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Utilization of Groundwater and Treated Wastewater in the Near East Region

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INTRODUCTION

1. The Near East Region is characterized by severe water scarcity and the situation is likely to worsen in the future, unless drastic measures are taken. National water resources in 16 member states fall below 500 m³ per capita per annum of the renewable water resources and some are approximately half this figure. Yet economic growth and agriculture and rural development are fully dependent on groundwater as the lead input in most of these countries. The option of exploiting additional groundwater resources is extremely limited as shallow aquifers become exhausted and water levels in deeper aquifers fall beyond the economic and physical limits of pumping. Food production growth and the stability of rural populations will therefore rely on improving performance of irrigated agriculture to increase overall productivity and reduce pressure on the available resources, through finding alternative sources of water (notably using low-quality water resources), cereal food imports, and developing non-farm incomes.

2. This paper focuses on the need for groundwater management and the potential for the use of treated municipal wastewater as they apply to the Near East Region. It gives an overview of the experience gained in the Region and of the constraints faced, and presents the future prospects and needs in light of this experience, as well as proposing strategic options and recommendations for the fulfillment of the Region needs.

PART I. GROUNDWATER

General overview

3. Groundwater will continue to be the dominant source of bulk water the Near East Region. Its use has been essential for meeting water demands and household food security. In addition to being a regular source of water under normal climatic conditions, it plays a critical role in food supply and livelihood security during dry periods, in view of its ability to act as a buffer against drought and precipitation variability. Increased access to groundwater reduces risk substantially enabling many farmers to escape poverty. From the environment perspective, groundwater plays another role of no less importance.

4. Shortages of groundwater in areas of excessive abstraction and groundwater pollution by various sources are now common in the Region and emphasize the importance of correct estimates and proper development, regulation and protection of supplies, in order to ensure the continued availability of this key natural resource. However, the management of groundwater has not always met the required standards and there are clear indications of major problems with over-abstraction and its consequences in many parts of the Region.

5. The available information clearly indicates that groundwater over-abstraction and quality degradation are the major emerging problems in the Near East. In several areas of the Region, over-abstraction is severe and water levels are declining at rates that range from 1-3 meters per year. Water level changes and fluctuations are the most important factors influencing access to groundwater for the environment and human uses. Even small drops in groundwater level can have substantial impacts on surface water availability because of the close link between surface and groundwater. In the Near East, the number of springs that have dried out or whose discharge has been reduced as a result of groundwater level decline has not been estimated; but the impact is evident in many areas where populations have had to resort to alternative sources.

6. The extent of groundwater depletion in the Region and its consequences are impacting many rural and urban populations but are not well known. Most groundwater monitoring networks are relatively new and collect data only on limited ranges of area related to quality parameters. Detailed data and information particularly on quality is often available on small locations and for specific purposes. In addition, groundwater level variations can be misleading as aquifers take tens or even hundreds of years to reach equilibrium after they are disturbed. As a result, the available data on groundwater in the Region is partial and does not allow a comprehensive and accurate regional assessment of the groundwater resource status. Point data collected for groundwater levels and quality are merely samples and are not naturally integrated as the point measurements for surface water. This difficulty which is inherent to groundwater assessment precludes an accurate and comprehensive assessment despite the levels of detailed groundwater studies in some countries like The Arabian Peninsula, Cyprus and to some extent North African countries. Consequently, continuing efforts are needed in order to assess groundwater availability and use at the national and regional scales, with a focus on trans-boundary aquifers whose characterization requires joint efforts and close coordination between the concerned countries.

Management of Groundwater

7. In countries where water scarcity is the general condition, the development of non-renewable water resources has opened new avenues for economic and social development. However, the lack of information and understanding on groundwater dynamics has been a challenge to the development of appropriate management systems. The challenges are both technical and social, as without these data and a shared understanding of the problems; the social consensus needed to implement decisions is difficult to generate and groundwater management decisions are often difficult. For instance, the reduction of groundwater overdraft to bring extraction to sustainable levels requires the establishment and implementation of a set of policies and measures including the metering of all wells, the establishment of formal water rights, and regulatory and economic mechanisms. While some progress toward this goal has been made in a few water-scarce countries of the Region; the situation is more complex in other countries with large numbers of wells and conditions that vary greatly even at local levels. Even where management is most advanced; it is socially and politically difficult to reduce groundwater extraction to sustainable levels. Wells are generally private and highly dispersed. Well Inventory and monitoring the extraction are problematic. Furthermore, reducing use to sustainable levels in arid areas often requires substantial reductions in the extraction which can have tremendous economic and social impact. As a result, Governments are not inclined to force such reductions.

8. The mining of **non-renewable water resources** could come to an end when the policy for their use includes a long-term strategy for water exploitation, as well as the identification of replacement solutions. These alternative of replacement solution should be examined simultaneously with the main issue, namely the choice of a long-term strategy. It has been proposed to include the replacement solution among the criteria that should be considered when a choice is made of a programme for water exploitation.

In several Region counties, groundwater resources have been over-exploited because there is no other alternative. The question that arises here is one of choosing between maintaining the present trend or modifying it by increasing or reducing production levels. The use of non-renewable groundwater resources could stimulate economic development and may be an effective means for promoting more economic forms of water used; although the cost of water production will increase. Therefore, water resources system should be planned under restrictions imposed by nature and by users.

9. In the case of **renewable water resources**, the driving principle for exploitation should be sustainability that requires a balanced use to maintain both quality and quantity for an indefinite period of time. Evidently, this principle does not apply to the mining of groundwater. When the latter has been chosen as a policy, the strategy can either opt for maximizing return for a limited period of time, or spreading it over a longer period. Since the start of intensive groundwater exploitation in several regions of the world, particularly the Near East; a wide technical experience has been gained on the management of these resources. The application of simulation models for planning and management of regional aquifer systems has proven to be a very useful tool. Sub-regional models and local simulation studies, quality monitoring and environmental impact assessment provide further refined decision tools. Strategies of groundwater development should address the impacts on the aquifer systems as well as the problems resulting from groundwater use as these are interrelated. A good example is the return flow of irrigation water which is always more saline than the applied groundwater. Salinity would increase if water is pumped from the same aquifer that receives the return flow, and such problems arise when irrigation takes place in closed basins and in oases.

10. **Groundwater development plans** are based on certain assumptions regarding changes in depth and quality. It is essential to install monitoring networks that provide the information required for assessing both production and quality. The continuous monitoring of water level, water quality and abstraction provide the information needed to verify if exploitation proceeds in agreement with development plans. In most countries of the Near East, **several institutions** are responsible for groundwater management, a situation that often results in diffuse mandates and the lack of law enforcement, which in turn leads to over abstraction. Water pricing and allocation policy has a direct impact on water use. In general, there is no charge for groundwater in most countries, but some countries impose a limit on the amount that can be abstracted although such quotas are difficult to monitor.

Groundwater Contamination

11. **Deterioration of groundwater** can be caused by the depletion of its level or through contamination, or both. Such forms of deterioration can be direct or indirect, and they stem from inaccurate assessment, inadequate planning, and the lack of appropriate management. The human activities responsible for quality

deterioration may be industrial, domestic and agricultural. Chemical composition of natural water includes a wide range of constituents that are normally derived from the atmosphere, rocks and minerals in the soils and waters. Water composition is also influenced by external factors such as evaporation and human activities. Urban contamination stems from liquid and solid sewage wastes that carry chemical and biological elements and compounds as a result of leakage from inadequate municipal sewage system and septic tanks. Industrial contamination results from the disposal of liquid, untreated wastes into surface and groundwater; these wastes could contain heavy metals and toxic elements. Under poor management conditions, return flow from irrigated lands contains soil salts, fertilizers and pesticides. High evaporation rates cause salt concentration in the soil and the insufficient drainage systems increase direct infiltration of contaminated water to the water table.

Concluding Remarks on Groundwater Management

12. The need to **conserve, protect** and use groundwater resources in a strict rational manner cannot be over emphasized. In addition to their vulnerability to deterioration and the high cost and long time required for their rehabilitation; these resources constitute valuable assets particularly in water-scarce areas such as the Near East. The protection of groundwater implies the integration of operations and practices at the local, national and regional levels. It is a long-term procedure that necessitates continuous monitoring of quantity and quality. The treatment of wastewater before its utilization and the selection of appropriate localities for liquid and solid waste disposal, are very important for preventing contamination of groundwater. Protection zones of groundwater fields and artificial recharge may be necessary as a mitigation measure against deterioration.

13. Sound development and management infer to establishing **sound policies**, conducting scientifically-based assessment and the planning for use. Groundwater assessment implies an integrated characterization of the water bearing formations and their natural recharge and discharge areas, in addition to the variation in time and space of the characteristics. These studies require reliable information and data on the hydrologic and geologic settings, the extension of the basin and aquifers, their hydraulic properties, recharge rates, so as to evaluate the potential safe yield and production capacity. Complex simulation models are often applied in the assessment process.

14. The groundwater resources of the Region have not been assessed in a comprehensive manner from the **quantitative and qualitative standpoints**, with the exception of the major aquifer basins and thorough assessments at the national level by some countries. For the major aquifers, essentially gross data has been collected and there is still a great need for a thorough assessment both at the national and regional levels. Joint efforts and close cooperation by the concerned countries will be needed to undertake collective investigations and to elaborate common strategies for the management of these resources. Although impacts on the resource in terms of quality are as important as quantitative effects; often little attention has been given to quality problems that may arise. An aquifer system in dry areas often has different quality levels in different parts because of hydro-chemical variations and complex alternations of continental and marine faces.

15. Countries such as Kuwait, Bahrain and Qatar, located down gradient with regard to the "Tertiary Carbonate Regional System", have faced much more serious problems than those located up gradient. Hydrological system analysis can be helpful in understanding and solving a broad spectrum of problems in the regional context. The development strategies of non-renewable resources in some countries of the Sahel have been based on a similar concept. In Algeria and Tunisia, the main concern of the management authorities was to assess the extent to which water production would be feasible in relation to cost.

16. The factors that lead to over abstraction of groundwater are of **policy**, institutional as well as technical and managerial nature. The starting point is a policy that favors public or private investment in agricultural activities based on groundwater. Such a policy usually aims at social and economic development. However, in the absence or non-enforcement of regulations targeting controlled exploitation; it will lead to over abstraction. Land and water ownership status also needs to be well defined. In most countries, groundwater is considered a public or national resource and its utilization should be regulated and managed equally by potential beneficiaries, within the limits allowed by water availability in the shared basin.

17. Well-defined and clear policies on water resources development, management and pricing are needed. Such policies should specify options chosen at the national level with regard to groundwater use, particularly when mining is a concern. The option of importing virtual water as an alternative is now more and more

considered. The policies should in addition be translated into strategies that specify the option of short term or long term return as well as the procedures and means of implementation.

18. In addition to the above factors, the **social aspect** is detrimental. The creation of awareness among the beneficiary populations on the threats to groundwater is essential. Their support and encouragement to adapt to the conditions of water scarcity and to adopt collective measures to reduce pressure on these resources are highly recommended.

PART II. REUSE OF TREATED WASTEWATER

General Review

19. Treated wastewater constitutes another strategic source of non-conventional water for releasing the pressure on freshwater and contributing to lifting the constraints of water deficit. It is already widely used in several countries and the prospects for its generalization in these countries and introduction in most of the Region are high. However, several problems still persist and need to be addressed.

20. Agriculture and the rural sector remain vital to pursuing the goals of food security, poverty alleviation and sustainable development in most countries of the Near East. In this Region, over 30 percent of the cultivated area are irrigated but it produces about 75 percent of the total agricultural production. The agro-climatic conditions and rapid development of irrigated agriculture have led to the mobilization of almost all easily accessible water resources, such as river flows and good-quality groundwaters. With the **growing demand for food**, some 80 percent of the increase in cereal production, expected by 2030 in the Region, will have to come from irrigation. The dilemma is that the potential for expanding water supplies for meeting these new demands is very limited if not existing in most countries. The options left for solutions are the improvement of irrigation performance, agricultural intensification and the use of non-conventional water resources, particularly treated wastewater. As the irrigation sector is the major water user, improvements in the current low level of its use efficiency will release large volumes of water for expansion and use by other sectors. Technological, operational and managerial techniques capable of improving efficiency levels are available. The safe use of treated wastewater constitutes a valuable source for agricultural production. Appropriate managerial tools as well as safety procedures for such reuse exist and are becoming more easily accessible.

21. The **improved technologies** and managerial tools in water resources management, including treated wastewater, have been introduced in the Region since a long time. Although their use and performance differ among countries due to some local specific conditions; a large potential for improvement still exists. Treated wastewater is now considered an additional source of water and has an important role to play in water resources management, particularly in water-scarce areas. By releasing freshwater sources for potable water supply and other priority uses; wastewater reuse makes a contribution to water conservation and takes an economic dimension. Moreover, wastewater use schemes, if properly planned and managed, will have positive environmental impact, besides providing increased agricultural yields.

22. Some degree of treatment must normally be provided to raw municipal wastewater before it can be used for agriculture. The quality of treated effluent used in agriculture has a great influence on the operation and performance of the wastewater-soil-plant system. The most appropriate wastewater treatment to be applied before effluent use in agriculture is that which will produce an effluent meeting the recommended microbiological and chemical quality guidelines, both at low cost and with minimal operational and maintenance requirement. Adopting as low a level of treatment as possible is especially desirable in most of the Region countries; not only from the point of view of cost but also due to the costs and difficulty of operating the complex systems.

Experience on Wastewater Treatment and Reuse

23. Water scarcity in the Near East has caused national concern and led planners and technicians to devise ways to optimize the available supplies and to augment available water resources through the use of non-conventional sources, including treated wastewater. Although the interest in reusing treated wastewater is comparatively recent in the Region; the concept of using sewage effluent for agriculture is more than 2000 years old. Several Near East cities have used untreated sewage effluent for irrigating fruit orchards and vegetables for many centuries.

24. The treatment of wastewater in the Region started almost half a century ago in the Gulf countries. Later on, it spread further as several countries adopted the technology on their own or in co-operation with FAO and other organizations. Today, most countries of the Region have included treated wastewater as an important dimension of water resources. FAO and its **Regional Office for the Near East** have addressed the subject of wastewater reuse in the Region more than three decades ago, jointly with the concerned institutions in member states. Some of these activities aimed at macroscopic capacity building in member countries with planning and managing the use of treated wastewater for irrigation. They included publications targeting the needs and specific conditions of the Region, such as Manuals, Guidelines, Standards, and Training Materials; as well as the organization of fora such as seminars, workshops and training sessions. The other category of activities concerned support and technical assistance for the implementation of national and regional projects addressing a wide range of issues (elaboration of strategies and national standards, pilot sites, training and capacity building, institutional strengthening, etc.) Direct beneficiaries from technical assistance included Cyprus, Egypt, Jordan, Morocco, Saudi Arabia, Syria, Yemen, and others.

25. With the growing experience on **wastewater reuse and management** is gaining a good momentum. At present, in almost all countries that were involved in these FAO sponsored activities; there is a background on wastewater reuse for restricted irrigation, with varying levels between countries. From the decision-making and social standpoints, the importance of wastewater as a valuable source of water is gradually being accepted and the benefits of investment in this sector are well recognized. Codes of practice and legal regulations concerning the use of the treated effluent have been developed in several countries of the Region or are under preparation. As a result, there is some control where the situation appears to be substantially different from that in other countries that still have not developed and implemented programmes on wastewater reuse.

26. **Training, sensitizing and awareness creation** have concerned a high number of individuals and institutions from different levels of policy-makers, technicians, farmers and communities. There is currently a large number of recognized experts and qualified engineers and technicians and the Region is getting close to self-sufficiency in terms of manpower to run future activities. The subject of wastewater treatment and safe reuse for environment control is also incorporated in the training curricula of several universities and institutions of the Region. The global area under irrigation from treated wastewater has also increased substantially over the past 20 years.

27. The **amounts of wastewater that are treated and reused** have increased substantially in recent years in many countries such as the Gulf countries, Cyprus, Egypt, Jordan and Tunisia. Pilot sites for reuse have also been established since the eighties in other countries, such as Algeria, Morocco, Pakistan, Syria, Yemen, etc. The number of treatment plants have also increased and are expected to double in the coming decade, as new projects are being established in almost all countries. With population growth, rapid urbanization, environmental concerns and water shortage; the potential of treated wastewater will attain several billion cubic meters and could constitute up to 30% of the total water resources consumption in some countries.

28. Several countries have **integrated treated wastewater in their national water resources** and elaborated policies and regulations on its treatment and reuse. Some countries such as Cyprus, Kuwait, Jordan, the Gulf states, Saudi Arabia, have national policies to reuse all of its treated wastewater effluents and have already made considerable progress towards this end. A second category of countries is mid-way in the process and has already accomplished tremendous advances in various aspects, from policy on wastewater safe reuse to strategies and implementation.

29. **Standards and guidelines** concerning the quality and use of treated wastewater have been formulated and adopted. Moreover, crop restriction is enforced and no vegetables cooked or uncooked are allowed to be irrigated with treated wastewater in several countries. The guidelines have also been followed by codes of practice intended to ensure public health and environmental protection. Demonstration plots using treated wastewater from sewage plant have been established. The situation however is lagging behind in several other countries where the subject matter has received little or no attention, for various reasons. These countries are currently faced with some acute problems and needs for capacity building and adoption of strategies on treatment and reuse of wastewater. They are at the foremost level of need from policy-makers, investors and donors for assisting them to lift the constraints and upgrade their capacity.

Major Constraints to the Development of Safe Reuse of Treated Wastewater

30. The efforts undertaken over the past three to four decades, and particularly since the 1980's, have achieved substantial positive results as described above. However, and in view of the difficulties inherent to

the technology; the social perception of wastewater and limited time since these efforts have started, the situation is far from being perfect in most if not all countries. Several problems and constraints still persist and need to be addressed. These are described briefly below, with large differences among countries:

- **Policy and Planning.** Clear policies on wastewater treatment and reuse are often lacking or, have some deficiencies. No adequate planning, monitoring and control measures are being taken, except in certain cases. The lack of effective and strictly-adopted measures can spread certain diseases in the Region, particularly if untreated sewage effluents are used.
- **Regulatory Mechanisms.** There is generally a lack of standards and the absence of suitable regulatory criteria and mechanisms. Where control and regulation measures exist, they are generally not seriously enforced.
- **Technical.** The overall technical capacity needs to be developed, particularly at the field level, with varying levels between countries. From the sustainability standpoint, most wastewater treatment plants in the Region are suffering from operational control problems and lack of routine maintenance. As a result, the effluent in many cases does not comply with the recommended guidelines or even with the original design of the treatment plant.
- **Institutional.** Responsibility is often dispersed among several institutions, with a lack of clear authority and cooperation mechanisms among the various institutions involved in the overall scheme of collection, treatment and reuse of the wastewater. At present, this is the most critical issue for most of the countries of the Region.

Strategy for Wastewater Reuse

31. As described briefly above, it is now widely recognized that wastewater reuse constitutes an important and integral component of the comprehensive national water management programmes. This is more relevant in “Water Scare” countries, which are the great majority in the Region. Although wastewater reuse for agriculture is widely practiced in Region; the practice, while highly desirable, is often poorly regulated and suffer from several constraints (lack of standards, policy deficiencies, absence of suitable regulatory criteria and its enforcement, etc.) This leads to economic inefficiency, public health problems and environmental degradation.

32. Within the Region, there is also a wide range of experience that can be beneficially shared among the countries. To address these issues and at the request of its member countries, FAO elaborated a strategy that includes the establishment of a Regional Network to coordinate among the various stakeholders and assist countries in several ways to assist in lifting the prevailing constraints.

Regional Network on Wastewater in the Near East

33. Following a joint collaboration effort of the Regional Inter-Agency Task Force on Land and Water Resources; the FAO Regional Office and the WHO Regional Office convened an “Expert Consultation on Low-Quality Water Reuse for Sustainable Agriculture” in Amman, Jordan, in December 1997. In order to strengthen regional co-operation in the field of treatment of wastewater and its use for irrigation, three alternatives were considered: i) strengthening the existing relevant institutions; ii) formation of a regional network; and iii) establishment of a specialized center. After considering these alternatives, the Consultation concluded that the first step for strengthening co-operation among countries is to establish a “Network on Wastewater Reuse”. The Consultation further recommended that a priority action for the establishment of the Network is to collect information on existing institutions, activities, projects, and key professionals in the field of wastewater reuse.

34. In view of the few available and accurate data on wastewater reuse, the Task Force deemed it as necessary to prepare an assessment report, regarding the status of wastewater treatment and reuse in countries of the Region.

In fulfillment of the above, the FAO Regional Office for the Near East prepared a detailed questionnaire in the form of “Wastewater Information Sheets” to be completed at the country level. The collected Wastewater Information Sheets for the 29 countries of the Region constituted a preliminary “Status Report” on Wastewater. The sheets will be continuously updated and validated in order to include the latest information on the status of wastewater and its use in agriculture, within the framework of the Regional Network.

35. Another joint FAO/WHO Meeting for launching the Regional Network on Waste Water Reuse was organized in Amman, Jordan, in November 2001. The establishment of the Regional Network on wastewater came as an implementation of the recommendations made during the past three years, in response to both the potential benefits and the problems posed by the reuse of wastewater in the Region. Country representatives to those meetings recommended that FAO and WHO Regional Offices in Cairo should continue to support the Network until it materializes and become fully operational. They further requested from FAO and WHO to continue assisting member countries on all aspects of wastewater reuse, particularly through the development of training materials and the promotion of training activities at all levels, including farmers.

36. The Network, in its operation, would try to follow these main recommendations:

- Realizing that the safe and efficient wastewater reuse, being a multi-sectoral task, requires collaboration of all partners involved.
- Adopting the concept that all aspects of Wastewater management should be driven by options taken considering the end uses of reclaimed wastewater.
- Promoting the concept of risk analysis, in all its aspects, is urgently required in the Region, and that capacity building in the wastewater reuse is to be emphasized.
- Conducting a training-needs assessment, for all aspects of wastewater reuse, including: planning, management, communication, networking, etc.
- Realizing that determination of the disease burden associated with wastewater reuse is not feasible; Countries are called upon to support the ongoing WHO research on the burden of disease which incorporates water-borne diseases as a determinant.

PART III. GENERAL CONCLUSIONS

37. The available conventional water resources in a great part of the Near East Region are already exploited and the availability of necessary water quantities will be in the near future a limiting factor for further development. The expected population growth, the development of towns, industries and tourism; as well as the necessary increase in the production of energy and food, will all require a sensible management of the available water resources and development of additional sources. Apart from that, the increased water consumption will provoke a greater sea and coast pollution. To overcome these limitations, there is a need to manage adequately the existing resources for their efficient use and to increase supply, where possible. A means for doing so is to develop, thoroughly and in time, new non-conventional water resources, such as wastewater, along with the implementation of necessary measures for its reuse, sanitary protection and environment control.

38. The potential for wastewater reuse in agriculture and for other purposes in the Near East Region is high. The cost / benefit of such uses is well demonstrated and so are the environmental impacts when the use is adequately planned and managed.

Recent experience in the Region has shown that the practice of wastewater reuse in agriculture can be greatly improved, with limited costs and substantial outputs in terms of crop production and environmental control. The experience has also created a great deal of knowledge and capacity in the Region. In all countries where the experience was initiated, it resulted in building a background, which in certain cases became solid, on wastewater reuse for restricted irrigation. Nevertheless, several constraints still persist and countries of the Region are at different capacity levels on the subject of wastewater reuse.

The basis and momentum created through recent programmes and activities, in cooperation with FAO and other parties, can be improved substantially. This can be achieved through the sensitization of decision-makers to take appropriate actions and catalyze change, the setting of standards, the promotion of better technologies, and the provision of technical assistance and training.

The strategy to establish a Regional Network on Waste Water Reuse in the Near East is likely to help lift these constraints and promote the development and safe reuse of treated wastewater in the Region, by enhancing the exchange of experience and regional cooperation among members countries.

39. Recommendations

A. On Water Resources Management, Member Countries are called upon to:

1. Develop comprehensive national strategies for sustainable management and protection of the water resources, including exploring the use of non-conventional water resources, with full adoption of standards and guidelines for explicit provisions for water quality and environmental protection.
2. Develop and enforce water quality legislation, including a system for taxation of companies or individuals that cause pollution, in order that such taxes would cover the cost for clean-up of the water.
3. Give due attention to modernize the monitoring programmes related to water quality standards, new technologies for assessment and sensitize the public on water issues like consumption, use efficiency, cost effectiveness, and environmental aspects.
4. Promote co-operation among other countries for exchange of experience in methodologies, practices, legislation, and terminology for data sharing and harmonization.
5. Promote among all stakeholders, the concept of demand management of water, in view of the accelerated demand of communities for water and the competitiveness from the various sector users, including agriculture, urban, industry and tourism.

B. On Wastewater Reuse, Member Countries are called upon to:

1. Make provisions, while making inventory of national water resources, to account for the non-conventional sources such as treated wastewater effluents and drainage water after the appropriate treatment of such low-quality sources.
2. Develop guidelines, legislation and code of practice that conform with each country local socio-economic norms, with consideration given to the economic return of these treatment plants.
3. In choosing of wastewater plants, to target those designs and technologies that are low-cost, low energy and easily managed and maintained, with full consideration to the needs of the end user of the treated effluent.
4. Ensure that the adopted guidelines are conforming with FAO/WHO standards, and are well-advertised, seriously and forcibly applied and monitored for the environmental protection, as well as to safe guard public health of all users of treated wastewater.
5. Adopt a standard that raw sewage water should always be avoided for any agricultural use, and that vegetables eaten uncooked are not to be irrigated with wastewater even if treated.
6. Require that each food processing factory or industrial complex to have their own treatment plant for their liquid and solid wastes, in order that this point-source pollution hazard is checked.
7. Promote dissemination of extension papers and Manuals of Guidelines to help farmers reuse the treated wastewater for irrigation in a safe and efficient manner through the proper selection of crops and irrigation methods.
8. Give each possible support needed for the successful operation of the newly-launched Regional Network for Wastewater Reuse, as countries are the main owners and beneficiary of such Network.

40. Recommended Action by FAO and other International Organizations

1. Providing support to the Network on Wastewater Reuse for its operation and sustainability and proper mechanisms.
2. Play a stronger role in supporting the integration of the topic of wastewater treatment and reuse in their priorities and plans for water resources management.
3. Continue their efforts in assisting countries of the Near East Region in order to reuse treated wastewater in appropriate and sustainable manner.
4. Promote the adoption by countries of the established FAO/WHO guidelines for the safe and efficient utilization of treated wastewater in agriculture.
5. Foster regional technical cooperation and human resources development through conducting relevant training courses and by sponsoring TCP Regional projects.