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**DEVELOPMENT OF GUIDELINES FOR THE
ECONOMIC USE OF WATER IN THE ESCWA REGION**

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VII. RECOMMENDATIONS

A. Introduction

Major water projects in the ESCWA region can be classified into three main categories:

- (a) Water supply and sewage disposal schemes;
- (b) Irrigation and agricultural projects;
- (c) Projects providing water for various industries.

(a) The water supply and sewage disposal schemes: there are non-profit enterprises planned and executed for the welfare of the citizens.

An adequate quantity of safe drinking water and basic sanitary facilities are a matter of human rights.

In the ESCWA member Countries the capital investment needed for such projects is totally paid for by Central Governments. Tariff schedules, however, are designed to cover the cost of operation, maintenance, and replacement. Only in Yemen are the tariff schedules also designed to recover the capital investment costs during a period consistent with the paying ability of the people served. Information on pricing and tariffs was presented at the end of chapters IV, V and VI. In most ESCWA Countries water and sewerage tariffs are of an increasing-block nature embodying the principles of equity and income redistribution;

(b) Irrigation and agricultural projects: with the continuing growth of the population of the ESCWA region (about 100 million at present to a forecasted figure of 135.5 million for the year 2000), agriculture is assuming a more important role in the development of the region.

Agricultural projects in the ESCWA region are economically feasible only when large quantities of water can be secured at relatively low costs.

Based on the price of water alone, desalinated water would remain uneconomical for agriculture until technological advances permit the production of abundant cheap quantities of fresh water from saline waters by solar distillation or other improved desalination technologies.

Irrigation projects are costly. They are generally highly subsidized by concerned governments. Justifications for subsidy are based on grounds of achieving an acceptable level of food self-reliance, decreasing food imports, increasing agricultural products exports and providing employment opportunities for the rural communities. A 100 per cent subsidy for irrigation and drainage projects is the common practice in the ESCWA region. Charges for operation and maintenance and other agricultural services are indirect in the form of a fixed land tax per hectare or a small percentage of the crop, usually not exceeding 10 per cent;

(c) Projects providing water for various projects: the total cost of water projects for industries together with the operation, maintenance and replacement costs, are fully recovered from the concerned industries and are reflected in the selling unit price of the final product.

B. Recommendations to ESCWA member countries

Based on the six previous chapters of the report, recommendations are presented to each ESCWA member Country as follows:

1. Bahrain

(a) Establishing a national water-resources authority responsible for water resources development, conservation and quality control is recommended. This may have been recently established;

(b) Combating water waste by reduction of water consumption through setting an adequate tariff system for drinking water, garden watering, and wastewater disposal, and the introduction of metering is urgently recommended;

(c) Since Bahrain is shaping up into a commercial centre for the Gulf region, desalinated water production must be increased to meet the demand for more drinking water of better quality. More desalination plants are recommended. Solar stills are a source of fresh water for desert hamlets, small settlements along the coasts, hospitals, hotels and resorts would be very economical and are highly recommended;

(d) To reduce water distribution losses, old networks must be renewed and conveyance water losses reduced through setting active maintenance and repair teams all around the country;

(e) Provision of some sewage disposal facilities for the rural communities and adequate sewage systems in all towns is recommended;

(f) Sewage effluents recycling projects are recommended whose water production should be allocated for agriculture and industry;

(g) Overpumping of groundwater must be avoided by setting advanced pumping programmes in co-ordination with the Gulf countries;

(h) Measures against pollution of shorelines must be enforced;

(i) Salt tolerant and moderately salt tolerant crops are to be encouraged. Date palm, sugar beet, cotton and salt grasses are among the salt tolerant crops, while pomegranate, fig, grape, olive, alfalfa, flax, tomato, asparagus, barley, rice and sudan grass are known to be moderately salt tolerant;

(j) It is recommended that agriculture be fully subsidized and that fish and sea-food be made a routine portion of the daily diet.

2. Kuwait

(a) Kuwait is urged to complete its programme of construction of seawater distillation plants. All people have access to safe water supplies and adequate sanitation services now thanks to the wise policies pursued by the government. The additional constructed plants will meet the water demands of the growing population and the different economic developing sectors in the future;

(b) Completion of sewage disposal systems and re-use of treated effluents for agricultural expansion is recommended;

(c) Metering and the introduction of an adequate tariff system for drinking water, garden watering and wastewater disposal are recommended measures to combat water waste and reduce water consumption.

(d) It is recommended that the irrigation efficiency be increased through the introduction of lined canals and pipes for water conveyance to the farms and fields and that water-saving field irrigation methods such as sprinklers and drip irrigation be adopted;

(e) Sufficient funds for research on desalination and on solar distillation, in particular, must be allocated;

(f) It is recommended that the water-transfer project from the Shatt-El-Arab to Kuwait be reconsidered since the preliminary examination of the old outdated data on the subject, when inflated by 450 per cent, to bring the cost and prices to present day levels, indicate the constructional and possible economic feasibility of such a project;

(g) Further recommendations are full subsidy of agriculture; enforcing measures against shoreline pollution, and making fish and seafood a part of the daily diet.

3. Qatar

(a) Qatar is recommended to optimize its drinking water supply by mixing distillate with brackish ground water in suitable ratios to ensure that people are ingesting an adequate quantity of mineral salts which is quite important in hot climates. It is also recommended to install small local reverse osmosis desalination plants wherever necessary and to complete and expand its sewerage systems to serve new developments;

(b) Since groundwater in Qatar has been overexploited optimization of groundwater extraction and allocation is recommended with the help of foreign technical aid. Pre-arranged pumping programmes in co-ordination with other Gulf countries are recommended to help stop decline of ground water levels, salt intrusion and quality deterioration;

(c) Solar stills all along the coasts of the Qatar Peninsula are recommended as an economic source of fresh water for small settlements along the coasts;

(d) Urban effluents recycling projects are recommended as an enhancing source for agriculture;

(e) Combating waste by the introduction of metering and setting an increasing block tariff system for drinking water, garden watering and water waste disposal and vigilant and active maintenance to detect and prevent leaks is recommended;

(f) In co-ordination with other Gulf members a project for rain-making and cloud seeding to force passing clouds over Qatar to unload their moisture cargoes is recommended;

(g) Increasing irrigation efficiency by lining canals or using pipes and irrigating fields by sprinklers or drip irrigation methods is recommended. Salt to tolerant and moderately salt tolerant crops must be given priority;

(h) Fish must be made a part of the daily diet.

4. United Arab Emirates

(a) It is recommended to establish a national water resources authority for water resources development, conservation and control. National design criteria and standards for water projects are also recommended;

(b) Increasing desalinated seawater plants in the Emirates to cope with the growing demand for drinking water is recommended;

(c) Solar stills should be introduced to supply small settlements, hospitals, hotels and desert hamlets near the coasts with relatively cheap fresh water;

(d) Completion of the sewerage of schemes of Abu-Dhabi, Dubai, Sharja and Al-Ain where 80 per cent of the population live is urged and speeding up the construction of sewerage schemes for the cities of the northern region is urgently recommended;

(e) It is recommended to introduce metering and to set up an increasing-block tariff system for drinking water, garden watering and waste water disposal;

(f) Making use of experiments in other countries in the field of rural water supply, sanitation and community participation is advised;

(g) Reduction of conveyance and application water losses in irrigation by conveying water through lined canals or pipes and using water-saving field irrigation methods such as sprinkling and drip irrigation are recommended;

(h) Drilling deep wells in the Khider and Nassassa regions to transfer water to Ghanassa Island and drilling deep wells to depths from 400 to 500 metres below ground level in the Saih-El-Miyah project is recommended since the water extracted would be suitable for drinking and agriculture and its cost would range between \$ 0.70 and \$ 0.90 per cubic metre judging by costs

obtained from deep wells in the nearby Za'ala and Bada'a Bint Suad projects. Pumping programmes should be co-ordinated with other Gulf member Countries;

(i) The Falaj systems in the central and southern coastal parts of the Emirates should be carefully looked after and reconstructed where necessary since they represent a cheap and safe method for groundwater extraction;

(j) Sewage effluents recycling projects are recommended and their yield is to be used in agriculture.

5. Oman

Oman is lagging behind other Gulf countries in developing its water resources and in providing adequate drinking water and sanitary facilities for the population, despite the fact that it is an oil-producing country and that it possesses relatively better water resources potentials.

(a) It is recommended to provide every township and village with reasonably accessible clean and safe water by investing heavily in water supply and sewerage schemes. A minimum of 100 litre per capita per day is recommended for urban population of 50 l/c/d for rural population;

(b) An equitable increasing-block tariff system is recommended to cover the cost of maintenance, operation and replacement;

(c) Standpipes should be fully subsidized;

(d) Allocation of sufficient funds for health education and environmental protection activities is recommended;

(e) Establishing a national water resources authority for water resources development, conservation and control and for setting standards is recommended;

(f) A comprehensive plan for rural water supply and sanitation should be prepared;

(g) Being the main source of domestic water in rural areas, falaj systems must be well maintained and protected from pollution;

(h) Measures to improve irrigation efficiencies, reduce agricultural water consumption and introduce water-saving irrigation methods including canal lining, use of sprinklers and drip irrigation should be taken;

(i) Recharge schemes should be prepared which will not only minimize losses and recharge the coastal alluvial fans, but will also help in control of saline water intrusion;

(j) Introduction of solar stills along the Omani coasts and cloud seeding activities should find room for useful application in Oman.

6. Saudi Arabia

(a) A national water resources authority responsible for water development, conservation and quality control must be established. Such authority should include a strong hydrology section responsible for carrying out periodic hydrologic measurements at selected sites all over the country. Data thus collected should be processed and published;

(b) A comprehensive plan for rural water supply and sanitation must be prepared;

(c) A set of national standards for minimum quality requirements of water produced for various uses and for disposal of wastewater must be prepared. National design standards for water projects should also be set;

(d) The city of Taif needs additional resources to supplement its present 7,000 cubic metre per day water supply. Groundwater resources should be investigated;

(e) Villages should depend primarily on deep wells for their water supply. The poor accessibility of many small villages which are scattered all over the country enhance the importance of deep-well drilling for supplying water to such localities;

(f) Combating domestic wastewater and reduction in water consumption is recommended through the use of metering and enforcement of an increasing block tariff system for drinking water, garden watering and wastewater disposal;

(g) It is recommended to improve irrigation efficiency by conveying irrigation water through lined canals or pipes and employ water-saving field irrigation methods such as sprinkling and drip irrigation;

(h) Natural pastures should receive proper attention overgrazing should be avoided. A grazing area should be kept aside for each village cattle of other villages should be prevented from using it;

(i) Falajs on the Tihama coast and Hassa and Qatif oases deserve attention. Maintenance of falajs and regulation of irrigation from these sources are recommended;

(j) Solar distillation, cloud seeding, recharge projects, icebergs towed to Jeddah for fresh water production should all find applications in a vast country like Saudi Arabia and are worth considering;

(k) Water transfer from the Shatt-El-Arab in Iraq to Saudi Arabia is worth investigation;

(l) Urban sewage effluents recycling projects whose yield is to be used in agriculture are highly recommended.

7. Democratic Yemen

(a) Preparing and implementing a groundwater pumping programme taking into consideration the safe yield of each region;

(b) Constructing spreading dikes and spate breakers at the terminal of wadis before they meet the Arabian sea to help control seawater intrusion and provide water for recharging the coastal strip;

(c) Introduction of solar stills all along the 1,100 km long coastal strip wherever feasible to provide fresh desalted water at low cost;

(c) Construction of sub-surface and surface weirs, at suitable sites, across wadis to help recharge the deltaic aquifers;

(e) Have at hand a suitable number of small planes with pilots trained in cloud seeding, if this proves feasible;

(f) Designing and implementing a tariff schedule of an increasing block nature for water supply and sewage service charges;

(g) The feasibility of building a surface dam with reservoir capacity of 2 billion or more cubic metres annual storage in Hadramwat Valley after interconnecting with all suitable adjacent valleys to provide sufficient storage water should be considered. A similar project was executed in the case of Grande Dexece Dam in Switzerland.

8. Yemen Arab Republic

(a) Groundwater extracted from drilled wells is expensive and of excellent quality. It should be reserved for drinking, unless its extraction cost is less than \$ 0.1.

(b) Solar desalination plants should be introduced for fresh water production along the Red Sea coast villages, hotels, etc;

(c) The small-dam construction programme is promising to provide relatively cheap water for agricultural expansion, recreation, fish-breeding etc;

(d) A programme for recycling urban effluent water should be initiated;

(e) Structures to prevent the spill of flood water from the western slopes to the Red Sea should be provided;

(f) A charge for water provided for agriculture should be levied on farmers representing an appropriate percentage of the value of the annual yield of the lot when irrigated from wells or from small dams.

9. Jordan

(a) Jordan is recommended to develop the groundwater potentialities in the Sama Sdud well field within the Irbid Governorate;

(b) Groundwater potentialities of the Swaqa, Qatrana and Sultani well fields in the Mujib basin, should be further developed and a water transfer project from the well fields to Amman is recommended to help solve the capital's water shortage;

(c) Both regulations and economic incentives are recommended in dealing with the treatment of waste effluents from industries, including modern equipment subsidy, to achieve pollution control of storage water of the King Talal Dam;

(d) It is recommended to investigate the economic feasibility of installing a medium-sized reverse osmosis plant in the Jordan River Valley to desalt its water for domestic use;

(e) It is recommended that schemes for re-using urban treated waste effluents from Jordan's northern cities, where 85 per cent of the country's population live, for agriculture and industry be introduced;

(f) Active maintenance teams for water supply distribution networks would minimize water losses and save water and money;

(g) A crop charge in terms of percentage is recommended in order to pay some of the expenses of the irrigation projects;

(h) Caution should be exercised before deciding to implement the Euphrates-Jordan water transfer scheme, as discussed below. All alternatives to achieve the same objective are to be thoroughly investigated from the practical and economic point of view. The transfer scheme will enable Jordan to abstract 160 MCM per year from the Euphrates in Iraq at Al-Qaim near the Iraq-Syrian border. The UK consultant Howard-Humphreys are well-qualified technically for the project. Its estimated cost is in excess of \$US 1 billion and consists of 650 km pipelines and four stages pumping stations. The project would serve all drinking water demands in North Jordan^{1/}. The cost of one cubic metre of transferred water will exceed \$ 0.50.

10. Lebanon

(a) The hydrology and topography of the country permit the construction of many dams to generate considerable amounts of hydroelectric energy, a substantial part of which can be readily sold to other countries. It is strongly recommended that this target should be actively pursued in all future plans for water resources development. This would enable the government to have sufficient revenue for carrying out modern water supply and sewerage schemes in the urban and rural areas, developing its industry and agriculture;

^{1/} "Maqarin Deadlock Forces Major Revision of Jordan's Water Plans", Arab World Water, (July 1983).

(b) Use of the 2025 MCM of water discharged, on the average, to the Mediterranean every year, must be realized in allocating it to various sectors of the economy;

(c) A non-profit tariff schedule for water supply, sewerage services and disposal of industrial waste should be prepared to cover operation and maintenance costs. It should be of an increasing block nature.

11. Syria

(a) Syria is recommended not to spend any more funds on major storage or flood-control works;

(b) Since groundwater extraction is relatively cheap in Syria, the Government is recommended to spend more on groundwater extraction to develop the desert and arid parts of the Republic;

(c) Cattle breeding is a profitable business in Syria, therefore pastures and grazing regulations should be given special attention in the water use in the various parts of the Republic;

(d) Water supply and sewerage projects should cover the whole country with well prepared tariffs to cover operation and maintenance expenses;

(e) Syria should conclude agreements with Turkey and Iraq in sharing the waters of the Euphrates, which will enable the Republic to plan its agricultural expansion on a sound basis;

(f) Since the cost of reclaiming the hilly gypsious land in the Euphrates project is high, Syria may confine its cultivation in areas with class 1 and 2 soils for the time being;

(g) Water saving irrigation methods are recommended to avoid drainage and salinity problems as much as possible;

(h) Socio-economic conditions give the development of groundwater in the semi-arid regions of Syria paramount importance in plans for future development;

(i) In the southwest artificial recharge of the alluvial and volcanic aquifers would be a practical and economic solution to problems that already exist and those expected to rise in the future.

12. Egypt

(a) Revision of the water supply tariff schedule on a non-profit basis is essential to cope with the increasing expenses of maintenance, replacements and operation. Public utility rates should be set at levels that would achieve a balance between cost and revenue, with only minimal subsidies to be provided by the Government. Sewerage service charges should be combined with the water bill following the same guidelines;

(b) The frontier governorates of the Red Sea, norther and southern Sinai, the Matrouh and New Valley, where only one per cent of the population lives, have a considerable resource problem. They can obtain water from the Nile only by expensive long trunk mains and pumping works. Treated urban wastewater, solar desalination and other non-conventional water development techniques are recommended measures for temporary relief of the resource problem in those frontier regions. In the long-run, dual-purpose desalination plants or water from the Nile, whichever is cheaper, are to be considered;

(c) With sufficient surface water provided by the High Dam at all seasons and the high agricultural skill acquired by the Egyptain farmers throughout the centuries, agriculture should remain the backbone of the country's economy, only to be enhanced by the following factors: (a) modern methods of cultivation, including the introduction of agricultural machinery, fertilizers, pest and plant disease control, and extension services; (b) specail consideration for cotton and rice production to help the export balance; (c) a land or a crop yield tax to be enforced to cover the operation and maintenance expenses of the irrigation and drainage systems; (d) farmers should be able to receive loans with low interest rates to be paid back on easy installments enabling them to purchase necessary equipment to increase production; and (e) due to the limited arable land in the Nile Valley, wher 99 per cent of the population live, vertical expansion of agriculture is strongly recommended;

(d) High losses in water supply distribution systems due to leakage in all Egyptian cities call for strict active operation and maintenance teams.

13. Iraq

(a) Iraq is almost 100 per cent flood-proof, therefore no more funds should be spent on other major works relating to flood-control;

(b) Drinking water and sewerage service tariffs should be revised and set to recover operation, maintenance and replacement costs through an increasing block tariff system making the first low-cost block so designed as to provide every person with 100 l/day. Standposts should be fully subsidized;

(c) The water-wasting traditional method of rice cultivation by in-undating the rice farms to a depth of 50 cm prior to seeding should be abandoned and replaced by modern methods using fertilizers, modern drainage systems, pest and plant disease control measures, weed extraction etc. This will save from 5 to 7 billion m³ wasted annually on what is locally termed as "Tadyiab" prior to seeding;

(d) Irrigation return flows in Iraq are abundant. It is roughly estimated to amount to 10 billion m³ in an average year with a TDS of 2000 to 3000 ppm. By mixing irrigation return flows with fresh river water, the TDS can be reduced to an acceptable level. The drainage water thus treated can be re-used for irrigation. Moderately salt resistant plants are recommended in this case. For example, pomegrenates, figs, grapes, olives, alfalfa, cantaloupes, flax, tomatos, asparagus, barley, rice, lettuce, carrots, spinach, onion, peppers, wheat, etc.;

(e) Iraq is recommended to continue land reclamation by constructing drainage systems down to field drains, land levelling and weed extraction, salt leaching and use of fertilizers, use of crop rotation, etc. Total reclamation costs are expected to range roughly from \$ 6000 to \$ 7000 per hectare. It is suggested that half of the reclamation cost be subsidized by the government and the other half be recovered through a land or crop-yield tax whichever is more feasible;

(f) Maintenance of all water projects should receive prime consideration. This will save both water and money in the long run;

(g) Projects for soil stabilization and prevention of sand-dunes movement along both sides of the Gharraf Canal in the southern part of Iraq between the Tigris and Euphrates should be implemented;

(h) Well drilling in the northwestern and southwestern deserts with a limited work on building of small dams at suitable sites of the Euphrates desert wadis will be necessary for the development of the desert areas and settling the nomadic tribes;

(i) Some harnessing measures of the springs in the north and northeastern parts of Iraq are recommended to provide water for forestry and local domestic needs;

(j) A programmed and co-ordinated operation of the reservoirs in the country together with the Tharthar project would enable Iraq to employ the principle of perennial storage almost completely, thus avoiding any wastage of water in wet years and any serious water shortage in dry years;

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