water situation has changed but public perceptions and attitudes have not.

Is it just a matter of education, attitude and perception? Or is it also a question of a failure to take the laws and regulations more seriously by both the general public and the private sector? This is one sensitive area that warrants immediate and serious review and evaluation by all concerned. It is high time to take action.



## RECLAIMED WATER

In a water-shortage country such as Jordan each drop of water counts. Reclaiming industrial and municipal wastewater through treatment plants must be given top priority by both the public and private sectors. The amount of water reclaimed through these processes is crucial if Jordan is to achieve a balanced water budget.



There are already 22 operational wastewater treatment plants across the country. They provide secondary treated water (reclaimed water) of about 85 MCM/a for irrigation purposes. An additional 17 plants are expected to become operational by 2015. The reclaimed water produced from these plants can almost fully meet the needs of irrigation in the Jordan Valley.

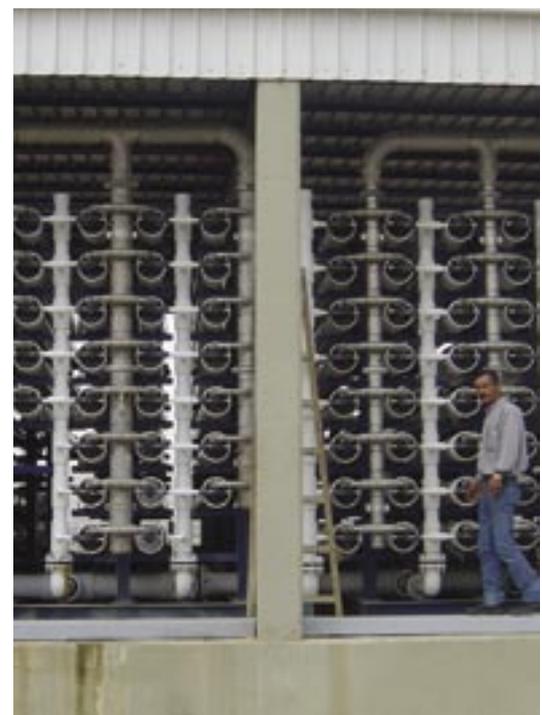
Some operating wastewater treatment plants in Jordan are unable to abide by the standards set by the concerned and specialized institutions. The Khirbet As-Samra Plant, 15 km east of Zarqa, that treats the sewage of the Amman Greater Area is a clear example. Health hazards from the plant such as odour, surface and groundwater contamination and disease transmitting vectors such as flies and mosquitoes are common. A new plant to replace this one is expected to become operational in 2006 and should minimize these hazards.

## DESALINATION

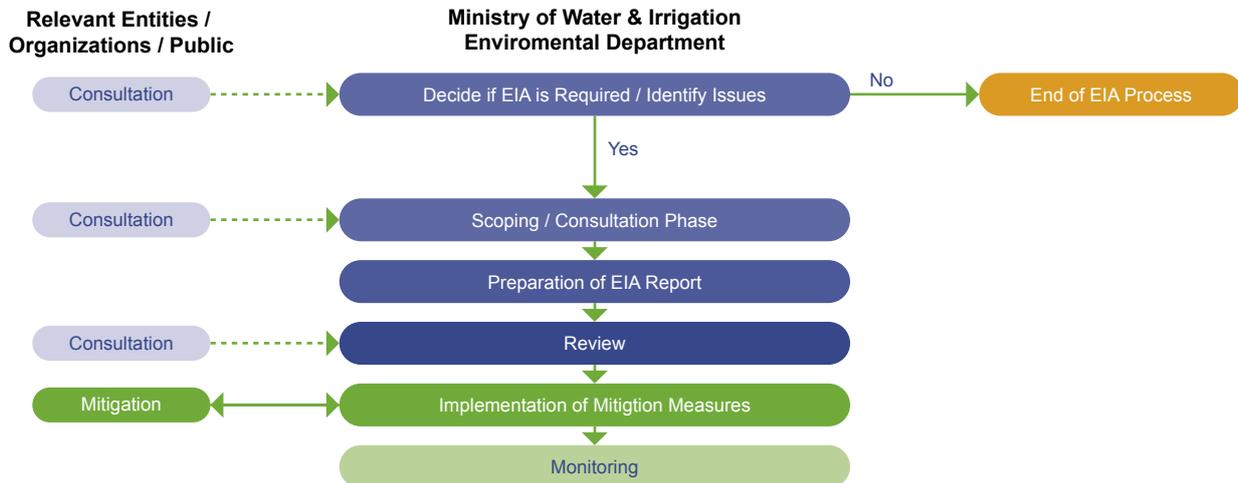
The option of desalination seems to be an ideal solution for Jordan's water problem in the long term. However high energy cost remains a major obstacle, as well as the fact that Jordan's sole access to the sea on the Gulf of Aqaba is located far from the urban centres. There are currently 27 desalination plants in the country, including 23 privately owned small plants that are mainly based in the Jordan Valley and have a total capacity of 1000 m<sup>3</sup>/h, which is used for irrigation. A further seven plants are under construction. The Water Authority of Jordan (WAJ) operates six desalination plants to produce drinking water in Abu Zighan, Risheh, Rueished, Ghaza Camp and Zarqa. The total capacity of these plants will amount to 5,5000 m<sup>3</sup>/h of drinking water.

When the Wadi Zara, Ma'in and Wadi Mujib desalination plant is completed by the end of 2006, an additional 38 MCM/a, of drinking water will be provided to the Greater Amman area.

The Ministry of Water and Irrigation is pursuing all conventional and non-conventional water methods to use the available renewable resources of water to the maximum with the major target of reducing extraction from depleting groundwater resources.



## ENVIRONMENTAL HAZARDS



The Water Information System (WIS) constitutes an integral part of the NWMP. As the first information basket of its kind to be implemented in the region to provide specialists with information concerning issues such as the monitoring, management and planning of a water sector. The WIS is complemented by GIS-based digital tools that facilitate planning under the guidelines of the NWMP.

The WIS is helping the specialized technical units in the MWI to monitor the water situation closely. These units have found that the continuous over extraction of water from renewable groundwater bodies such as the Amman-Zarqa and the Azraq basins causes significant damage to the environment and ecosystems in these two areas and increases the salinity of the remaining water in the aquifers.

When planning for major water projects in Jordan such as dams, the environmental aspects need to be taken in consideration in order to maintain the delicate balance between the feasibility of these projects and their possible negative and/or positive impact on the environment. To this effect the MWI, in cooperation with GTZ, has drafted an Environmental Impact Assessment methodology, outlined in the NWMP, to facilitate the task of decision makers.

The MWI, supported by the German Federal Geological Survey (BGR), is in the process of identifying groundwater protection zones to minimize the negative impact of any infrastructural project in the vicinity of these resources.

To ensure the full control over water usage a number of steps must be taken, including curbing over-extraction and illegal well drilling, as stated by the Underground Water By-law (Nr. 85/2002).

## MONITORING WATER



The WIS has provided the necessary tools to monitor water quality and quantity in Jordan. The laboratories of the WAJ routinely conduct quality tests on drinking water before and after it is treated. This is done in coordination with the Ministry of Health to make sure that the quality of the water complies with the Jordanian specifications for drinking water.



At a network of monitoring stations across the country complete chemical analysis of parameters such as electrical conductivity, anions, cations, pH and nitrates at all levels of groundwater, wells, springs, aquifers, base flows and other resources is also conducted. The third type of monitoring is carried out on irrigation water, which so far is done without set guidelines.

The JVA has now drafted these guidelines in cooperation with the Reclaimed Water Project of GTZ. Without continuous improvement of the data gathering process it will be difficult to guarantee better management of water resources in Jordan. This is a challenge that the WSPS Project has taken up. More efforts will be exerted by GTZ through a new project focusing on Information Management known as the Improvement of the Steering Competence in the Water Sector (SCWS) Project.

According to Eng. Edward Qunqar, former Director of the Water Resources and Planning Directorate “The data we gather day to day on the water resources in all of our monitoring stations near aquifers or ground water basins are directly and automatically transmitted to the main computer terminal at the MWI. To do that, we have installed sophisticated computerized monitoring units in each station.”

“To improve the accuracy and efficiency of our work further it is important to maintain an adequate and well trained staff, in addition to introducing the latest equipment necessary to maintain thorough and accurate monitoring operations,” he adds.

The Water Resources and Planning Directorate at the MWI plays an essential role in generating the foundations for the national water policy. It is the ultimate source and last filtering station of all data and information gathered on the water situation that supports decision making at the highest level of responsibility in the country. Therefore, efficiency and accuracy in data gathering is of utmost importance in the work of this Directorate since all short and medium term key decisions related to water issues depend on the WIS database.

The two sub-directorates in charge of surface and groundwater resources and the subordinate monitoring systems work year round to compile the database, without which there can be no convincing and rational annual water budget. To fulfil this task, the Water Resources and Planning Directorate works closely with the other two principal players in keeping the balance between water resources and consumption, namely the WAJ and the JVA.





## ONE GOAL, SEVERAL STEPS

**“...And (God) has sent down water from the sky to bring forth crop for your sustenance”**

*The Holy Qur’an, the ‘Cow’ Chapter,  
Verse number 21.*

This verse from the Holy Qur’an is a clear and sublime illustration of the close connection between the three main components of life: Man, land and water and it reminds us of the extent to which man’s survival depends on water.

Nevertheless in our modern times, and in light of the intricate interaction between the key stakeholders in the water equation, a new approach to dealing with the water shortage problem in Jordan has unquestionably proved more imperative with every passing day.

Now that the new digital NWMP has moved into the implementation phase, there is more room for hope and optimism.

However, there is still a delicate situation where the three major elements of the new strategy have to interact positively and simultaneously in order to keep Jordan in the safe zone regarding its water needs for the foreseeable future. These three elements are: The NWMP as the overall umbrella of water budgeting and allocation, the populace whose welfare is the ultimate focus and intent of this NWMP and finally, the establishment of an institutionalized and innovative planning mechanism at MWI; an endeavour that can be carried out using modern technology while safeguarding the rights, responsibilities and obligations of all parties concerned.

With a positive interaction between the three elements, the taps will continue to flow.

## LESSONS LEARNT

During the eleven years of project work, a great deal of experience has been gathered on the processes, data, tools, inputs, and institutional arrangements necessary to create a NWMP. The following pages endeavour to summarise these lessons learnt, partly through statements from the key personnel involved in the NWMP development, and partly by stating general principles.

**Suzan Taha, *MWI Project Coordinator and Director of the NWMP Directorate***

“Until 1977, Jordan’s water strategy was built on a huge, static non-transparent document also known as the NWMP. However several important developments in Jordan and in the region, notably the sudden influx of large numbers of refugees into Jordan and the fluctuating rainy seasons, made it imperative to review the national water strategy.

The new NWMP consists of three main axes:

1. A qualitative and quantitative description of water resources – surface and underground – and other resources.
2. Forecasting of demand on water resources by all four consuming sectors.
3. Offering technical and operational measures to meet these demands and suggesting alternatives and substitutes for the current diminishing resources.



During the stage of research three unit types were identified to ensure a reasonable balance: Administrative, hydrological and socio-economic units. When eventually a consensus was reached to produce the new digital NWMP, it was meant to be flexible, accessible and easy to handle and update. The plan has also allocated each governorate a separate chapter or a mini-plan, which takes into consideration the size of the governorate, its population growth and its need for water. When it came to national water resources, my colleagues at the NWMP Directorate and I of course had to look in a fair balanced manner in the overall strategic interest of the country.”



**Lothar Nolte, former GTZ Team Leader**  
**March 2000 – October 2003**

“I came into the almost seven year old project as its third team leader. One can easily imagine that I considered myself as not being in the position of needing to change much. I had actually hoped to find things settled so that I would be free to concentrate on the final shaping of the project.

From the beginning I was clear about the high expectations of the MWI’s management with respect to the outcome of the project, even though I did not immediately clearly understand the point of interest. On the one hand there was the objective to finalise a digital NWMP as a component of the Water Information System (WIS) in order to improve the management of the country’s scarce water resources. On the other hand, the MWI aimed to develop the NWMP tools as water sector monitoring tools to support its existing water balancing functions. We spent a lot of time in checking the modules, which were expected to be in the final development phase.

As with any software development, checking the functionality of the developed software took much more time than expected. Bugs occurred in the developed modules as well as in the WIS database and this hampered the production of reasonable outputs. We were prone to becoming caught up in software development and in data management issues. At this time, the Japanese International Cooperation Agency (JICA) launched a very similar project entitled “Water Resources Management Study”. The JICA study team was instructed by the then MWI’s Secretary General to prepare the study using WIS data, including scenarios prepared with the NWMP tools. I started to recognise the enormous challenge of the project!

The tight timetable, together with the continuous demands of the JICA study team, forced our team to reconsider the concept of master planning. The workload and the worry about failing were enormous.

Finally we presented our results and found our work had become a reference for other projects in the water sector. I believe this experience encouraged our team a lot. Despite this progress, the NWMP was lacking a clear-cut vision of the targets to be reached with respect to development goals for the water sector. The awareness of these shortcomings motivated us to communicate our work more effectively to the MWI management and to concentrate less on software development. Finally a steering committee was established under the chairmanship of the Minister.

The NWMP concept broadened and was finally overarching the whole water sector including the water sector project planning process of the MWI, the WAJ and the JVA. However, due to the technical problems there was still too little communication about our nationwide water sector planning objectives across the water sector institutions. Therefore we decided to prepare brochures summarising the essential information of the NWMP documents. The feedback to the first drafts of the brochures was really surprising. Fruitful debates started at once. These debates proved that the NWMP ideas were recognised as a matter of importance! The brochures have now been disseminated to other governmental institutions in workshops, as well as to other donors.

Having visible outputs at hand, it became possible to communicate NWMP ideas to donors, who welcomed the NWMP process as a key tool for the MWI in establishing well-coordinated efforts to reduce the negative effects of water scarcity on Jordan’s national economy. From my point of view the initiative to prepare the brochures was the catalyst for the institutionalisation of the NWMP within Jordan’s water sector.”

**Dieter Bohnet, Information Management  
Consultant for GTZ since 1995**

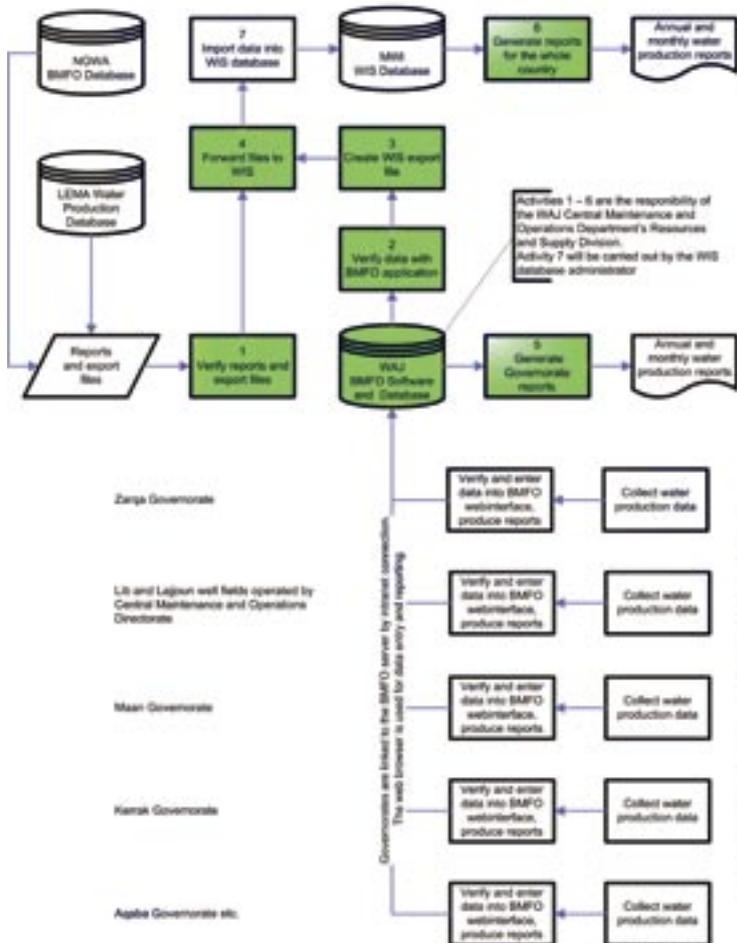
“The quality of the NWMP largely depends on the quality of the data that are used to prepare it. In this regard the NWMP team encountered two major problems: The quality of some core data was not reliable and the management of existing data posed major problems for their use in the NWMP, especially when aggregating data from the operational to sector and national levels.

The NWMP team understood that the data quality could not be improved in a sustainable way without strengthening or restructuring the major operational data collection and processing processes. Standardising or harmonizing database structures codes and documentation between the main water sector players was another urgent matter.

The organisation of data flows was more complex and time consuming than anticipated. We not only had to re-engineer the processes but also to implement them on the operational level and develop software that was needed to automate certain functions. The objective was to implement reliable processes that provide timely data for the Water Information System (WIS), the Ministry’s central data repository for water sector management and master planning. The endeavour has yielded good results but is not yet operational in all Governorates.

Standardising and harmonising the MWI, WAJ and JVA database structures and documentation was an equally ambitious enterprise. The NWMP exercise served as a justification and a forum to tackle this issue for the first time. The inter-agency “Standardisation Working Group” addressed important problems in five task forces with the support of the NWMP team. Although major problems have been resolved, a lot still needs to be done. The new joint project of the MWI and GTZ, the “Improvement of the Steering Competence in the Water Sector Project”, will provide a framework for the Standardisation Working Group to continue its essential activities.”

**Improved WAJ Water Production Data Management System –  
Data Flow and Processing Model for Public Wells**





**Eight main steps for the successful implementation of a National Water Master Plan:**

1. Review strategies and policies of the institutions in the water sector, or create them if nonexistent
2. Review data situation, institutionalise data flow and acquisition procedures
3. Review reporting needs of water sector
4. Design and adapt NWMP software tools to local conditions and requirements
5. Run NWMP tools for local conditions for base year and projection period
6. Write text parts of NWMP, engage in review process
7. Spread the word about the NWMP – permanent activity from point five onwards
8. Institutionalise NWMP recommendations

**Dr. Philipp Magiera, GTZ Team Leader**  
**October 2003 - August 2004**

“In addition to the main milestones of a NWMP design process, some core lessons need to be taken into consideration and can increase the success of any water master planning process enormously:

- The institution taking the lead in the master planning process, in the case of Jordan the MWI, needs to exert its role as governing body for the sector. The framework and recommendations of the Plan need to be communicated to subordinate institutions as binding.
- Planning nationwide for projects involving water should be carried out in close cooperation with the planning body in the water sector (MWI) to ensure compatibility with water availability and environmental sustainability.

- Strengthened cooperation with all affected governmental bodies and authorities will improve the quality of scenario assumptions of a NWMP and will help develop confidence and acceptance of the means required to achieve the strategic goals.
- In water scarce countries master planning that fails to embrace all water demand management tools will not succeed. Demand management is the key to a sustainable future and only bold measures will help achieve NWMP results.
- A unified information base for the water sector that can be used/shared by all related institutions is of pivotal importance for the planning process. Ideally, this information base receives its quality controlled data from the operational level, and allows the planning and managerial levels to use the information readily to fulfil their tasks.
- Thus, data and information management is a key to sector development. The system development is always easier than the organisation of the data flows and quality assurance. Enough time needs to be allocated to these vital steps. Data exchange and updating routines with third parties are especially time-consuming and need to be prepared well.
- In order to make sure the NWMP recommendations are translated into action, the master planning needs to be linked with the investment planning. Any project proposed for implementation needs to be tested against the NWMP framework and its contribution to the chosen allocation scenario needs to be proven.
- Modelling results need to be checked critically. Sometimes, modelling results might look more real than reality. In order to achieve credibility for the outputs of a NWMP, supporting software tools and models need to be reviewed thoroughly. Any automation by software only makes sense if the results can be, and are actually being, checked.”

## BENEFITS OF PROPER WATER ALLOCATION PLANNING

One of the most important results of the NWMP is the country-wide estimation of the water demand development in all sectors. Water Demand Management strategies are consistently used on the computations. The following small calculation illustrates the beneficial effects of proper demand planning for the design and rehabilitation of a village water supply:

### Rehabilitation cost of 20 km cast iron pipe for a village in northern Jordan

Water supply 2004 (with administrative and physical losses)	ca. 1 Mio. m <sup>3</sup> /a
Water demand in 2020 without <i>Water Demand Management</i>	1.5 Mio. m <sup>3</sup> /a
Projected water demand in 2020 by NWMP, based on population growth, demand structure and <i>Water Demand Management</i> , especially loss reduction measures	0.9 Mio. m <sup>3</sup> /a
Pipe diameter for supply of 1.5 Mio. m <sup>3</sup> /a	250 mm
Pipe diameter for supply of 0.9 Mio. m <sup>3</sup> /a (NWMP)	200 mm
Total cost of pipeline 250 mm	2.052 Mio. €
Total cost of pipeline 200 mm (NWMP)	1.459 Mio. €
<b>Cost savings</b>	<b>ca. 0.6 Mio. €</b>

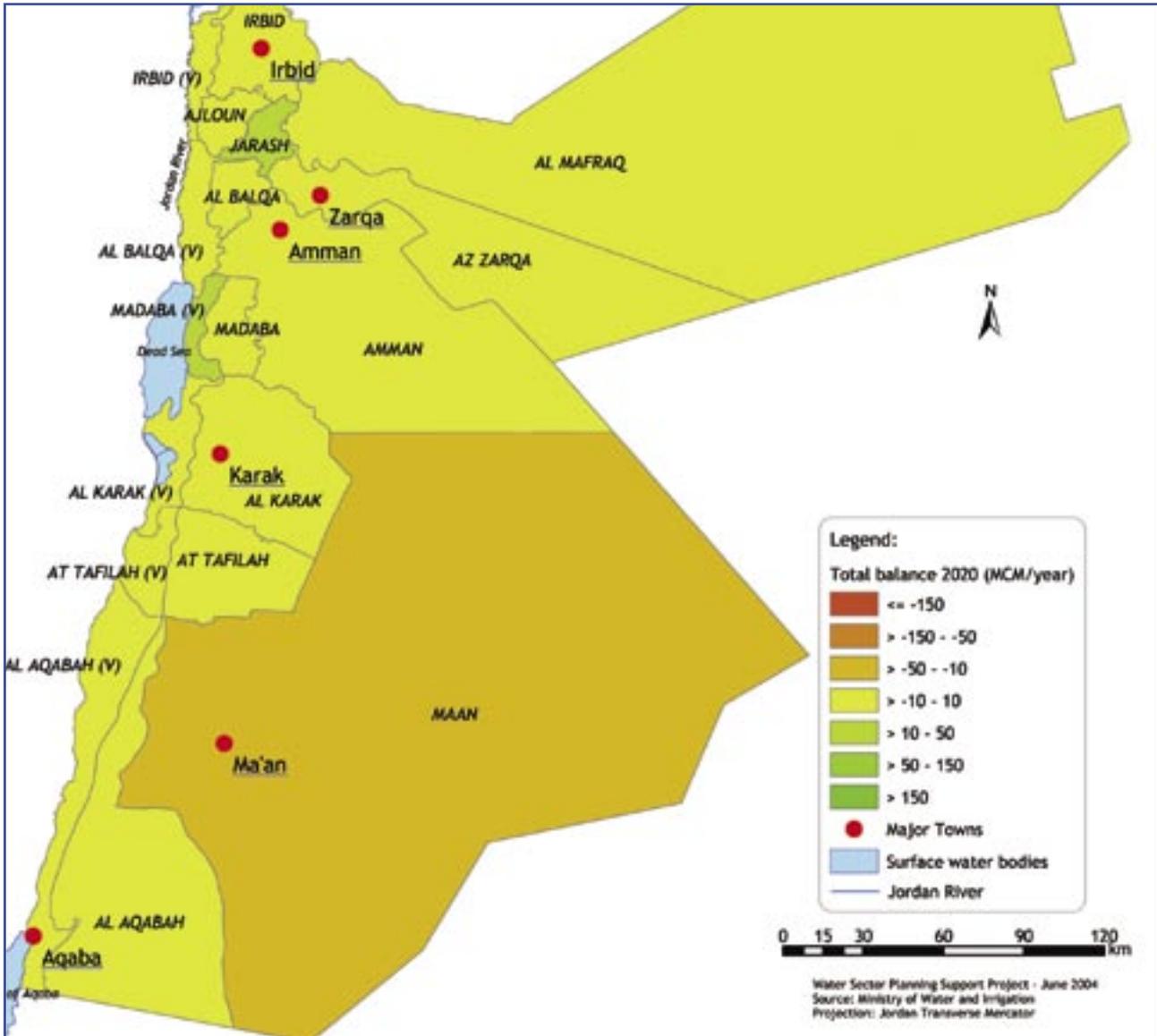


## RESULTS AND NEXT STEPS



### The goals of the WSPS Project were fivefold:

1. To introduce formal procedures to update the NWMP: The WSPS Project documented the data flows necessary to keep the NWMP updated and established procedures and routines for this update. Examples are the well production data flow, including a survey of all public wells in Jordan, and the efforts of the Standardisation Working Group initiated by the project, to standardise data documentation and cataloguing.
2. To enable the MWI to maintain and update the planning instruments on a regular basis: the MWI, through its NWMP Directorate, is constantly updating the NWMP based on the latest assumptions and developments. Regarding software updating and maintenance, it has been agreed that the MWI will directly contract external support.
3. To introduce and gain acceptance for the NWMP: The NWMP was formally launched by the then Minister of Water and Irrigation at an international conference in May 2004. It is available in summary version on CD and on the website of the MWI. The results of the NWMP calculations and projections are available through the main database of the MWI Water Information System and can be viewed using viewer software, the Digital Visualisation System, developed by the project. The Ministry has asked all sector managers to use the NWMP figures in their planning and project identification.
4. To identify options for the implementation of strategies based on the NWMP: The main effort needed is to spread the NWMP content through brochures, CD's, a short film and other means. Water sector staff will only be able to focus on NWMP strategies if they know about them. The NWMP Directorate acts as an information hub for all questions around the NWMP. This means that whenever a department or a project needs to plan for the future, the NWMP Directorate is there to help. In order to further strengthen the institutional link between the NWMP and the investment planning process in the water sector, BMZ agreed to fund another joint MWI-GTZ project, the Improvement of the Steering Competence in the Water Sector project, which started in May 2004.
5. To introduce water management strategies in the water sector: Many of the recommendations and strategies of the NWMP are already being implemented by institutions or projects. NWMP demand projections were used for the design of the future drinking water network in the Northern Governorates. Recommendations of the NWMP regarding groundwater protection are being implemented through a joint Jordanian-German project, implemented by the Federal Institute for Geosciences and Natural Resources (BGR).



All these results were achieved during the project period and further support to the implementation of the NWMP was granted by BMZ (see above). In terms of economic and socio-economic impacts, key areas for BMZ's evaluation of a project's success, the following was achieved:

The impacts of the project in economic terms can be divided into impacts on the target group and impacts for the economy of Jordan. The target group of the

project was the entire population of Jordan and this makes it difficult to prove the direct economic benefits of better water resource management by the MWI for individuals. Nevertheless, a better management of the scarce water resources will mean savings for the Jordanian economy. If conventional resources are used in a sustainable way, Jordan can do without the expensive tapping of non-conventional resources, such as desalination or imports, for a longer period. As the cost of new resources will have to be met by the

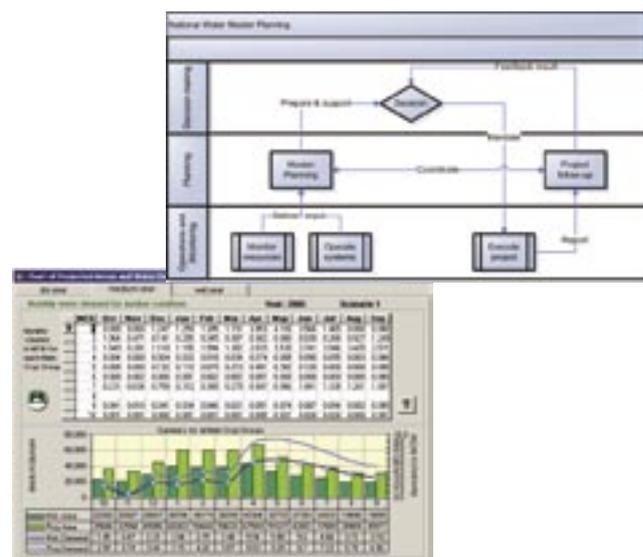
consumers, either directly through their water bill, or indirectly through subsidies, they will mean a burden to the economy in any case.

New processes for data exchange or master planning have lead to a higher efficiency in the overall planning process, leading to savings for the national economy through the ending of old, complicated and staff-intensive routines.

The Jordanian economy gains a twofold benefit from realistic planning for the future: First, overly elaborate infrastructure planning (for e.g. wastewater treatment plants or water transfer lines) can be avoided. Second, all sectors of the Jordanian economy can plan on the basis of a long-term water allocation based on regions and sectors. This increases planning security for industries and tourism projects and supports a positive investment climate. In the case of agriculture, the NWMP supports the arguments in favour of curbing irrigated agriculture in the Highlands. The water resources no longer used for irrigation can be saved and used for more productive sectors. At the same time, irrigation with treated wastewater in the Jordan Valley will increase, thus avoiding higher food imports resulting from reduced production from the Highlands.

One of the principles of the NWMP is the equalisation of the extremely different water consumption figures around the country. Whereas urban areas and especially Aqaba enjoy a three digit consumption of water in litres per capita per day, some rural areas only use around 60 litre per capita and day. The water allocation of the NWMP aims for an equal treatment in the future, with only slightly higher figures for the urban areas because of the higher percentage of small industries and trade. The project impacts therefore promote a greater equality of water supply and a greater justice in distribution and thus safeguard the quality of life for citizens in less privileged regions.

The results achieved by the WSPS project are remarkable and are a visible sign of the good cooperation enjoyed between Jordan and Germany. However all of this would not have been possible without the relentless efforts of the project partners from the MWI, GTZ and many consultant companies and individuals. All the individuals and institutions mentioned on the next page are to be thanked for their collaboration and for their contribution to the digital National Water Master Plan of Jordan.



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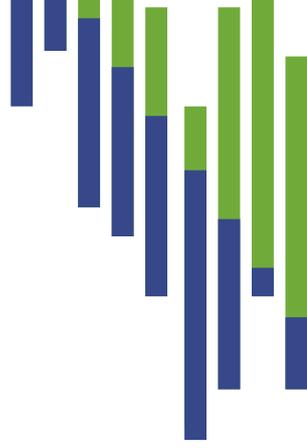
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