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TOWARDS AGENDA 21 - CHAPTER 18
EGYPTIAN POLICY FOR IMPLEMENTATION

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The views expressed in this paper are those of the author and do not necessarily reflect those of the Economic and Social Commission for Western Asia.

Towards Agenda 21- Chapter 18
Egyptian Policy for Implementation

By

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1. INTRODUCTION

Egypt covers an area of about 1,000 000 km^2 of the arid belt of North Africa. Only 3.4% of this area is occupied by its population of nearly 60 million, of which 99% is concentrated in the Delta Zone. The Nile Valley consists of floodplain, bordered by flat terraces, most of which are suitable for land reclamation. Prime quality arable land surrounds the two Nile branches in the Delta, Rosetta and Damietta. Cultivated areas occupy nearly 7.37 million feddans (1993), mostly confinded to the floodplain and the Delta of the Nile. Few oases and some arable land in Sinai, irrigated by are irrecoverable groundwater.

Rainfall in the Mediterranean coastal strip decreases from 200 mm/yr in the west and drops dramatically inland to some 20 mm/yr near Cairo, 200 km from the coast. Rainfall in Egypt only occurs in winter in the form of scattered showers. Rainfall is utilized only in the Northern part of the Delta as supplement to irrigation diversions in the winter closure period, but cannot be considered a dependable source for extensive agricultural production. A reliable supply of water for irrigation is therefore mandatory for the development of agriculture in Egypt.

The socio-economic development of Egypt has been, and will remain, greatly dependent upon the development of its agriculture sector. However, water demands in Egypt have increased not only parallel to the agriculture horizontal expansion plan set by the government, but also in relation to the industrial development, the increase in population, and the rise in living standard. The share per person was estimated as 950 m^3/year which is considered under the water poverty levels, where it is anticipated that this amount will be reduced to about 500 m^3/year by the year 2025.

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2. EGYPT'S WATER RESOURCES; CURRENT AND POTENTIAL DEVELOPMENT.

2.1 The Nile River as the Main Water Resource of Egypt.

The main and almost exclusive source of water is the Nile river. Nearly 85% of the Nile water originates from the Ethiopian highlands through the Sobat River, the Blue Nile River, and Atbara River; the remainder originates from the Equatorial lakes highlands (through Bahr El-Jebel and Bahr El-Ghazal). The highest annual river flow at Aswan was 150 Milliard m^3 (1878/1879), the lowest 42 Milliard m^3 (1913/1914). The average annual natural flow at Aswan for the period 1900-1955 was estimated as 84 Milliards m^3/yr where abstraction in Sudanese part of the river are estimated at about 14 milliards m^3/yr.

The multi-year regulatory capacity provided by High Aswan Dam (HAD) has given stability to Egypt's water resources despite the wide range in annual flows recorded in the last 100 years (which limits the use of statistical forecasting of flows for planning purposes). The storage capacity of Lake Nasser (live storage 90 Milliard m^3) can safeguard downstream water requirements in years of less than average inflow to the lake. The African drought in the recent past (1984-1987), while being devastating to many parts of Africa, had limited impacts on Egypt. HAD's water reserves were seriously reduced, but the high inflows during 1988 have restored reserves to nearly the 1983-1984 levels. Egypt is now directing more effort on water management and forecasting, to improve the utilization of its water resources in order to be able to meet future increasing demands.

The Nile water agreement of 1959 with Sudan was based on the average Nile flow at Aswan during the period 1900-1995 (84 milliard m^3/yr) and estimated average annual evaporation and other losses in Lake Nasser (nearly 10 Milliard m^3/yr). The agreement allocates 7.5 Milliard m^3/yr to Egypt and 14.5 Milliard m^3/yr to Sudan, as HAD benefit gained from the flow was going to the sea beside the required (historical) rights for each country (Egypt 48 & Sudan 4.0 Milliard m^3/yr).

As a matter of fact, Egypt's share from Nile water is fixed by the agreement to 55.5 Milliards m^3/year. It is worth mentioning that the different other uses as the reuse of drainage water, groundwater in the valley and delta and waste water reuse are not considered as independent sources and added to Egypt's Nile share, rather, it could be considered as a factor helping in increasing the efficiency of the overall system.

2.2 Groundwater

2.2.1 The Nile Aquifer

Groundwater in the Nile aquifer can not be considered a separate source of water. The aquifer is renewed only by seepage losses from the Nile, the irrigation canals and drains and percolation losses from irrigated lands. Its yield may therefore not be added to Egypt's total water resources without taking into account salinity build up due to groundwater abstraction/ recharge cycles. The potentially recoverable abstraction rate (safe yield) of this aquifer is estimated at 7.5 Milliard m/yr further abstraction may result in a significant lowering of the groundwater table and an increase in sea water intrusion in the Northern part of the Nile Delta. Hence, this aquifer can only be seen as a small reservoir in the Nile River system with a limited-rechargeable-life storage compared to its total volume which is estimated at 500 Milliard m^3/yr. The current rater of abstraction from the Nile aquifer is estimated at 4.1 Milliard m^3/yr.

2.2.2 Groundwater in Western Desert

Groundwater exists in the western desert in the aquifer of the New Valley and region East of Owaynat. The total groundwater volume in these areas has been estimated at 40,000 Milliard m^3 with salinity varying between 200 and 700 ppm (Abu-Zeid and Rady, 1991). The groundwater occurs however, at great depths and is generally considered to be non-renewable. Use of this water, as adopted in the water policy of Egypt, depends on pumping cost and depletion rate versus potential economic return. A study has indicated (Abu-Zeid and Rady, 1991) that 125,000 feddans can be irrigated (by 1 Milliard m^3/yr of groundwater) in the New Valley; another 180,000 feddans can be irrigated in the East Owaynat area by groundwater from the deep Nubian Sandstone.

2.2.3 Groundwater in Sinai

In Sinai, numerous smaller groundwater aquifers exist, for example the shallow aquifers along the Northern coast, the Northern and Central Sinai that are recharged by rainstorm floods and the aquifers in South Sinai, which are mostly deep and non-renewable. Present groundwater abstraction in Sinai and western desert is estimated at 0.57 Milliard m^3/yr, where potentially could be increased to 3.5 Milliards m^3/yr.

2.3. Reuse of Agriculture Drainage Water

Drainage flows stem from three sources, all of which depends upon Nile inputs; namely; Tail-end losses from canals, surface flow from irrigated fields, and percolation. Intrusion of saline groundwater contributes greatly to the salt load, in particular in the Northern part of Nile Delta, where 80% of the salinity of the drainage water is added by upward seepage of saline groundwater. Lower salinity is found further southward, where it remains below a critical level (estimated at 1000 ppm TDS). Studies have indicated that drainage water can be reused directly for irrigation if the salinity level is low or mixing with fresh canal water when the salinity is high. An example is El-Salam Canal which uses drainage water of Bahr Hadous and El-Serow drains mixed with fresh water in a ratio of 1:1 the total amount which can be reused is estimated at about 7.5 Milliard m^3/yr. However for the time being, about 3.7 milliards/year is being used.

2.4 Desalinization

Desalination is being applied only to few areas along the Red Sea Coast, especially in tourist resort, where water consumption is relatively small. However, desalinization in Egypt has been given a low priority in thinking of non-conventional water resources, mainly in view of its relatively high costs.

2.5 Improvement of the Irrigation System

Field water application, agronomic water use, and field canal conveyance efficiencies determine the overall efficiency of the irrigation system, which is in the order of 70% at present (Planning Sector, 1994). An ongoing project exist within Ministry of Public Works and Water Resources to implement a plan designed by the National Water Research Center to improve the irrigation efficiency in the old lands. The project comprises the improvement of control structures application of modern methods in land levelling/tillage and on-farm development, and by the rehabilitation of main canals, branch canals, and mesqas (field canals). However, due to a reduction in water losses that are not returned to the system, the project is expected to yield savings 0.5, 1.5 and 5 Milliard m^3/year in the years 2000, 2012 and 2025 respectively.

2.6 Reuse of Waste water

Waste water reuse has been applied in Egypt for centuries, but was formally used in 1915 at Gable El-Asfar (North-East of Cairo), after primary treatment, for cultivation of 2500 feddan. As new waste water treatment plants-using secondary treatment-are being built in some cities, the reuse of treated waste water could be increased from the present amount (estimated at 0.6 Mm^3/yr) to 1.67 Mm^3/yr. in 2000 and to 2.4 Mm^3/yr. in 2010.

2.7 Water Quality Aspects

2.7.1 Salt Water Balance Over Egypt

The water balance for Egypt is presented in Figure (1). Components in the figure are given as gross supply and net consumption. In Figure (1), it is indicated that at present, some 12 Milliard m^3 of drainage water is being spilled annually to the sea, some of which is to maintain the salt balance and to flush the high salinity water in the northern Delta, where salt intrusion from the sea takes place. However, the amount of lost drainage water seems to be inaccurately estimated as part of this water (possibly 2.0 Milliard m^3/yr) is the drainage of sea water intruded in the Northern part of the Delta, which affects the water and salt balance. Another uncertainty in the estimation of the "net" amount of spilled water is due to the salt from leaching soils of newly reclaimed northern lands. This may indicate that the actual drainage water produced from agriculture is about 10 Milliard m^3.

The non-recoverable volume of drainage water that has to be spilled to the sea to allow sufficient leaching of the soils and to counteract sea water intrusion is estimated at 8 Milliards m^3/yr (6 from agriculture lands + 2 from sea water intrusion) as minimum. Therefore, drainage reuse projects in the near future may use about 4.0 Milliard m^3/yr, of the presently spilled drainage water. Water pollution hazards as well as ecological considerations are however expected to limit these objectives.

A thorough investigation into the use of brackish or highly saline water on sandy desert soils under modern irrigation techniques might reveal increased possibilities for the use to this water.

2.7.2 Water Quality and Environmental Aspects

Water quality parameters in Egypt can be grouped according to their constituents as follows:

- salts, which have been extensively studied;
- organic pollutants from industrial, domestic and agriculture wastes, which can be removed by natural processes (bio-degradation);
- pathogens and bacteria;
- nutrients resulting from the application of manure and fertilizers of the bio-degradation of wastes; and
- other organic/inorganic chemicals (e.g. heavy metals) stemming from industrial and domestic waste water of pesticide application in agriculture.

The first category of pollutants is most harmful to agriculture, whereas the others form a danger for humans, fisheries and the environment in general.

A relatively clear picture exists in terms of water salinity, information and data on other water quality parameters is limited. The few data available do however suggest that "black spots" are still of a local nature. Pollutants loading results from untreated/semi-treated municipal and industrial waste water discharges in drains (sometimes also directly in the Nile River or canals in case of industrial waste water discharges) from drainage water discharging in the Nile River in Upper Egypt, and from the leaching of fertilizers and pesticides form agriculture.

Generally, for most of the irrigation canals, water is still relatively clean, in contrast to that in the drains where most of the wastes are dumped.

The almost stagnant bottom waters in Lake Nasser are becoming lacking of adequate oxygen. After releasing the water to the river, it however soon regains its natural content. Large organic pollution loads from urban areas and industries in Upper and Middle Egypt cause local "black spots" but the self-purifying capacity of the Nile River still results in reasonable levels of organic pollutants downstream. The levels of BOD, as a measure for degradable organic matter, are still satisfactory up to the Delta Barrages. (Table 1).

Fertilizer use has increased almost fourfold during the four decades. Groundwater contamination from fertilizer user requires attention as groundwater is used widely for drinking water and is considered more vulnerable than surface water. Pesticide use has also increased but at a lower rate. In 1991, herbicides were used to control aquatic weeds of which 13,000 km of canals/drains were infested, but their use was eliminated as a result of political and public concern. On the other hand, alternative means have disadvantages as well; manual weed control possibly causes an increase in Bilharzia infections, while the use of mechanical and biological means may require extensive investment. The best solution would probably be to use integrated means on the basis of an optimization study.

Water pollution from industrial and domestic wastes in the Nile Delta is likely to cause degradation of land/soil and water resources. Degradation of natural resources is rather general in Egypt as a result of adverse impacts of developments that received limited attention in the past. This impact can be considered as a cost to the national economy. However, the impact on human resources is of a higher concern since it represents a cost to health and the economy. A legal basis for controlling water pollution, especially by municipal and industrial effluent, already exists through the Law 48 of 1982. A nation-wide Water Quality Monitoring program has been proposed as part of the implementation of Egypt's Environmental Action Plan.

3. EGYPT'S WATER DEMANDS: PRESENT AND FUTURE SITUATION

3.1 Agriculture Water Requirements

Water requirements of the agriculture sector represent the largest component relative to the other users. Gross water demand from irrigation is in the order of 54.5 Milliard m^3/yr, including all application, distribution and conveyance losses. Irrigation is applied to 7.37 million feddan of arable land, whereby the annually cropped area is 14.7 million feddan (i.e. a cropping intensity of nearly 200%).

The Land Reclamation Plan, developed by the Ministry of Agriculture together with MPWWR, aims at reclaiming more than 2.2 million feddan during the period 1993/94 till 2000. The plan includes the reclamations of:

- 1.7 million feddans by an improved efficiency of surface water, i.e. through projects to conserve winter closure losses (mainly for navigation) and by improved reuse of drainage water and groundwater Figures (2) and (3);
- 0.2 million feddans with water provided by sewage treatment projects; and
- 0.3 million feddans with unrecoverable groundwater in the New Valley (Western Desert) and Sinai.

The implementation of this ambitious plan faces however several obstacles, such as the resistance against the storage of losses during the winter closure period in the costal lakes due to its adverse impact on fisheries and the environment and the constraints in the reuse of drainage water by the increasing pollution of the drains. Moreover, the salt balance in the Delta necessitates that 8 Milliard m^3/yr. (at minimum) of the drainage water has to be flushed to the sea, which could also limit the future increase of reuse.

Due to these obstacles, horizontal expansion might be limited. In order to reach the target of the plan, the following measures have to be taken (Planing Sector, 1994):

1. Implementation of a strict scheme for protecting waterways from pollution (Although there is good cooperation of MPWWR with the Egyptian Environmental Affairs Agency);
2. Reduction of areas cultivated with rice;
3. Modification of the current cropping pattern to incorporate less water consuming crops, e.g. by replacing sugar-cane by beat which consumes less water;

4. Modification of the winter closure (to make it more flexible) and conservation of the fresh water losses to sea (see the section on navigation water requirements);

5. Calculation of crop water requirements at field level in a more accurate way by using new methods for the computation of evapo-transpiration losses and aerial photogrammetry or satellite imaging techniques to obtain actual cropping patterns;

6. Eradication of aquatic weeds to reduce evapo-transpiration loss from canals and lakes;

7. Drainage reuse at the potential capacity to minimize the spilling of drainage water to the sea beyond the amount needed to maintain the salt balance.

For the period from the year 2000 till 2010, additional areas of about 0.3 Million feddans can be reclaimed only if Jonglei Canal Project is implemented Which would add almost 2 Milliard m^3/yr. to the annual water budget of Egypt.

3.2 Navigation

Since the construction of HAD, the water released for irrigation and municipal and industrial demand for the period from February till September is sufficient to maintain adequate depth for navigation on the Nile. However, from October till January, Irrigation water demands are relatively low (also many regions in Northern Delta utilize winter rainfall to supplement irrigation), particularly during the winter closure (three weeks in January/February), and the Nile water discharges become too low to provide the minimum drafts required for navigation.

In the section Aswan-Luxor (where a minimum draft of about 1.5 m. is required, navigation bottlenecks may occur in winter, when there is a peak in tourism activities. The Luxor-Cairo section is hardly sailed by tourist boats and may only have navigational bottlenecks during the closure period. The normal Nile flows - without extra releases - during this period will be sufficient for partially loaded tourist boats and for cargo ships operation with a lower efficiency. To overcome the navigational bottlenecks in the Aswan - Luxor section, extra water is being released from HAD - mostly during the closure period - in addition to the requirements for municipal and industrial supply. As this water is not required for any of the other demands, it is being spilled to the sea.

This amount of fresh water annually spilled to the sea was about 1.8 Milliard m^3 in 1990/91, 3.8 Milliard m^3 in 1991/92, 2.08 Milliard m^3 in 1992/93, and 1.15 Milliard m^3 1993/94. Most of this water is spilled at Edfina (end of Rosetta Branch). Around 0.2 Milliard m^3/yr. is being spilled to Lake Manzala at Damietta; the latter amount is used to flush silt and rubbish from Damietta

Branch. For the conservation of this water, various alternatives have been considered, such as storage in the pools upstream of the Nile River Barrages, artificial groundwater recharge, increased winter irrigation, storage in the coastal lakes and staggering or eliminating the winter closure period which is being tried this year.

However, all proposals do seem to have adverse impacts on water quality, fisheries, human activities and the environment in general. Detailed studies have to be carried out to determine these impacts which may lead to discard some or all of the proposals. Currently, Esna and Naga Hammadi Barrages are being renewed, which will guarantee a better control of the Nile levels in Upper and Middle Egypt. The extra releases of fresh water could therefore be reduced in the near future to an estimated 0.35 to 0.4 Milliard m^3/yr. Figure (4).

3.3 Municipal and Industrial Water demand

3.3.1 Municipal Water Demand

Municipal water requirements are being assessed -over Egypt- the requirements per governorate, estimated on the basis of three factors: population and population increase, consumption per capita (in liter per capita per day), and water distribution efficiency. In the recent past, municipal water demand did not take a major part relative to the other water uses (in the order of 2.70 Mm^3/yr. with a net consumption of about 1.51 Mm^3/yr.) It will require a considerable part of the national water resources in the future due to the population growth as well as the rise in living standard, which generally increases the per capita demand.

For planning purposes, future municipal demands are estimated by considering different permutations of the three principal factors given above.

3.3.2 Industrial Water Demand

Industrial water demand also constitutes a considerable part of the total water demand in Egypt. The total demand was estimated at 5.89 Milliard m^3/yr. in a net consumption of about 0.41 Milliard m^3/yr. Use of the return flow from industry is hampered by the low level of treatment and consequently low quality of the waste water. Future industrial water requirements are estimated by taking into account planned growth rates of different industrial sub-sectors, proposals to reduce water requirements e.g. by using seawater for cooling of new power stations, improvement of industrial process and reuse of industrial waste water.

The analysis of the future demands for municipal and Industrial for the year 2000 is estimated as 1.0 Milliard m^3/yr. and for the year 2025 is 6 Milliards m^3/yr.

Accordingly the current yearly demand status is:

-	Agriculture of physical area of 3.37 million feddans	54.5 milliards/year
-	Municipal	2.7 milliards/year
-	Industries	5.9 milliards/year
	Total	63.1

It is obviously clear that Egypt's share in Nile waters is completely exhausted.

4. FUTURE CONCEIVED PROGRAMS:

The features of the conceived programs till the year 2000 are presented:

4.1 Drainage reuse:

The potential of the drainage water which could be used was estimated at 7.5 milliards m^3/yr. with a reasonable water quality constraint, out of which 3.7 milliards m^3/yr. is being used. However, 3.8 milliards m^3/yr. are available to be reused.

4.2 Groundwater:

The groundwater potential in the valley and delta was estimated at be 7.5 milliards m^3/yr. as safe yield, out of which 4.1 milliards m^3/yr. is being used. Thus, the balance of 3.4 milliards m^3/yr. could be used.

4.3 Irrigation improvement:

Improving irrigation projects conveyance efficiency, and on farm irrigation as well, studies have showed that 0.5 milliards m^3/year could be saved.

4.4 Limitation of high consumptive use Crops:

Rice and sugarcane are considered as very high consumptive crops for water. It was noted that about 1.6 million feddans were cultivated rice recently. It is planned to reduce that area to 0.7 million feddan only as it was planned after the erection of the High Aswan Dam. This reduction of area would save about 3.0 milliards m^3/yr.

The year 2000 extra demand status is:

-	New land cultivation (1.6 million feddans) (infra structures are being completed)	9.0
-	Municipal and Industrial	1.0
	Total	10.0

4.5 Estimation the required additional water demand for year 2025:

The additional demand up to year 2025 could be stated in Milliard m^3/year as follows:

*	New land cultivation (about 1.0 million feddan)	5.6
*	Municipal and Industrial	6.0
	Total	11.6

The required resources which could satisfy the above demands up to year 2025, could be saved through better integrated management of existing water resources, i.e. reuse of drainage water, groundwater, reduction of municipal and industrial losses, reduction of high water consuming cropped areas as well as irrigation and drainage system losses.

5. WATER MASTER PLAN PROJECT:

In year 1977, the water master plan project was established. Through two phases, 30 technical reports were produced. The project was interested in collecting different relevant data; viz, hydrological meteorological, agricultural, municipal, industrial, economic, physical, quality, demographic and ecological data, beside the irrigation and drainage and administrative systems. The project was also interested in designing an information data base system where all irrigation, drainage, agriculture and economic data were stored. Many mathematical models were developed, Viz, a groundwater, Lake Nasser simulation, upper Nile, agro-economic, forecasting, dynamic policy, operational distribution mathematical models.

By using the mentioned data, in formations and tools, several studies were conducted in relevant fields and three alternative plans were reached.

Table (2) lists all the technical reports published for the water master plan of Egypt. This project was terminated in year 1990.

6. ACHIEVEMENTS TOWARDS THE IMPLEMENTATION OF RECOMMENDATIONS OF CHAPTER 18-AGENDA 21

6.1 Institutional Capacity Building:

Many-water institutions were established in order to improve water policy and water management such as:

National Water Research Center which was established in 1975 and involves 12 Research Institutes which are:

* Water Management Research Institute;
* Waterways maintainence Research Institute;
* Drainage Research Institute;
* Groundwater Research Institute;
* Water Resources Development Research Institute;
* Nile Research Institute;
* Survey Research Institute;
* Hydraulics Research Institute;
* Construction Research Institute;
* Mechanical and Electrical Research Institute;
* Costal Research Institute; and
* Climatic Changements and its impacts on Water Resources Research Institute.

The National Water Research Center has 193 research Engineers, 50 out of them are Ph.D holders. The objectives of the establishment of the National water research Center are to outline and implement long-term policies for managing the water resources in Egypt in order to cope with national demands solving the technical and applied problems associated with the general policy for irrigation and drainage and conducting investigations and research work connected with the extension of agricultural and land water resource assessment both surface and groundwater.

Also the Ministry of Public Works and Water Resources in Egypt established an Information Center which serves all its organizations and support decision makers to take the right decision in the right time.

A National Training Center within the Ministry of Public Works and Water Resources was established and is responsible for the development and strengthening of skills for the Ministry's staff in accordance with its policies. The training center is located at 6 October City near Cairo and contains classrooms and laboratory facilities to accommodate over 2500 trainees per year. It involves the most modern learning technologies and methods.

In addition to serving the manpower development needs of the MPWWR, the training center offers its facilities and services to other ministries within Egypt and to government and private students from countries within the region. The new facility has a complete dormitory for 250 students and on-campus dining and recreation facilities. Training for outside agencies is offered on a tuition basis.

The Training Center's Objectives are:

* Training a cadre of senior supervision executive and middle managers with comprehensive knowledge on how to plan and direct MPWWR technical, financial and manpower resources.

* Train engineers and other professional staff of the Ministry for their present responsibilities and for future targets.

* Provide management and training resources for continuing Professional Self - development of engineers and other graduated staff.

* Create and execute training programs for sub-professional personnel to develop their needed range of practical skills.

* Facilitate training opportunities for African, Arab and Mediterranean countries in the fields of irrigation, drainage, water resources development and management according to their needs.

6.2 To Satisfy the Freshwater Needs for Sustainable Development

- Construction of Al Salam canal which will allow for cultivating 600,000 Feddans to help in producing food for the Egyptian population.

- Construction of the new navigation lock at Naga Hammadi Barrage saves 1.0 milliard m^3/yr. to be utilized in irrigation of new lands and in increasing efficiency of the river transportation.

- Construction of new pumping stations on Al-Naser canal to irrigate 130,000 feddans in Nobaria area at west of Alexandria.

- Construction of New Esna Barrage on the Nile River for providing efficiently the required irrigation water to the upstream canals and for power generation and improving navigation conditions in the Nile River.

- Establish a Telemetry System which covers the inter length of Nile River in Egypt and the irrigation and drainage networks. This system allows for best water control and management and to facilitates communication between MPWWR and its organization.

- Establishment of Forcasting Center at Ministry's building which helps in estimation the Nile yearly flood to set the future plan for water resources management.

- Establishment of public awareness unit at the Ministry headquarter to promote the public awareness towards the water quantity and quality issues and its importance for sustainable development.

- Widening of Ismailia canal for proving irrigation water for 900,000 Feddans to be added to the cultivated area of Egypt.

- 200 deep wells have been dug to increase utilization of the deep ground water and increase the cultivation areas in desert and to increase the conjunctive use of surface and groundwater.

- Constriction of some small dams in Sinai to save flush floods which falls occusionly in winter to be used for providing drinking and irrigation water.

- Implementation of the National irrigation Improvement Project which will save the water losses through the earth field ditches.

- Extending the tile drainage to cover all old cultivated land. This system of drainge will help in increasing the productivity of the cultivated land and improve the soil structure.

- Using the modern techniques for conducting areal survey for assessment of land and water resources.

- Develops work plans for the various water related issues, which allows for a systematic approach in resolving these issues, and prepares technical reports on planning and water related issues.

- Improve and modernize the present system by introducing several new and innovative measures and practices.

- Combines available technical data and suggests additional data recorded to perform hydrological as well as operational studies.

- Improve the control of the Nile water for all uses and, particularly, its optimal allocation to and within agriculture as a means for helping increases agricultural production and productivity.

- Outline and implement long-term policies for managing the water resources in Egypt in order to cope with national demands.

- Determine the crop water requirements for different regions and study evaporation and seepage losses form waterways, lakes and reservoirs.

- Develop and improve the design, planning and execution of drainage projects in Egypt and determine the drainage water quantities and qualities which can be reused for irrigating purposes.

- Protect and maintain the High Aswan Dam. Study earthquakes effect on High Aswan Dam, sedimentation in Lake Nasser, earthquake activity and earth movement in the area around Lake Nasser.
  Protect the critical areas along the Mediterranean, specially within the Delta area.

- Study the operational of all types of pumps and conducting tests checking their safety range and calibration.

- Produce, maintain and distribute current and accurate geographic data describing the Egyptian landmass, the cultural features thereon and its ownership.

6.3 Towards Protection of Water Resources, Water Quality and Aquatic ecosystem:

- Establishment a monitoring network to cover the Nile river and its two branches within Egypt, Lake Nasser and also the drainage network as long as it is being used for irrigation.

- Starting a national project for preventing the raw industrial wast to be discharged into the Nile or any other waterway. This is only is allowed after prelimenary treatment. Therefore, constriction of some treatment units at the different factories have been started and will continue in the future.

- Investigate theoretically and experimentally the characteristics of sediment materials and the mechanics of its movement in the River Nile.

- Monitor and evaluate the sedimentation in Lake Nasser and its effect on the reservoir storage capacity and Aswan Dam operation.

- Carry out aquatic weed control manually, mechanically and biologically.

- Provide studies and recommendations to protect the Egyptian heavily populated Northern coast, with its valuable agricultural establishment and infrastructure.

6.4 Towards Drinking - water supply and sanitation

A comprehensive plan was set up to provide all Egyptian living either in, megacities, cities, and in countryside with drinking water. This plan is completely implemented. However renewing the treatment plants and constructing new ones are continuing to cope with the rapid increase in the public demands. The Ministry of Health of Egypt is responsible for monitoring of potable water quality and it has a plan for insuring the supplied potable water for drinking to avoid any health risk which will affect the national income.

7- CONCLUSIONS AND RECOMMENDATIONS

Water is the vital element of the life of all sorts of creation and is the main element of sustainable development of all nations. Therefore, maintaining its quantity and its quality at an acceptable level is desired.

The water balance of Egypt as shown previously results in deficit to year 2025. This can be recorded only if more water resources are developed and if the water quailty of Nile waters, groundwater and drainage water are maintained at acceptable level which has no consequance on the environemntal aspects.

All proposed mentioned plans related to reuse of drainage water and shallow groundwater are necessary to be followed to get the required water balance. In the meantime the progress in the implementation of National Irrigation Improvement is required not only to save water but also to increase the productcity of the cultivated land.

The strengthening of the Telemetry, system; the public awareness unit, and the information center is highly desired.

The shortage in funds available for implementing the mentioned plans and projects espically that which related to the water quilty issues should be managed due to their consquences on the public health. This can be overcommed by increasing of the international participation in funding such plans and projects.

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Table 1 Water quality status in Nile river
Identification of Black spots by comparing Parameter Standards and Existing values

Parameters\Constitutes / Units			TDS ppm	DO mg/l	BOD mg/l	COD mg/l	Total Coliform No./100ml	Organic Nitrogen mg/l	NH3-N mg/l	NO3-N mg/l	Turbidity mg/l	PH
Appropriate Standards												
For Nile main reach (Source Low 48/WHO)			500	min. 5	6	10	3000	1	0.5	10		7 to 8.5
For discharges to Northern lakes (Law 48/Art 66)			650	min. 4			5000				50	7 to 8.5
Nile Reach (Node)		Km from Aswan										
Aswan		1.4	135	DET 3.15	3	9	12000	0.04	0.02	0.55	3	7.4
		21	150	DET 3.77	2	5	1500	0.02	0.02	0.35	3	7.35
		53.8	155	DET 4.5	4	8	2000	0.01	0.45	0.52	3	7.25
		83.4	160	DET 5.45	2	9	18500	0.02	0.42	0.46	3	7.25
Idfu		114.5	154	DET 6.0	1	9	800	0.015	0.42	0.42	255	7.3
		143.05	160	DET 6.23	1.3	7	1500	0.02	0.13	0.26	260	7.35
Esna (Barrage)		167.65	163	8.5	1	9	6000	0.02	0.5	0.54	5	7.4
		206.9	166	8.4	1	8	1000	0.017	0.6	0.44	4	7.45
		236.8	170	IMP 9.2	3	7	1000	0.015	0.25	0.54	4	7.5
Naga Hammadi Barrage		268.15	167	DET 9.3	3	9	2000	0.01	0.13	0.7	3	7.55
		299.2	173	IMP 9.1	3	7	3000	0.07	0.02	0.38	5	7.6
		331.1	178	IMP 9.15	3	10.5	1900	0.03	0.05	0.24	5	7.65
		361	176	IMP 8.4	3	10.5	53000	0.06	0.02	0.28	7	7.5
		397	180	IMP 9.0	3	9	50000	0.02	0.02	0.32	6	7.5
Sohag		438.55	186	IMP 9.57	3	7.5	5000	0.04	0.02	0.26	9	7.65
		472	182	IMP 8.6	3.5	13.5	1500	0.055	0.02	0.8	7	7.7
		512	180	IMP 9.12	3	13.5	500	0.06	0.01	0.27	10	7.6
Assuit Barrage		547.4	180	IMP 9.72	4	15	2500	0.02	0.01	0.24	13	7.55
		587	183	IMP 8.75	3.5	14	1000	0.08	0.008	0.87	16	7.7
		618.65	186	IMP 8.6	4.5	25	2700	0.015	0.008	0.45	12	7.75
		646	189	IMP 9.25	3.5	15	2000	0.03	0.008	0.42	12	7.7
Minya		686.05	183	7.85	3.7	9	5500	0.015	0.008	0.3	20	7.65
		716.6	186	IMP 8.4	3.2	16	5500	0.035	0.008	0.2	17	7.6
		748	182	IMP 8.55	3.2	10.5	2000	0.025	0.008	0.2	14	7.65
		792.4	188	IMP 7.17	3	16	2000	0.01	0.008	0.64	37	7.35
Beni Suef		807.8	187	IMP 7.55	2	8	2000	0.01	0.02	0.52	42	7.5
		862	196	DET 7.2	3	10.5	1000	0.01	0.07	0.44	40	7.4
		887.95	200	DET 7.45	3.2	10	500	0.01	0.08	0.25	41	7.5
Cairo		921.8	205	DET 6.5	3.7	5.5	6000	0.01	0.02	0.51	20	6.8
U.S. of Delta Barrage		947	208	DET 5.8	3.2	16.5	4000	0.03	0.02	0.78	25	6.9
Damietta Branch Zifta Barrage		1166	350	DET 4.65	7.6	46	4500	0.03	0.31	0.94	10	7.5
Damieta (At Outflow to Manzala Lake)		1180	375	IMP 6.0	6.5	13	5000	0.03	0.24	0.76	7	7.5
	Rosseta Br.	1075	320	4.7	8.5	15	20000	0.025	1	2		7.5
	Edfina	1156.5	345	DET 5.65	6.5	15	1500	0.025	0.2	2.5		7.5
General Trend of Parameter Status with time			Improving		Improving	NA	NA	NA	NA	NA	NA	NA

Table (2)

REPORT NO.	NAME
technical report 1	WATER PLANNING :METHODS AND THREE ALTERNATIVE PLANES
technical report 2	WATER DEMANDS
technical report 3	WATER SUPPLY
technical report 4	GROUND WATER
technical report 5	REGULATION STUDIES
technical report 6	PROJECTS INFORMATION SYSTEM
technical report 7	WATER QUALITY
technical report 8	THE ORGANIZATION , ADMINISTRATION , AND LEGAL FRAMEWORK FOR WATER PLANNING
technical report 9	WATER AND WASTE WATER STUDIES MUNICIPAL AND INDUSTRIAL SECTORS
technical report 10	INDUSTRIAL WATER USE AND WASTEWATER PRODUCTION
technical report 11	WATER MANAGEMENT CAPABILITIES OF THE ALLUVIAL AQUIFER SYSTEM OF THE NILE VALLEY , EGYPT.
technical report 12	SEDIMENT PROCESSES IN THE NILE RIVER
technical report 13	FISHERIES , ECOLOGY , HEALTH AND FISH FARMING
technical report 14	HYDROLOGICAL SIMULATION FOR LAKE NASSER
technical report 15	MATHEMATICAL MODEL FOR THE UPPER NILE
technical report 16	AGRO ECONOMIC MODEL
technical report 17	CONSUMPTIVE USE OF WATER BY MAJOR FIELD CROPS IN EGYPT.
technical report 18	HYDROLOGICAL EVALUATION OF ENVIRONS OF LAKE NASSER
technical report 19	ECONOMIC EVALUATION OF LAND RECLAMATION
technical report 20	THE IRRIGATION SYSTEM
technical report 21	MULTI-LEAD FORECASTING OF RIVER NILE STREAMFLOWS
technical report 22	ADAPTIVE CLOSED-LOOP OPERATION OF THE HIGH ASWAN DAM
technical report 23	WATER RESOURCES PLANNING GUIDELINES
technical report 24 (VOL. I)	AN ECONOMIC EVALUATION OF NEW LANDS PROJECTS IN THE NATIONAL FIVE PLAN (1982/1983-1986/1987)
technical report 24 (VOL.II)	APPENDIX 1 : SHADOW PRICES APPENDIX 2: MECHANIZATION
technical report 24 (VOL. III)	APPENDIX 3 :CROP PATTERNS
technical report 24 (VOL. IV)	APPENDIX 4 :COSTS & BENEFIT STREAM
technical report 25	NILE RIVER IRRIGATION DATA COLLECTION SYSTEM /BACKGROUND AND FEASIBILITY
technical report 26	THE OPERATIONAL DISTRIBUTION MODEL
technical report 27	VERTICAL DEVELOPMENT OF "OLD LANDS"
technical report 28	LOSS OF AGRICULTURAL LAND
technical report 29	DETAILED EXAMINATION OF EXISTING LAND RECLAMATION PROJECTS
technical report 30 (VOL I)	PRESENT AND FUTURE OPERATING SCENARIO FOR THE HIGH ASWAN DAM
technical report 30 (VOL II)	REPORT APPENDICES

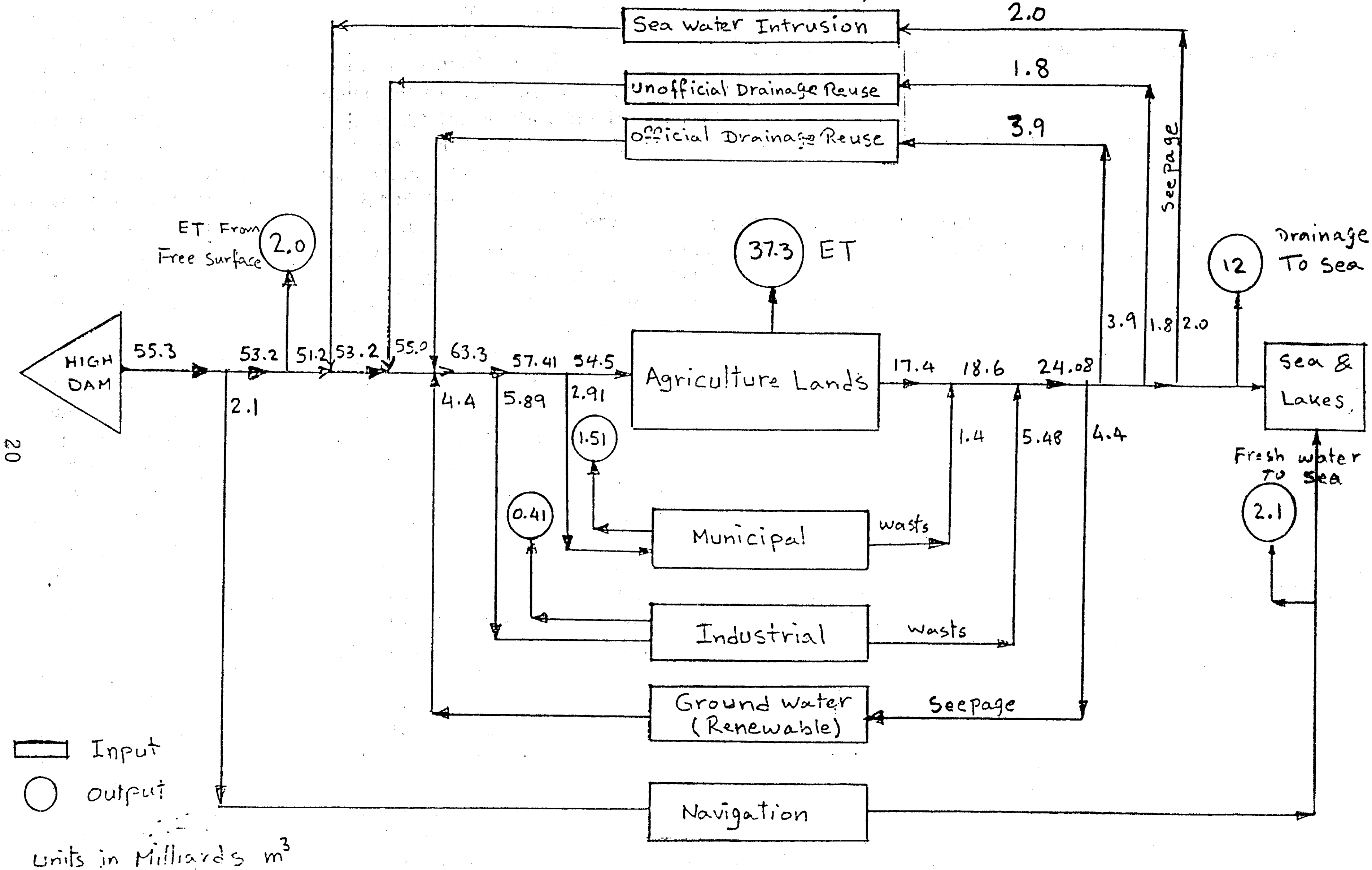

Figure 1. National Water Balance 1992/1993

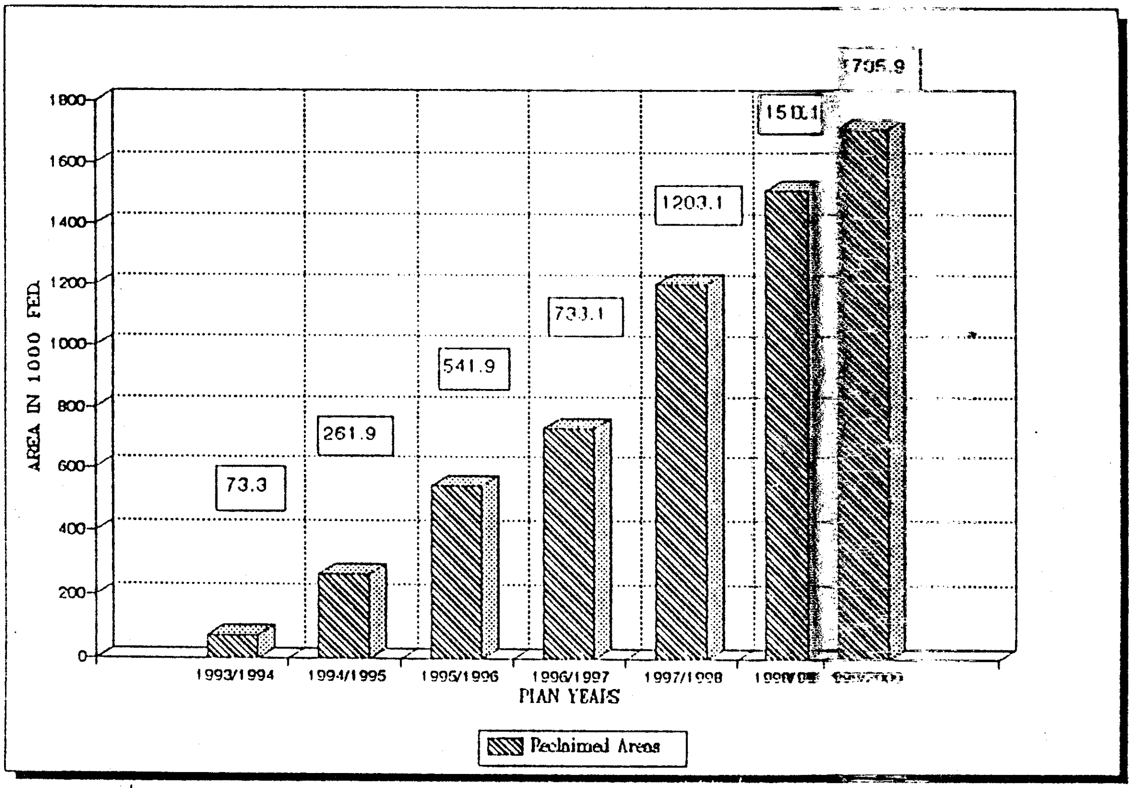

Figure (2) - Horizontal Expansion Future Plan

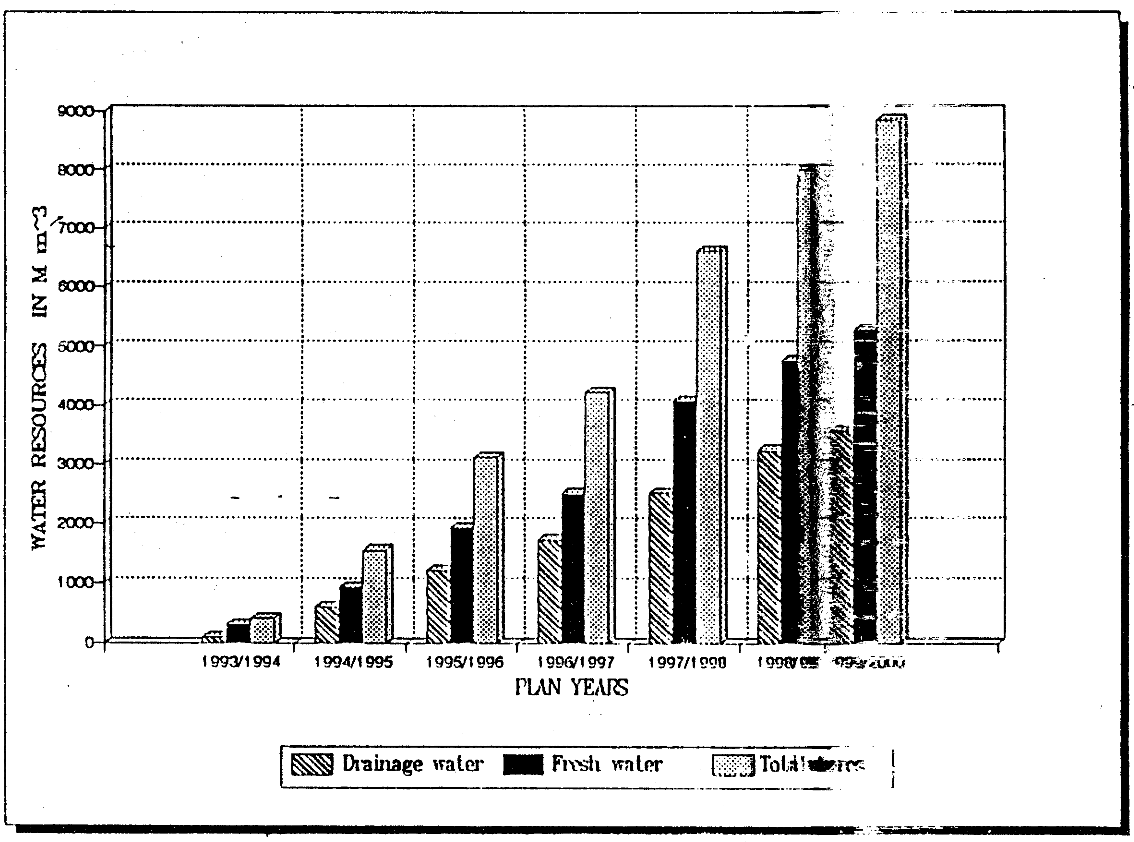

Figure (3)- Water Resources Plans to cope with Land Reclamation

Figure (4)- Volume of Fresh Water Annually Spilled to Sea