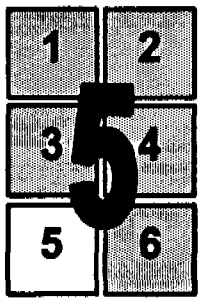
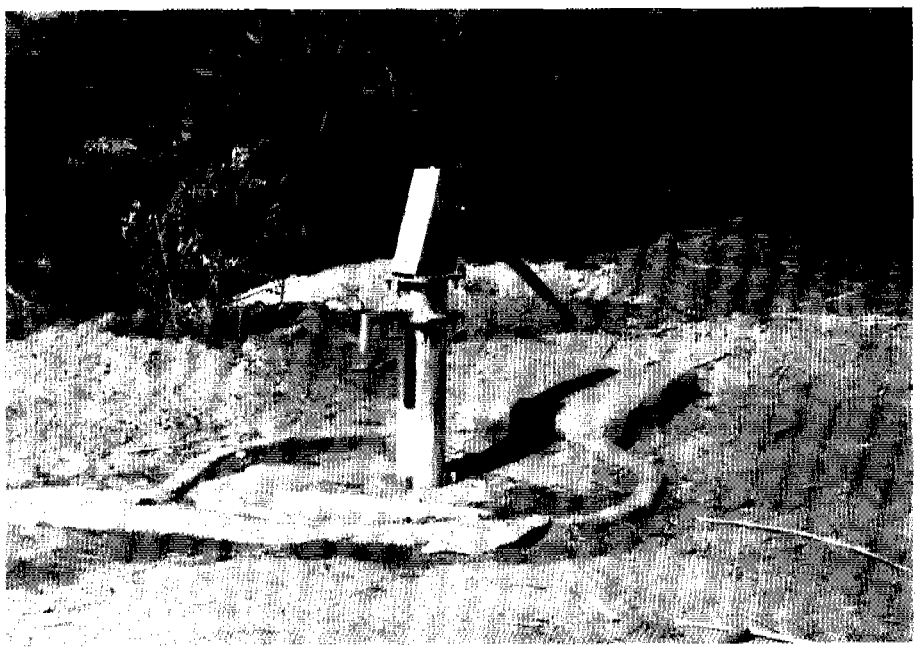


WHO ORDEV UNDP UNICEF

DRINKING WATER SUPPLY AND SANITATION SECTOR SUPPORT PROJECT IN EGYPT

(UNDP : EGY/82/002 WHO : EGY/CWS/001)

RURAL WATER SUPPLY TECHNOLOGY



WORLD HEALTH ORGANIZATION
Regional Office for the Eastern Mediterranean
Alexandria
1992

DRINKING WATER SUPPLY AND SANITATION SECTOR SUPPORT PROJECT IN EGYPT

RURAL WATER SUPPLY TECHNOLOGY

5. Rural Water Supply Technology

CONTENTS

In the name of God, the Compassionate, the Merciful

FOREWORD

I am pleased to have the opportunity of contributing a foreword to this series of six booklets prepared to describe the work which has been done under the project, "Drinking Water Supply and Sanitation Sector Support", in Egypt.

It is appropriate that, at the end of the project, we should analyze what has been achieved, what have been the successes and shortcomings of the project, and what lessons we can learn for the future development of the water supply and sanitation sector not only in Egypt, but also in other countries of the Eastern Mediterranean Region.

WHO has executed this project, with the financial support of UNDP and UNICEF, to provide technical support to the Organization for Reconstruction and Development of Egyptian villages (ORDEV), in order to extend water supply and sanitation services to rural communities. WHO has been guided by the approaches of the International Water Supply and Sanitation Decade which have called for the complementarity of sanitation development with that of water supply, the inolvement of communities in the planning and execution of projects, the utilization of appropriate technologies, and the training of personnel. The project has covered both software and hardware aspects, has used improved, self-sustaining and affordable methodologies, and, with its inter-sectoral approaches, has achieved a marked success in the rural areas of Egypt where it has been possible to implement demonstration activities.

I commend these booklets as illustrative of the success of this innovative project. If they can in some small way arouse interest in the importance, to us all, of the development of a sustainable programme of water supply and sanitation in rural areas, they will have served their purpose.

Hussein A. Gezairy, M.D., F.R.C.S.
Regional Director for the Eastern Mediterranean

PREFACE

This booklet is one of a series of six in similar format prepared to demonstrate the objectives, activities and outputs of the project of the Government of the Arab Republic of Egypt, in cooperation with the United Nations Development Programme (UNDP), the United Nations Children's Fund (UNICEF), and the World Health Organization (WHO), for Drinking Water Supply and Sanitation Sector Support project.

The booklets in the series are entitled:

1. Social Aspects and Health Education
2. Sector Information Management
3. Human Resources Development
4. Rural Sanitation Technology
5. Rural Water Supply Technology
6. Leakage Detection and Control

Copies of any of these booklets can be obtained from:

World Health Organization
P.O. Box 1517
Alexandria 21511
Arab Republic of Egypt

INTRODUCTION

The activities of the project, "Drinking Water Supply and Sanitation Sector Support", started formally in January 1987, having been preceded by a preparatory phase (Phase I) from October 1984 to May 1985. The project was formulated within the context of the International Drinking Water Supply and Sanitation Decade (IDWSSD), 1981-1990, with the development objective of assisting the Ministry of Local Government to extend water supply and sanitation coverage to Egyptian villages (numbering about 30000) and to other underserved sections of the population through improved infrastructures, human resources development and transfer of appropriate technology.

It was recognized that activities in the water supply and sanitation sector had been considerably accelerated in the first half of the Decade. The purpose of this project has been to build on this initiative and to support further development through:

- introduction and demonstration of affordable, appropriate technologies based on technical, economical and social feasibility;

- establishment of a human resources department consisting of specialists and trainers for the planning and organization of training of water supply and sanitation personnel;

- upgrading of local capabilities in operation and maintenance, management, water and waste-water analysis, through appropriate training courses;

- assessment of sector information processes, identification of needs, and development of improved management information systems.

This booklet covers two linked, but separate subjects: rural water supply methods, and water quality control. Both are considered to be of great importance in the present stage of development of the water supply and sanitation sector in Egypt. The International Drinking Water Supply and Sanitation Decade 1981-1990 focused attention on the sector and had the effect of accelerating investment and development of water supply and sanitation services. At the beginning of the Decade, with more than half of the country's population classified as rural, it was

estimated that 36.3% of this population had no access to safe drinking water. In urban areas, the corresponding figure was 12.3%. For a further 40%, the access to safe water was outside the dwelling place.

Difficulties had been experienced in applying the current national drinking water quality standards to rural water supplies where ground water was the source. It was felt that, with the publication of the revised WHO Guidelines for Drinking-Water Quality in 1984, these need to be taken into account in revising national standards.

SPECIFIC OBJECTIVES

The specific objectives of the project relating to rural water supply technology may be summarized as follows:

- To review the existing situation with regard to water supply coverage, particularly in rural areas, and to study the technologies used, the capacity to expand coverage, and the water sources available;

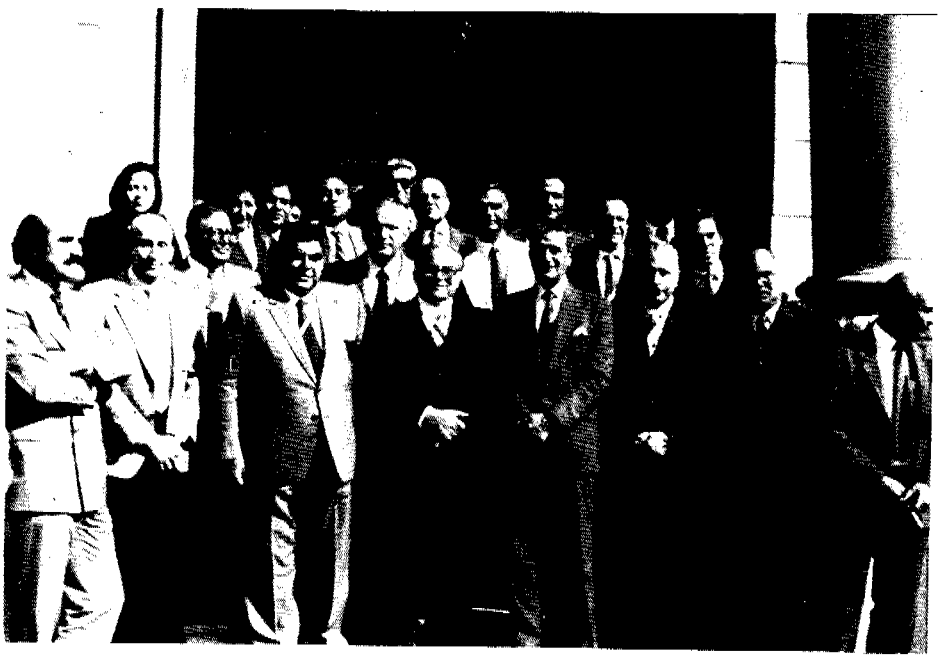
- to assess the technical, economical and social aspects of the Self-Contained System (SCS) of water supply, promoted by UNICEF, to evaluate operation and maintenance requirements and identify problems, and to recommend remedial measures to extend the use of the system;

- to review the current design, construction and utilization of the various types of public water taps, to assess their performance and durability, and to develop and demonstrate new types as appropriate;

- to undertake a comparative study of conventional and compact water treatment plants in order to upgrade designs and efficiency of operation and maintenance;

- to convene a national water quality seminar in order to identify water quality problems in Egypt, create awareness of the need for action in water quality control, agree on priorities, upgrade current activities and introduce the WHO Guidelines; and to initiate the revision of national water quality standard criteria; and

- to organize a national water technology seminar on current designs and practices in water supply planning, scheme selection and operation and maintenance practices.



WATER QUALITY SEMINAR
EMRO, 1987

PROJECT APPROACH

In order to carry out the numerous studies proposed in regard to water supply technology and water quality control, the project used both teams of national experts and staff of the project, and international consultants . Reports presenting the results of these studies were distributed to interested government authorities and were discussed at various meetings with relevant water authorities including the Organization for Reconstruction and Development of Egyptian Villages (ORDEV), the National Organization for Potable Water and Sanitary Drainage (NOPWASD), the United Nations Children's Fund (UNICEF) and governorates at the three administrative levels.

In addition, seminars were held on national water quality and on national water technology to review the findings of studies and discuss the experiences of different agencies in the water supply field. These seminars led to reports detailing recommendations for action to be taken in various fields to improve the situation in the water supply sub-sector.

The following sections describe the activities undertaken and the findings in the different areas studied:

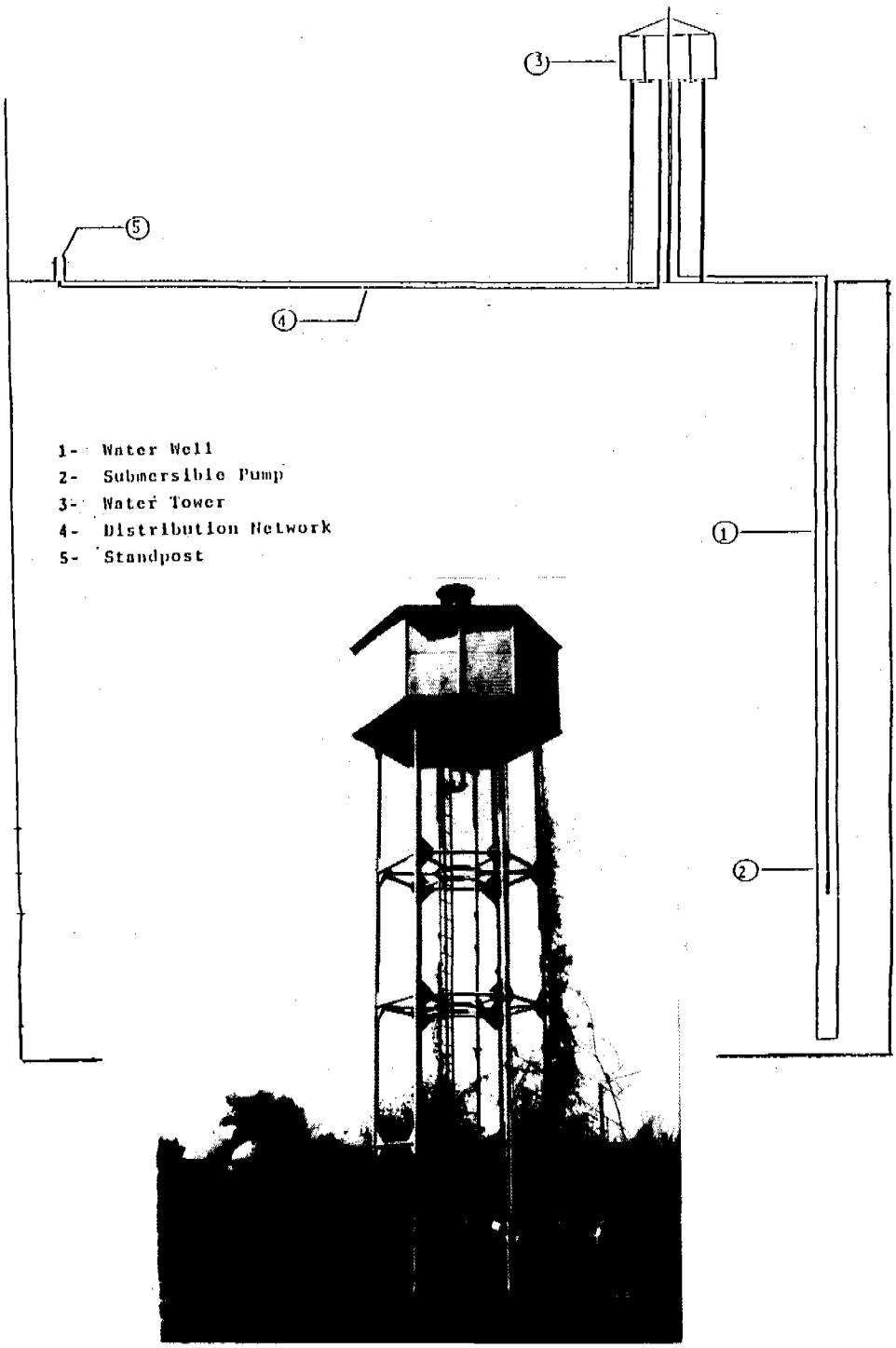
1. EXISTING SITUATION

At the beginning of IDWSSD in 1981, national reports showed that 25.2% of the population of Egypt did not have access to safe water in their homes or at a reasonable distance from them. This comprised 36.3% of all rural population and 1.3% of urban dwellers. In 1989, however, Egypt reported to WHO on the sector status as at the end of 1988 providing figures showing considerable improvement. Of a total population of 42 million, 12.5 million lived in urban areas (30%) and 12 million of these (96%) had satisfactory access to water supplies. Of the rural population of 29.5 million (70%), 24.2 million (82%) were now served. These percentages were expected to be the same at the end of the Decade.

The implication is that very great advances have been made in providing water supply coverage during the IDWSSD and that it may be difficult to arrive at higher levels of coverage, particularly in rural areas, in view of the dispersion of hamlets and houses in certain regions. It must, of course, be assumed that these figures represent preliminary estimates which will be verified as the sector information management system becomes more effective in providing countrywide coverage.

For many consumers in rural areas, water is supplied through public standposts which are common features in most Egyptian villages, hamlets and small towns. The standposts were originally designed to provide water for drinking and cooking, but, as house connections have become more abundant, there has been a trend towards using the public taps for washing household utensils and clothes, which can create problems unless the drainage of waste-water has been given careful attention.

In Lower Egypt, practically all water supplies are drawn from the Nile and its irrigation canals, appropriately treated before distribution. The water table is relatively high and shallow wells do not supply a quality of water which is suitable for domestic use. Thus piped, treated supplies are generally the preferred option. In Upper Egypt, however, groundwater has been used and is being promoted as an alternative to drawing untreated water from the Nile. UNICEF has been active in developing and demonstrating this approach, involving the communities in decision-making regarding the selection of sites for storage tanks, standposts, etc.



UNICEF SELF-CONTAINED WATER SUPPLY SYSTEM

2. SELF-CONTAINED SYSTEM

UNICEF started implementing the Self-Contained System (SCS) in 1981 after a successful trial in El Barahma village, Qena Governorate, in 1981. The programme was planned to implement 60 self-contained systems in selected satellite villages in Upper Egypt Governorates of Aswan, Qena, Sohag and Assiout. The SCS is a small-scale water supply system that is capable of supplying 50 to 1000 cu.m/day or serving a population from several hundreds to several thousands. It consists of a water well, a submersible pump, an elevated water tank, a distribution pipe network, and a number of standposts or public taps.

The submersible pump is the only mechanical component of the system requiring an operator's attention and intermittent maintenance. The system is applicable where ground water of adequate quality is available in sufficient capacity for continuous supply. Water is pumped from the drilled well to the elevated tank of 25 to 50 cu.m capacity which is lined with synthetic material or a bituminous layer. It flows by gravity through galvanized steel pipes 50 to 100 mm diameter to the public tap sites. The number of these is a function of the population served, the distance of service and the number of people who can be served by a single tap. The pump operates in accordance with the level of storage in the tank.

A study of the system was undertaken by the project to assess the technical, economical and social aspects, to evaluate operation and maintenance requirements, and to recommend any remedial measures. The technical aspects would embrace design procedures, selected materials, and the quality of the water produced. Social acceptance of the system and the required degree of community participation were addressed under the social aspects. The study team, which was led by a WHO water supply consultant and included national engineers, a sociologist and a chemist, reviewed all available documentation before making field visits to seven selected SCS installations where data were collected and facilities inspected.

Based on the findings and analysis of the team relating to the technical, economical and social assessment of the seven SCS schemes visited, it was concluded that the SCS is a practical, simple, reliable and

cost-effective solution to the problem of water supply in the satellite communities of Upper Egypt. Specific conclusions on the various aspects were as follows:

- the scheme is properly designed, simple to operate, and requires no specialized skilled personnel;
- the SCS is only viable when the test borehole confirms the presence of an aquifer of acceptable water quality which needs to be approved by the health authority;
- the use of a hydropneumatic tank, instead of an elevated tank, might be a cost-effective alternative for communities of less than 2000 persons;
- preventive maintenance of the submersible pump should be the responsibility of a regional maintenance centre;
- spare parts, especially for the pump, should be made available to the local authority;
- further reduction in cost and time saving might be achieved by replacing as much as possible the imported components with locally manufactured ones;
- the water produced in the SCS was chemically and bacteriologically acceptable, according to the Egyptian tentative standards, but at times the levels of iron, manganese and TDS exceeded WHO guideline levels;
- the presence of faecal coliforms in some water samples taken from taps or in-house storage containers indicated the contamination of water due to extended storage in the house or to leakage in the network which required remedial action;
- from a social standpoint, these schemes have played an important part in providing water to previously deprived areas;
- a significant role was played by the communities in planning and implementing the schemes;
- in some villages house connections have been successfully made with the agreement of the local authorities and at the expense of the householders;
- health education and public awareness programmes are needed to overcome the belief held by certain sections of the community that the water from these schemes is a source of disease;
- the involvement of the local government authorities was significant in both governorates studied.

3. PUBLIC WATER TAPS

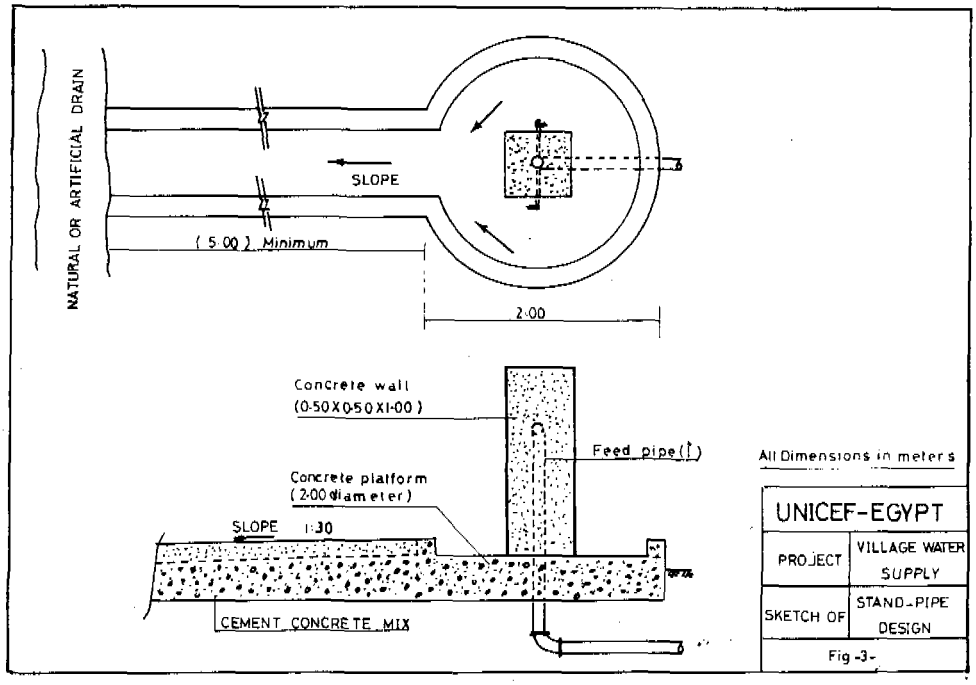
The project undertook to review the current design, construction, utilization, performance and durability of the various available types of public water taps. On the basis of the study team's findings, an improved design would be prepared. The team was led by a WHO consultant who was supported by two national sanitary engineers and a sociologist. Field visits were made to some 25 sites in Fayoum, Daqahliya, Behera , Aswan and Assiout Governorates, and a detailed study was carried out in four selected villages. The criteria adopted were that different rural communities of Egypt should be covered, a majority of the villagers should use the standposts as the primary water source, and the design and utilization pattern should vary from village to village.

Three basic designs were encountered, referred to as the NOPWASD design, the Behera Water Company design and the UNICEF design. All had the common features of a concrete platform, concrete support wall, concrete bucket stand, feed pipe, and taps mounted vertically on the wall. These are illustrated opposite. The NOPWASD design was the oldest and most common in rural Egypt, the Behera design was only used in Behera villages, and the UNICEF design was developed specially for use in conjunction with the SCS scheme villages in Upper Egypt. General comments on these designs are given below.

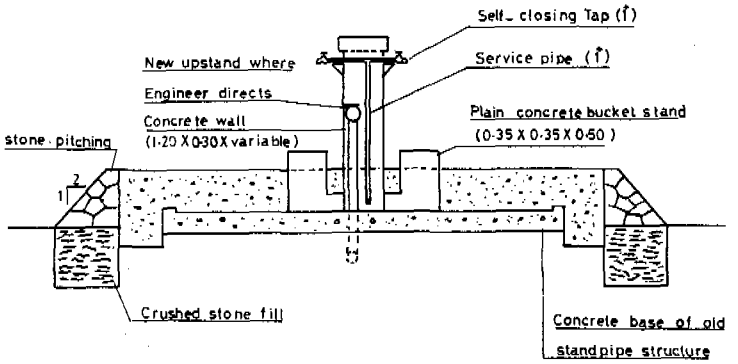
1. The Behera design had been planned as a rehabilitation scheme and was very similar to the NOPWASD basic design, differing by having a larger (150 mm) drain size and a self-closing gravity type tap which has advantages over the standard screw tap; a further advantage was the flow control valve and meter on the service pipe.

2. A limited number of the UNICEF design taps had been installed but these differed significantly from the others in that the feed pipe was embedded in the concrete wall, only one tap was used, there was no bucket stand, and a concrete drain was provided.

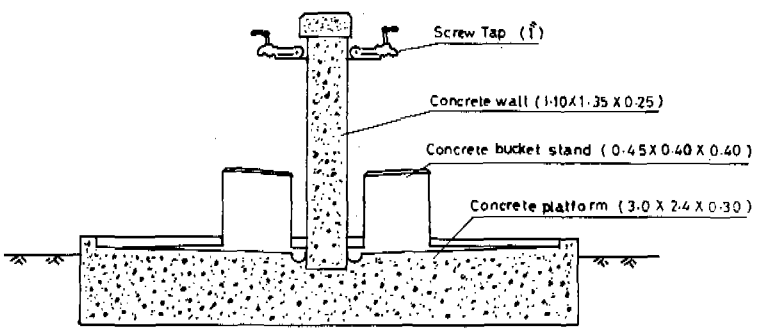
3. In several schemes using the NOPWASD design, specifications had not been strictly followed so that brick had been used for support walls and bucket stands, and some drainage systems were missing.



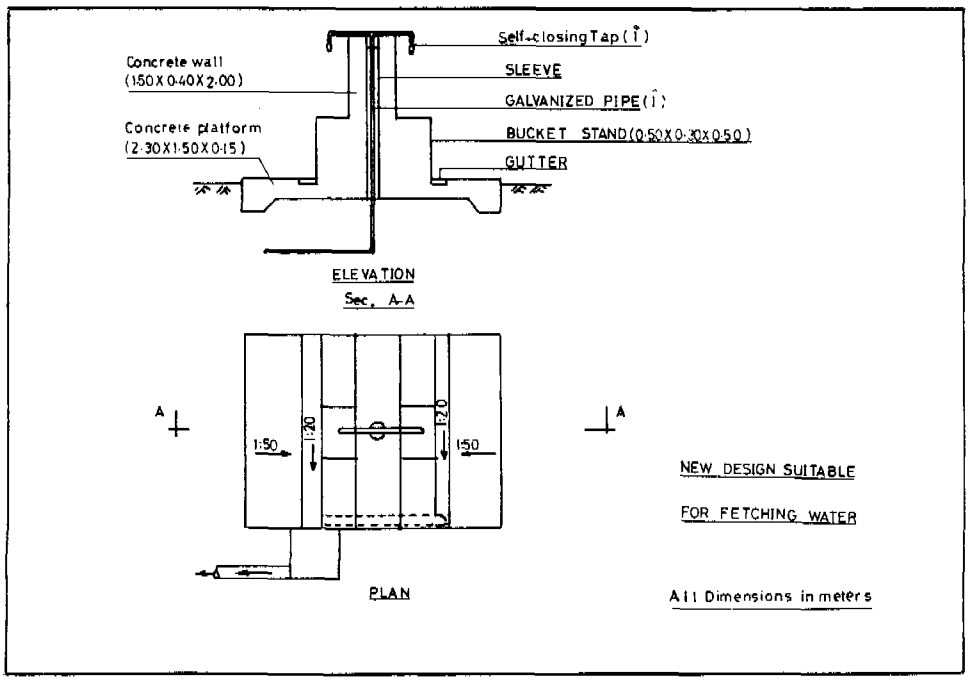
UNICEF DESIGN



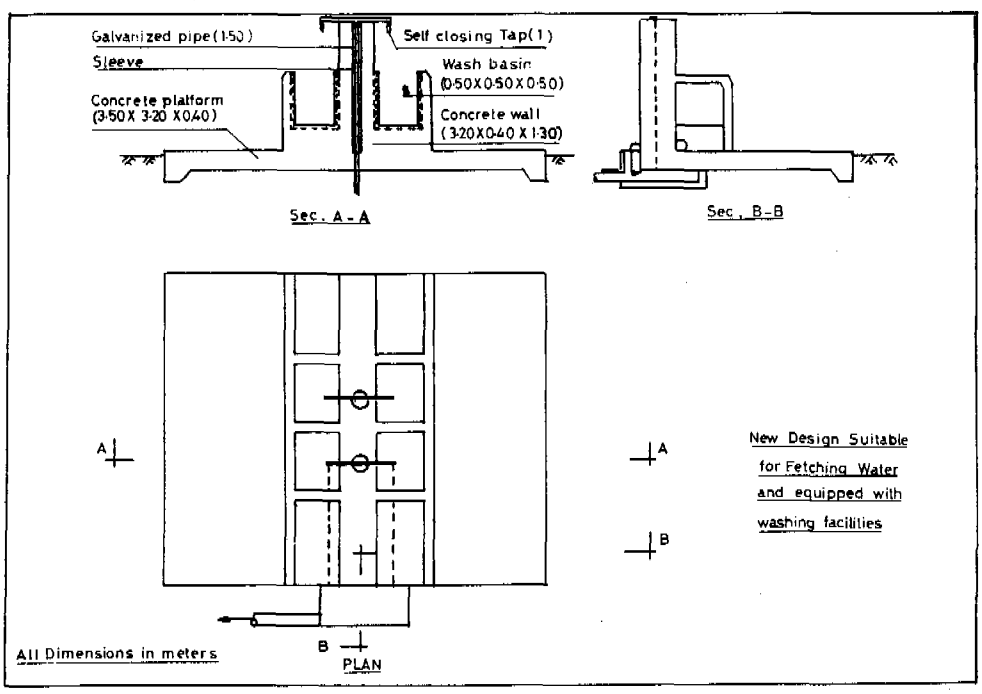
BEHERA DESIGN



NOPWASD DESIGN



STANDPOST DESIGN, TYPE A



STANDPOST DESIGN TYPE B

4. The average number of persons served by one public standpost was 1000 (range 500 to 2500).

5. Location of standposts was not based on even distribution in the village but more on access to discharge points, so that more standposts were installed near canals.

6. In many villages, even where there was a high proportion of house connections, standposts were used extensively for washing and laundry purposes, causing increased crowds and more frequent breakdowns.

7. Increased water demand caused by improved hygiene awareness and population growth had also had an adverse impact.

8. The parts most subject to breakdown in NOPWASD's design were the screw taps and feed pipes, and there was considerable damage where brick walls and stands were used.

9. In almost all cases studied, drainage facilities were damaged or not in proper working order, giving rise to adverse environmental conditions.

10. The lack of community involvement in planning and design of taps was evidenced by the lack of understanding of the need for any maintenance and, at the same time, complaints regarding breakdowns, poor drainage, etc.

11. The frequent breakdowns of NOPWASD taps, causing considerable loss of water and consequent drainage problems, was blamed on the taps not being strong enough to withstand the frequent usage; this was not a problem with the Behera and UNICEF designs.

12. Village women were the main users of the taps and their use of them for washing and laundry was considered positive as it avoided the health hazards of the traditional use of the canal.

13. An extensive health education programme was required to persuade the women to store the drinking water hygienically in their homes after collection from the taps.

14. Both the Behera and the NOPWASD designs did not cater well for washing and laundry activities even when satisfactory for collection of water for domestic purposes.

15. No preventive maintenance was practised by formal or informal organizations at any of the sites studied, and this was reflected in the frequent breakdowns and damages observed.

In view of the findings of this study, it was proposed to design and demonstrate new prototypes of the standpost in consultation with the local and water authorities and the community representatives. Two designs were proposed (as illustrated) to meet all the shortcomings observed in the study. The second of these makes allowance for washing and laundry at the site.

PUBLIC WATER TAPS

4. CONVENTIONAL AND COMPACT WATER TREATMENT PLANTS

Egypt relies on both surface water and groundwater for its public supplies. Rainfall is slight and generally restricted to the coastal strip near Alexandria and can be discounted as a water resource as far as drinking-water systems are concerned. Surface water comes from the Nile River and its network of canals and ditches. Groundwater sources consist of shallow aquifers mainly recharged from the Nile, and deeper aquifers which are frequently artesian.

Conventional treatment plants using surface water sources have been in operation in Egypt since the last century. A more recent problem since the construction of the High Dam has been the occurrence of algae due partly to reduced turbidity and increased salinity. This has required the use of up to 40% of plant output for filter backwash. Several regional plants are still in operation after 40 to 50 years, but structures and equipment have deteriorated and need rehabilitation. While the cities of Cairo and Alexandria have had to construct new conventional systems to cope with the unprecedented population growth, in rural areas there has been political pressure on local water authorities to accept solutions which could bring rapid relief, and the package or compact system was often adopted since the rehabilitation or construction of conventional plants would take longer. More simple technology which would eliminate, as far as possible, sophisticated mechanical systems was given insufficient attention. Because they could be installed more quickly and in view of favourable bilateral turn-key offers, over 500 compact plants of seven different makes are now in operation in rural areas and hundreds more are planned for the next few years.

The project undertook a comparative study of the relative merits of the conventional and compact plants, selecting the Governorate of Daqahliya for this purpose. This Governorate has conventional plants dating from 1920, while the first compact plant was commissioned in 1980. At the time of the study, there were 9 conventional plants and 89 compact plants of 5 makes in the Governorate, plus 69 groundwater abstraction points supplying potable water. Consequently, considerable experience in operation and maintenance had been acquired. The objectives of the study were to analyze and report on the technical,

operational and economic advantages and disadvantages of the two types of plant, including their suitability for use under Egyptian conditions. Recommendations should be made on:

- possible improvement in the design and construction of each type of treatment plant;
- possible upgrading of operational procedures and practices to enhance treatment efficiency;
- appropriate preventive maintenance procedures to ensure reliability.

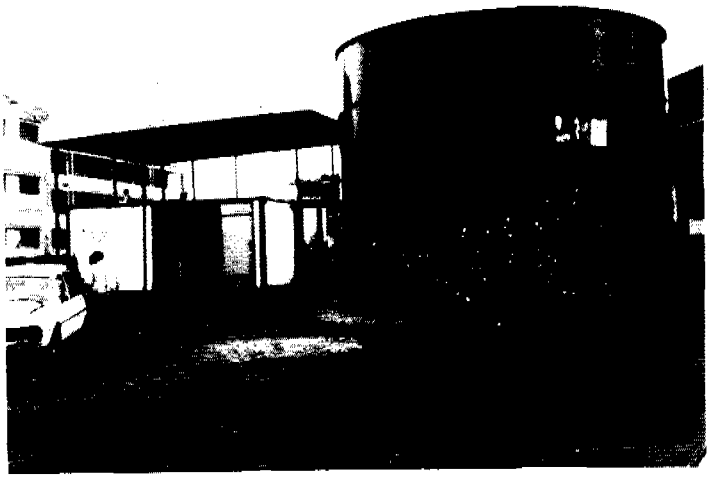
The study team was led by a WHO consultant and had the support of national engineers from the General Organization for Greater Cairo Water Supply (GOGCWS) and NOPWASD, and a sociologist. A WHO staff member from Headquarters assisted in the planning and review. Four conventional plants of two types and five compact plants of different makes were selected for the detailed study. Based on the collected data from visits to these sites, field observation and discussion with responsible staff, results and findings were prepared and categorized in terms of:

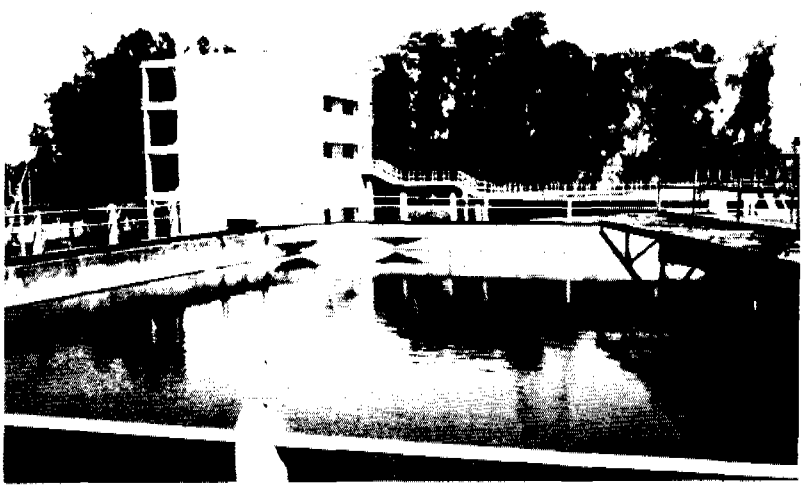
- technical and planning aspects;
- engineering aspects;
- operational parameters;
- water quality;
- economic aspects;
- social aspects.

The study exposed a considerable number of shortcomings in the performance of most of the plants visited. Some of these were caused by shortage of chemical supplies, lack of water quality control procedures, lack of record-keeping systems, filter media not complying with specifications, lack of manuals or guidelines for operators, process control gauges and meters being of order, damaged equipment, corrosion through lack of maintenance, etc. In general, conventional design had been proven to be long-lasting and reliable with more flexibility to cope with changes in raw water quality. Conventional systems had larger capacity and thus economy of scale, had less power

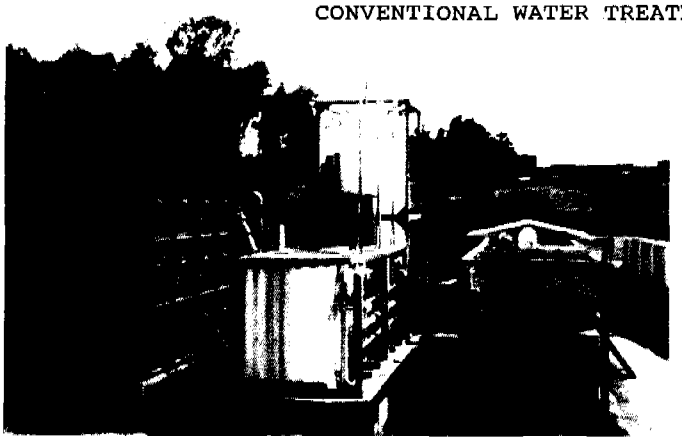
consumption and a lower requirement for operation and maintenance personnel. Operators of compact plants were not aware of proper operation requirements and chemical dosage, most had no laboratories and the study showed that compact plants were neither cost-effective regarding capital investment nor expenditure on operation. From the social point of view, the system with less frequent shut-downs was preferable, and the conventional systems were more favourable in this respect.

The conclusions and recommendations of the study emphasized the need for long-term planning, taking into consideration that compact plants are designed to be a short-term solution. Training and human resources development were particularly important and detailed proposals were made for improving the skills of operators for operation and maintenance. It was recommended that, in order to improve the status of water quality control, water and governorate authorities should give more attention to upgrading the laboratory capacities at the conventional plants, in terms of provision of basic laboratory equipment and improved premises. All technical staff should receive training on all aspects of water treatment processes and water quality testing. Metering and control devices had to be repaired, and proper records kept. Research was required at national level on control of growth of algae and/or the development of more effective technology to replace the present practice of removal of algae by prechlorination at the water treatment plants.





CONVENTIONAL WATER TREATMENT PLANTS



COMPACT WATER
TREATMENT PLANTS

5. NATIONAL WATER QUALITY SEMINAR

The project convened a national water quality seminar in November 1987 which was attended by representatives of the Ministry of Health, NOPWASD, ORDEV, several governorates, other government agencies, international organizations and project staff. The objectives of the seminar were to:

- identify water quality problems for Egypt;
- create an awareness of the need for action in water quality control for Egypt;
- improve the understanding of drinking water quality criteria;
- encourage development of a defined comprehensive drinking
- water quality control programme in Egypt;
- identify priorities for action in water quality control;
- upgrade the current activities in water quality surveillance/ monitoring;
- introduce the WHO Guidelines on Drinking-Water Quality;
- guide the development of drinking-water quality standards for Egypt.

The seminar, after listening to and discussing a number of technical presentations, made recommendations which are summarized below.

1. National Drinking Water Quality Standards for Egypt should be urgently revised taking into account the national conditions and the 1984 WHO Guidelines.

2. The Nile River should be protected from the disposal of untreated industrial, sewage and agricultural wastes.

3. To minimize chemical pollution, physical rather than chemical means should be used to control aquatic plants in the Nile River and canals.

4. To economize on Nile water use and reduce costs, local sources of groundwater should be used for drinking purposes rather than Nile water, especially in rural and desert areas.

5. There is a need for one national scheme for Nile water treatment which should take into consideration the changes in Nile water quality, and also incorporate simplicity in design, operation and maintenance of the systems used for water treatment.

6. A national technical committee, assisted by international expertise, should be formed to investigate the current practice of algae removal and develop a new process for minimizing prechlorination and the consequent formation of chlorinated organic substances in drinking water.

7. The establishment of national industries to produce water treatment chemicals including alum is urgently needed.

8. Considerable attention should be given to all aspects of water loss; national and local water authorities should adopt appropriate leakage control procedures including leak detection and rehabilitation of distribution systems.

9. An appropriate standard design of roof water tanks should be developed, taking into consideration the current behavioural practices, the use of non-health hazard construction materials and provision of tank covers.

10. Provincial health laboratories should be upgraded for water quality testing in terms of:
    - provision of adequate premises/facilities;
    - provision of adequate testing equipment;
    - adequate training for technical laboratory personnel;
    - record-keeping, information and dissemination of data to concerned agencies.

11. Periodic inspection and cleaning of roof water tanks should be put in the hands of a health authority.

12. A single government body charged with adequate powers should be responsible for the monitoring of Nile water quality.

13. A programme should be urgently introduced for implementing coordination of effort amongst sector organizations and authorities to ensure cooperation and to avoid duplication.

14. Intensification should take place of training programmes in the fields of:
    - water supply systems operation and maintenance;
    - water surveillance and monitoring, and water works management;
    - information collection, programming and storing.

15. Programmes should be urgently introduced to increase public awareness in water quality especially through audio-visual means in relation to:
    - sources of pollution of drinking water;
    - appropriate health methods in handling and storage of drinking water;
    - health problems of drinking polluted water.

16. International and bilateral agencies should be approached to support training programmes in the field of overall water quality control.

6. NATIONAL STANDARDS FOR DRINKING-WATER QUALITY CRITERIA

As a consequence of this seminar, a committee was convened to:

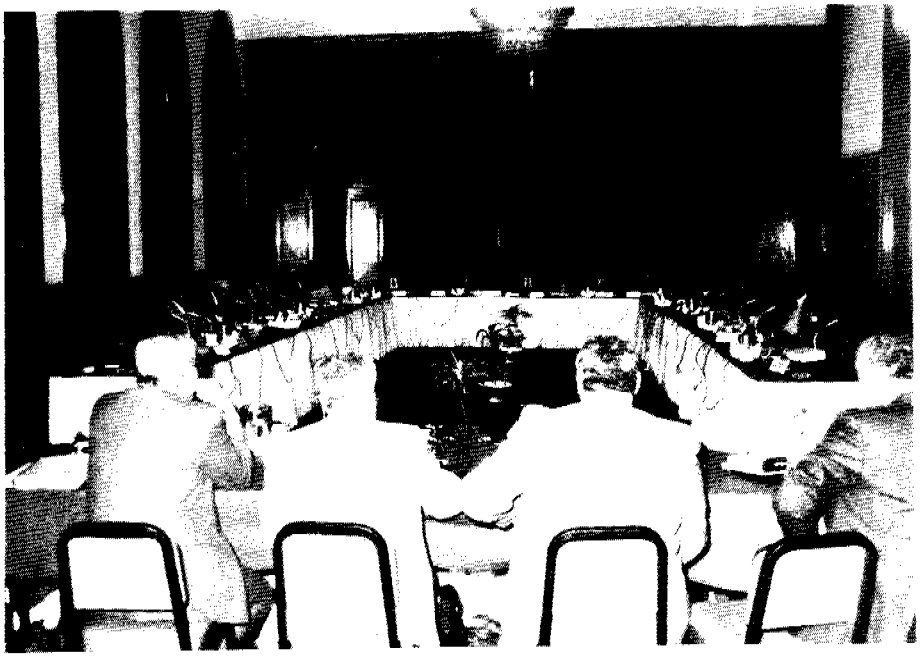
- review the current drinking water quality standards and criteria in accordance with the 1984 WHO Guidelines for Drinking-Water Quality, and the local practices and conditions;

- develop new standards and criteria for drinking-water;

- review the present practices of water quality analysis and specify standard laboratory control methods of analysis at different levels;

- prepare a report on the new studies and proposed standard of water quality criteria for consideration by the Ministry of Health.

This committee held several meetings and produced a report entitled, "Revision of the National Water Quality Standard Criteria" which has been submitted to the Ministry of Health and circulated as a draft document. It is expected that the new Egyptian National Standards will follow the recommendations in this report.



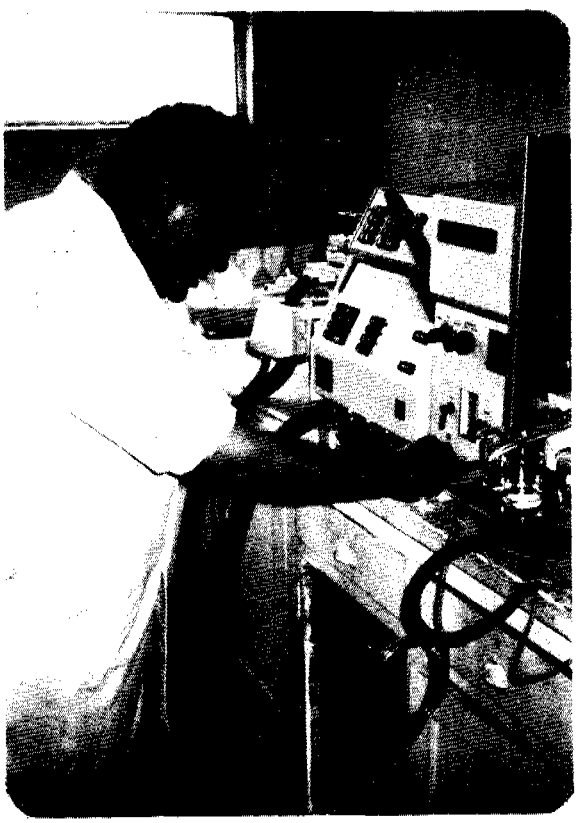
NATIONAL WATER TECHNOLOGY SEMINAR

7. NATIONAL WATER TECHNOLOGY SEMINAR

This seminar, which had been planned over a long period, was held in Cairo in January 1991. The following list of titles of papers presented and their authors is illustrative of the subjects covered, which included the reports on the special studies undertaken by the project.

- Project objectives and achievements, by Eng. M. A. Mullick, EMRO.
- Role of ORDEV in developing rural water supply, by Eng. Magued El Shaabeni, ORDEV.
- The benefits of water supply systems on public health, by Dr Mohamed Fathy Shebat, Ministry of Health.
- Socio-cultural aspects related to public water supply, by Dr Sandra Lane,
- Criteria for planning and design of water treatment plants by Eng. Mohamed Abdel Halim, NOPWASD.
- An overview on water supply technology in GOGCWS, by Eng. Saad El Din El Deeb, GOGCWS.
- Comparative study of conventional and compact water treatment plants, by Mr T. L. Videnov, WHO Consultant.
- Case study : evaluation of SCS system in Upper Egypt, by Eng. Magdy Zaky, UNICEF.
- Improvement of public water taps, by Dr Tharwat Saleh, WHO Project Coordinator.
- Water quality related to water supply systems, by Dr Fatma El Gohary, National Research Centre, Cairo.
- Practical aspects of operation and maintenance of water treatment plants, by Dr Hasan Metwali, WHO Consultant.
- Legal aspects of raw surface water pollution control in Egypt, by Dr Hasan Metwali, WHO Consultant.

WATER SAMPLING



WATER ANALYSIS

EVALUATION

The studies carried out under this sector of the project have had a considerable impact on the approach of the local, governorate and central authorities to the development of rural water supply in Egypt. They have been recognized as unbiased evaluations which serve to indicate directions which should be taken to improve the service to the rural population.

The study of the UNICEF's Self-Contained System has proven the effectiveness of this approach in very specific conditions where ground water of acceptable quality is available at reasonable depth, and where treatment of surface water would not be a feasible alternative. This study has also brought out the importance of involvement of the community in decision making, in basic care and attention to the installations, and in improvement of their own environmental situation as a step towards better health.

The comparative study of the different designs of the public tap revealed a number of problems, mainly related to lack of supervision of construction and of responsibility for maintenance of the facilities. Some points of design which could be improved were discovered and recommendations made for remedial action to be taken in future schemes. In particular, the fact that many village women prefer to use public taps for washing and laundry, even when they have piped supply to their homes, is a significant finding and a preference which should be catered for, as far as possible, by installing appropriate washing facilities at the standposts.

The evaluation of the spread of compact water treatment plants as a quick solution to the urgent problem of supplying safe drinking water to a rapidly increasing population has brought to light several factors that the authorities need to pay attention to. The finding that, in the long run, the conventional type of plant is more reliable, economical and acceptable to consumers shows the importance of planning for the future by rehabilitating existing plants which have deteriorated and by commissioning new ones in centres of population growth. There is still an important role for compact plants in the short term, but early attention must be given to more appropriate training of the operators,

technicians, chemists and maintenance staff who are responsible for their performance.

The steps taken by Egypt, with the support of the project, to update the national drinking-water quality standards are commendable. The country is fortunate to have an abundance of water in most of the settled parts, but indications are that the quality control is less than adequate. Revised national standards would provide an impetus to the upgrading of the water testing laboratories and the improvement of drinking-water quality, in general, which would certainly have a positive effect on the public health situation, especially in rural areas.

LINKAGES

The project's linkages in this area of activity have been especially with:

- ORDEV: in its capacity as Government Implementing Agency, as participant in the studies, and as sponsor of the seminars on drinking water quality and on national water technology;
- NOPWASD: as supporter of and contributor to the studies, and as participant to the seminars;
- Governorate, markaz and village authorities who have assisted in the studies, provided information, answered questions, facilitated field visits and participated in meetings and discussions;
- UNICEF: as co-sponsor of the project, as supporter of the studies, particularly those on the Self-Contained System, and as contributor to the seminars;
- UNDP: as main sponsor of the project.

FUTURE ACTIVITIES

The project's activities in promoting UNICEF's successful Self-Contained System for communities where treatment of surface water is not feasible, and in drawing attention to the need for an improved design of public water tap, need to be further publicized and combined with a programme of rehabilitation. This should include attention to the social aspects of the programme to promote community involvement and acceptance of responsibility on the part of the villagers for looking after the improved facilities.

The work on comparison of compact water treatment plants with conventional plants should also be continued. In addition to stressing the need for further training to be given to the plant operators, the project has a responsibility to promote, at central and governorate levels, the importance in the long term of rehabilitating and upgrading the existing conventional treatment plants.

The project should also take a lead in following up on the preparation of the Egyptian National Standards for Drinking-Water Quality. It may be appropriate to reconvene the national technical committee which produced the revision report, in order to study comments which have been made by the Ministry of Health and other institutions.

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