LOCAL DEVELOPMENT II — PROVINCIAL

مشروع التنمية المحلية

LD II-P

FINANCED BY U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

مصدر التمويل : الوكالة الامريكية للتنمية الدولية

INTERRUPTION AND RESTORATION OF PUBLIC SERVICES IN RURAL EGYPT

USAID CONTRACT No. 263-0182-C-00-8041-00
PROJECT No.: 263-0182-3-60054

Prepared by
The Operations and Maintenance Section

February 1990

O&M-R-8

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٨ شارع الفواكه / مهندسين . القاهرة / تليفون : ٣٤٨٢٢٤٧ . ٣٦٠٢٥٤٥ / فاكس : ٧١٨٩٨٦ / تلكس : ٩٣٠٣٧

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EXECUTIVE SUMMARY

The primary purposes of a service interruption tracking system (SITS) are to:

- Provide a means for recording and tracking responses to interruptions in key services, and

- Help managers identify situations where problems leading to service interruptions are recurring ones requiring corrective action. Appropriate actions range from equipment and structure repair to capital investments for replacement.

Field trips were carried out in Assyout and Damietta Governorates to determine if systems for tracking service interruptions (SITS) were in place in these locations. These investigations revealed that:

- Some water systems maintenance workshops do track, i.e. record, service interruptions, and carry out repairs.

- The electrical power companies have effective systems for tracking interruptions, and they have the means to respond quickly when breakdowns occur.

- None of the systems investigated in the survey governorates used data collected to help identify and analyze the cause of the recurring problems.

As a result, we are recommending that the SITS:

- Be developed only for electrical and mechanical equipment located at water pumping stations,

- Be integrated into the previously developed water system maintenance plan (monitoring and recording component) prepared by the LDII/P, and

- Be limited to providing a means of recording and tracking responses to service interruptions. As the monitoring and recording system is consistently utilized in more governorates, the practicality of expanding the concept of using SITS to analyze data on service interruptions for planning purposes should be investigated.

This report also presents actions that could be taken prior to project commissioning to reduce the number of service interruptions that take place. For example, poor water main laying usually leads to frequent

breaks in the pipeline and service interruptions. Better construction supervision will generally result in a good quality of workmanship and a more reliable water delivery system.

SECTION 1. INTRODUCTION

1.1 Scope

Task g7 in the Technical Assistance Contract of the Local Development II-Provincial Project addresses the problem of interruption and restoration of services. The contract formulates the task as follows:

- Some governorates are currently experimenting with weekly surveys designed to systematically track interruptions of key services such as water, roads, and electricity in each local government unit. A record of such service can be extremely useful for maintenance planning as well as longer range investment planning where upgrading of deficient facilities is required.

- The contractor will review such systems as currently used, propose modifications and improvements in them if needed, and introduce them to other governorates.

This statement suggests that service interruption tracking systems (SITS) can contribute to higher levels of service delivery insofar as they provide local officials the data with which to locate and identify service shortfalls and their causes and thereby to allocate capital investment and O&M resources more efficiently. The shortfalls in question may be traceable to particular local units, to particular types of services, and even to particular components or individuals. The solutions may include training or alteration in the O&M budget or they may involve project rehabilitation or upgrading.

A fundamental requirement, then, for an effective SITS is for data on service interruptions to be collected and organized in such a manner that the data can be used to (1) respond to service problems, and (2) analyze the causes of service interruptions and develop plans for resolving problems.

The purpose of this study is to determine if SITS are currently being used in rural Egypt, if it is practical to introduce such systems, and, if so, to recommend the type of SITS that should be implemented.

1.2 Methodology

Chemonics advisors selected for study two governorates reported to have SITS . These governorates were Assyout and Damietta. The primary source of data was discussions with officials at all levels of local government. Since the SITS were mostly highly developed in the electricity and water sectors, most attention was paid to these two sectors. Some consideration was given to the roads sector, but as road service in

these two governorates was rarely "interrupted" in the strict sense (as distinct from temporary restriction of use on account of cable or pipe installation, etc.), this sector will not be discussed in the report. A study of road service interruption would be more meaningfully conducted in a desert governorate where a sandstorm or shifting sand dunes can seriously interrupt road use.

The field research found that the SITS in the electricity sector were well developed, while the SITS in the water sector were considerably less so. The water "SITS" are generally no more than written requests for repair services, plus notes on actions taken. They are not useful for tracking the duration of interruptions or the sequence of actions leading to restoration. They are generally only used when the repair requires the services of a different level of local government or an outside agency. Moreover, since they are only notifications/requests, they are not easily amenable to aggregation for analytic and planning purposes. In all sectors, however, the most significant defect of the existing SITS is not in their form, but in the fact that the documentation is simply filed away without analysis.

1.3 Structure of the Report

In thinking about the observations gathered for this report, it became obvious that while there were interrelations between the phenomena of interruption and restoration --- as, for example, when poor-quality restoration leads to renewed interruptions --- the sources of interruption and the sources of delay in restoration were sufficiently distinct to warrant separate discussion. Consequently, Section 2 deals with service interruptions and their causes, and Section 3 deals with the service restoration and delays in that process. Section 4 presents the recommendations of the LDII-P team for implementing SITS in rural Egypt. This section also offers suggestions on actions that should be taken to reduce the number of service interruptions.

2.1 Water Systems

The water supply systems of Assyout and Damietta represent the two major types of water supply technology in use in rural Egypt. The Assyout system draws on aquifers; these are tapped through a system of wells and pumps. Some storage capacity usually exists. Distribution is through pipeline networks. This type of system tends to be highly localized, with wells in each main village or even satellite village. Pumps in main villages tend to be powered by sets of electric motors (one or two), with a diesel engine for use after 5:00 p.m. when electricity demand increases. The diesel units are often placed into service after this hour to avoid running the electric motors in reduced voltage situations. These diesel engines are also available for standby use in case of an electrical power outage or motor failure. Not all satellite villages have diesel engines, hence, not all have standby capability.

The main reasons for interruption in water service, according to local government officials, are malfunction of electric motors and, to a lesser extent, pipeline bursts. Breakdowns in the electric motors can usually be traced to one of four causes:

- The voltage delivered by the power company ranges from 320 to 380 V. If the pump set operator has not been attentive to power surges and fluctuations, the motor may overheat at the lower voltage levels causing rapid failure. Surges in power supplied can also cause motor failure.

- Operators may not switch from electric to diesel drives at night, either because diesel motors require a higher level of attentiveness in operation or because of diesel fuel shortages.

- The power company may cross phases after making repairs to main power lines, thus causing electric motors and pumps to run in reverse.

- More fundamentally, many of the systems themselves were built with mismatched components, e.g., a pump which requires 40 HP is connected to a 25 HP motor.

Motor failures, which appear to occur more frequently than breaks in the pipe network, will affect the entire village or set of villages which are supplied by the well, unless standby capability exists.

Pipeline bursts typically derive from the advanced age of the pipelines or from the low level of workmanship involved in the original fittings. The

scale of the service interruption — i.e., the number of persons affected — caused by pipeline bursts depends upon the place of the segment within the network. A burst in a trunk main may disconnect an entire village, whereas a burst in a branch line may only affect a street.

The Damietta water system, which supplies treated surface water, is a more centralized system than that of Assyout, a feature it shares with a number of the delta governorates where saline intrusion is a factor. The Damietta system is based on three large treatment stations (Damietta City, Bustan, and Kafr Sulayman), a booster station at Kafr il-Arab for a line coming from the Busat Karim il-Din station in Daqahliya, and eight compact units. (Six more compact units are under installation.) The stations have standby diesel motors; the compact units do not. The networks in the villages are relatively extensive, and there are few storage facilities. The system is managed by a Water Company.

Interruptions in water service would appear to be evenly distributed between those caused by pipeline bursts and those caused by the failure of electrical or mechanical equipment. The chief reason for the magnitude of pipeline-based interruptions is the lack of sufficient storage facilities. Without storage, a surge in water supply will often lead to breaks at aged or faulty joints in the network. Electric motor failure seems to be caused predominantly by operator negligence in attending to current fluctuations.

2.2 Electrical Power Company

The main causes for power failures in the two governorates are circuit overloading resulting in transformers tripping off line and, in Damietta, rainy weather which causes erosion and may result in falling power poles if the poles were not anchored properly when installed. Transformer failures in rural areas typically occur in the evening when the demands for power are greatest.

In addition, transformers in Assyout Governorate occasionally trip due to birds resting on power cables, causing short circuits. This leads to the practice in Assyout of reconnecting the line after one minute to see if the transformer will again trip or will remain on line. Reconnecting is tried once before dispatching a repair crew.

In both governorates, indicator lights are mounted on distribution panels showing if distribution lines are in service. If a failure occurs, the repair team is dispatched to the general location of the interruption and begins to track the line fault. Troubleshooting is done systematically by testing branch lines in a prescribed order until the fault is located.

The power companies are much better organized for identifying and locating system faults than is the case with water systems. This is probably for two reasons. One, the expectations for good service of the power company customers is higher than for water system users; thus, the users are more likely to complain of poor service. Two, the power grids are

better mapped than the water systems and faults are spotted more quickly. The distribution panels help in this respect.

Conversely, water system networks are usually not mapped, and since the notification of a pipeline failure generally comes from the public, delays in reporting the problem often occur due to poor communication.

SECTION 3. SERVICE RESTORATION

The service restoration process can be analyzed as consisting of four stages:

- Identification of the problem
- Notification of the agency responsible for restoration
- Mobilization of the resources required for repair
- Repair and return to service

3.1 Water Systems

In Assyout electric motor and other equipment failures are diagnosed by the operator, and he communicates his diagnosis to the village council chairman or directly to the markaz maintenance center (MMC) by telephone. The responsibility for carrying out the repair is given to the markaz only if the V/C workshop cannot handle the problem. Four of the ten MMC's in Assyout have limited medium repair capabilities; the others have none. Where no markaz repair capability exists, the responsibility is transmitted to the main maintenance center of the governorate. MMC or GMMC repair teams are sent to the sites. Where capital repair is needed, the damaged motor is sent to the GMMC, which usually relies on private sector assistance. The GMMC has a stock of spare electric motors which can be substituted for the duration of the repair. The substitution usually takes one or two days to complete; the capital repair can take from 20 to 30 days.

Where standby motors are available, the interruption in service may not be more than momentary. Where a substitute motor must be installed or medium repair is required, the interruption will last not less than four or five days, given the time required for mobilization, transportation, and repair/substitution.

Four to five days is the minimum figure. Problems which may arise at any stage of the restoration process will lengthen the process, e.g.:

- Telephone lines from the village to the MMC or the GMMC may be down, busy, etc., delaying notification. And at the receiving end, the office may closed.

- Mobilization may be delayed by paperwork requirements for issuing a vehicle and dispatching a repair team, or because the repair center does not have sufficient vehicles.

- Inadequate or incorrect identification of the problem by the operator may entail a complete repetition of the restoration process when the repair team realizes the problem requires different tools, parts, skills, etc.

- The precise level of MMC and GMMC capability for medium repair does not seem to be well-defined. MMC technicians may spend some days working with an engine before they decide it must be sent to the GMMC; the GMMC may do the same before sending the engine to a private sector agency.

Pipeline restoration responsibility depends on the diameter of the line. Bursts in the 4" and 6" internal lines are repaired by village plumbers affiliated with the VC or the VC maintenance workshop; all three local units visited in Assyout had plumbers for this purpose. Breaks in the internal lines can be fixed the same day as the interruption, but the restoration process can be lengthened because of a number of problems: identification, since as-built drawings are frequently not available; an insufficient number of valves, manholes, or inspection chambers; or the plumbers may not know where these are. Only one of the three VCs had an as-built drawing of its distribution network. In any case, the entire village supply will have to be turned off until the nearest valve can be located.

All Damietta plant operating centers have repair divisions on 24-hour call (Assyout does not have this capability) and have stocks of spare parts. As noted in Section 2.1, the main stations also have standby diesel engines, while the compact units do not. Since operating and repair centers are located in the same place, the identification - communication - mobilization stages take very little time. Medium repair may take one or two days. Capital repair (usually done with private sector assistance) may take from two to six months as the item may have to be sent as far as Cairo for skilled service. The Water Company has plans to construct a main maintenance center with capital repair capabilities.

There are network repair teams, subordinate to one or another of the three main stations, assigned to all the villages, though some teams must serve more than one village. It appears that in some cases the network repairs are beyond the village team's capabilities or, more likely, require spare parts not in sufficient supply in the village; in these situations, the station teams are called in.

The sources of delay in service restoration in Damietta are somewhat different from those in Assyout. The more sophisticated technology requires a higher level of skill and better spare parts procurement. Capable repair service facilities may be difficult to find, and the Water Company does not seem to make use of service contracts.

Network restoration is complicated by the uneven distribution of village repair teams and, apparently, spare parts.

Several local government officials in Damietta expressed the view that the Water Company is not responsive to repair requests because it considers itself accountable to NOPWASD only.

3.2 Electrical Power Company

In both governorates, power failures are usually corrected in less than one day, frequently in a matter of hours. The two primary reasons for this are the availability of trained technicians on a 24-hour basis and adequate spare parts to carry out repairs. In Assyout, the power company has established a training center to upgrade the skills of its workers. In both governorates, preventive maintenance schemes are in place to which help to reduce the incidence of service interruptions.

The next section of this report presents the conclusions and recommendations of the LDII-P project staff regarding the practicality of implementing a service interruption tracking system in rural Egypt.

SECTION 4 . CONCLUSIONS AND RECOMMENDATIONS

4.0 Introduction

In virtually all respects regarding operation, the power companies have advanced well beyond the organizations (Housing Department or Water Company) responsible for water. Despite this, the power companies do not attempt to use data gathered on service interruptions to plan repairs or future capital investments. It is, we believe, premature to introduce comprehensive SITS for water supply systems to the water sector in rural Egypt. We will present in the next sections our observations regarding the components of the existing system for tracking and repairing service interruptions and offer recommendations for improving the data collection techniques for water system operations, and, as a result, improving the system for tracking service interruptions.

4.1 Conclusions

4.1.1 Service Interruptions

Recurrent service interruptions that occur in water supply systems can be traced to deficiencies in project design, construction, operations and maintenance.

- Problems in design and construction. Examples of inadequate design from the water sector include mis-matched components, such as a 25 HP motor driving a pump which requires a 40 HP unit, lack of tank facilities to moderate water pressures, etc. Examples of poor construction include improperly laid or joined pipelines and misalignment of pumps and motors resulting in damaged couplings.

- Problems in operation. Pump operators are sometimes inattentive to voltage fluctuations which may cause motors to overheat and fail.

- Problems in maintenance. The frequently poor condition of oil switch copper blades is an example of poor maintenance practices as is the failure to change engine oil at the specified interval.

Our experience in the test governorates as well as in Minya and Gharbiya (O&M pilot program) suggest that maintenance workshops frequently do not respond effectively in carrying out the repairs caused by the situations described above. Thus, it seems more productive at this point in the implementation of O&M programs in rural Egypt for LDII-P Project advisors to work with local governorates to help them improve their

ability to respond to service problems rather than implement more extensive information systems.

4.1.2 *Service Restoration*

Delays in service restoration derive from the following sources:

- Operators are not always able to adequately describe the problem, thus resulting in the repair crew being dispatched with the wrong tools or spare parts.

- Communications between village and markaz are frequently inadequate.

- Few villages have as-built drawings, making repairs to water lines often very time-consuming.

- Not all maintenance centers are functioning yet. Even when maintenance workshops are operating, there are delays in response due to paperwork requirements, shortage of tools, lack of transport and lack of spare parts.

- Most governorate maintenance workshops have poorly developed capital repair capabilities; even in the private sector, repair capabilities may be insufficient. Some technical skills, e.g. electricians, are in short supply in maintenance workshops.

Some steps have been taken to resolve these problems. Maintenance workshops are becoming better equipped with tools. The Bab II budget has been increased to enable governorates to purchase spare parts and contract with equipment dealers for service. In the pilot O&M program, villages are preparing sketches of their water networks. However, in other areas such as proper communications, developments are slower.

As a result of the investigations carried out during this task, we have concluded that only the simplest of service interruption tracking system should be developed at this time. The modest interventations recommended below which are designed to gather data on service interruptions caused by the failure of electrical/mechanical equipment used at water pumping stations reflect a pragmatic approach to the SITS development.

4.2 Recommendations

The field visits carried out as part of this investigation revealed that it would be impractical at the present time to try to implement a service interruption tracking system with the expectation that the data gathered would be used for investment planning or to identify recurrent problems. The monitoring and recording (M&R) component (data collection component) of the O&M system developed by the LDII-P contractor is now

being utilized in some rural governorates; in particular, in Minya and Gharbiya Governorates where the pilot O&M program is being tested, the technical personnel are accurately recording data on maintenance activities. We have also noted in Damietta and Assyout that some modification to the existing M&R system forms plus two additional forms would enable the governorates to begin to collect and report data on service interruptions.

Given this situation, we recommend that the following actions be taken with respect to the implementation of a SITS in rural Egypt:

- The SITS be limited to a system for capturing data on service interruptions.

- The SITS be developed for the electrical/mechanical equipment found at water pumping or treatment facilities.

- The SITS be integrated with the M R system developed by the LDII-P contractor.

- The new and modified forms be introduced into Minya and Gharbiya Governorates during AWP II for an extended field test, to last approximately one year.

- The development of a program to utilize data on service interruptions to assist with investment planning should be postponed until the O&M program has been introduced into all of the rural governorates via the use of intensive TA and technical training. This is a three to four year effort.

- The LDII-P advisors who carried out the investigations in Damietta and Assyout identified a number of actions that could be taken by technical personnel to reduce the number of service interruptions. The actions are listed in Annex 1. We propose to promote discussion of these actions at the next secretary generals' conference or through some other medium, e.g. a newsletter, whereby all rural governorates are reached.

4.3 SITS Description

As noted above, some modification to the forms currently used to collect data will be required. From an information flow standpoint, a SITS requires:

- Method for notification,
- Directive to field crews to take action,
- A work order, and
- Management report listing problems and corrective actions taken.

Figure 1 shows the recommended flow of information from notification to the management report. The forms that are needed to gather and report on service interruptions are attached in Annex 2 and are described as follows:

- *Notification Form* (Form 1). This is an an existing form prepared by the V/C workshop supervisor that has been modified to capture information on service interruptions. The form is used to record information on the nature of the problem. The form was modified to indicate whether service was interrupted and (below the double line) the action taken to effect repairs.

- *Request for Maintenance Action* (Form 2). This is a new form and is used by the markaz to record information on service requests from villages. The MMC supervisor who prepares the form also records what action will be taken to resolve the problem.

- *Request for Equipment Repair/Maintenance* (Form 5.1). This is an existing M&R form used by the V/C to request service from public or private sector firms. It fills the same role as Form 2 in requesting work outside of the V/C workshop.

- *Service Order* (Form 3). This form is used by the markaz repair crew to report on its work. It acts as a work order. One copy is left with the V/C workshop and the original is retained by the MMC. The previous method was for the crew chief to prepare a statement in writing describing the work done.

- *V/C Quarterly Progress Report* (Form 5-VR). This is the report used by the maintenance supervisor of the V/C workshop to report work performed to the V/C chief. It is also used by the markaz to prepare its report summarizing the work carried out on village water systems in that markaz.

- *Service Interruption Report* (Form 4). This is a new form which is designed to separate service problems that caused interruptions from those that did not. It is prepared by the MMC supervisor and forwarded to the governorate level water engineer in the Housing Department. We have added one column to the form with the heading *No. of Same Interruptions Last Year*. While this information will not be readily available with the present SITS, it will be necessary to gather this type of data in the future if the SITS is to be used to analyze future needs.

- *Management Reports* (Forms 5-MR & 7-GR). The forms are used by markez and governorate level supervisors to report O&M activities for the previous month. Each report has a section dealing with problems and difficulties. We envision that this

report (or a version of it) will be used to report recurring problems when the SITS is expanded to include analysis for investment planning or the resolution of recurring problems through maintenance actions.

We believe that if we can successfully introduce the data collection efforts represented by the SITS and required forms described above, then over several years enough data will have been collected by local government to begin to use the data to identify recurrent service problems and effective solutions to those problems.

ANNEX 1

RECOMMENDATIONS ON ACTIONS TO HELP REDUCE THE FREQUENCY OF SERVICE INTERRUPTION AND RESTORATION

- The catalogues, handbooks and technical instructions of the different types of equipment should be made available to facilitate operation and maintenance.

- There should be an emphasis on the importance of good technical supervision during construction and installation to avoid defects and help to ensure implementation quality according to standard specifications.

- Regular technical training is required for operators and technicians to avoid any troubles resulting from *mistakes or unsound* operation. Training programs for maintenance engineers are also needed.

- Adequate funds should be provided for maintenance and repair activities including provision for spare parts and materials.

- It is highly important that maintenance workshops carry out preventive maintenance operations as required and this necessitates sound organization of workshop operations.

- Proper and regular recording of O&M operations should be emphasized.

- Data on equipments cards and in records should be reviewed while performing biannual preventive maintenance in order to attempt to identify recurrent troubles, types of service interruptions, and the procedures and repairs that were done.

- Communications between project sites and maintenance workshops and centers should be organized, and telephone lines provided between the village and markaz levels.

- Suitable transportation should be provided at maintenance centers to ensure rapid response and movement of repair teams to job sites.

- Consideration should be given to providing continuous maintenance service through the use of regular shifts.

- It is important to have water system network plans which identify the location of all components of the system.

ANNEX 2

PROPOSED SITS FORMS

(FORM (1)

NOTIFICATION FORM

EQUIPMENT DESCRIPTION: SERIAL NO.:

_____ _____

_____

DATE/TIME PROBLEM DISCOVERED _____

LOCATION _____

DESCRIPTION OF PROBLEM

IS SERVICE INTERRUPTED? ____Y____N

CAUSE OF PROBLEM (IF KNOWN)

ACTION REQUIRED

NOTES:

NOTIFIED BY: RECEIVED BY:

_____ _____

ACTION TAKEN FOR REPAIR

_____

_____

_____

_____

REPAIR MADE BY: _____

NAME: _____

POSITION: _____

SIGNATURE: _____ DATE _____

FORM (2)

REQUEST FOR MAINTENANCE ACTION

EQUIPMENT DESCRIPTION SERIAL NO.

_____ _____

_____

DATE/TIME PROBLEM DISCOVERED _____

LOCATION _____

DESCRIPTION OF PROBLEM

IS SERVICE INTERRUPTED?___Y___N

DESCRITPION OF CAUSES (IF KNOWN):

ACTION REQUIRED:

NOTIFIED BY:_____ RECEIVED BY: _____

_____

ACTION TO BE TAKEN

APPROVED BY:

NAME: _____ DATE_____

POSITION: _____

SIGNATURE: _____

FORMS/JJ/SA

Form (3)

SERVICE ORDER

DATE: TIME LOCATION

DUE TO NOTIFICATION NO.:

THE MAINTENANCE & REPAIR TEAM CONSIST OF:

MR./ MR./

MR./ MR./

TEAM MET WITH MR./
SUPERVISOR/OPERATOR

ACTION TAKEN: (describe work carried out)

_____

_____

_____

_____

_____

_____

_____

Repair Team Crew Leader

NAME:

SIGNATURE:

DATE:

Pump Station Supervisor

NAME:

SIGNATURE:

FORM (4)

INTERRUPTION AND REPAIR RECORDING SCHEDULE FOR WATER PROJECT IN MARKAZ:

MONTH: YEAR 19

Ser. No.	Equipment Type	Location	Type of Inter-ruption	Date of Notifi-cation	Notified Level	Starting date	Completion date	No. of same interruption last year.	Recommen dations

FORM 5.1
REQUEST FOR EQUIPMENT

Work Permit No.:----------

Date:----------

Governorate:--------

Repair/Maintenance

Name of the Operating Authority:----------

Markaz:----------

EQUIPMENT NO.	TYPE	MODEL	TYPE OF WORK REQUIRED	DIAGNOSIS	SPARE PARTS RELEASED		TOTAL PRICE
					TYPE	QUALITY	

Inspection Remarks on the equipment of the repair and maintenance:

- ----------
- ----------
- ----------
- ----------
- ----------
- ----------

Inspector Signature
(----------)

Drivers operator name and signature:----------

Name and Signature of the Pre-repair inspector:----------

Maintenance Center Chief

Name:----------

Signature: ---------

Name and Signature of the Operating Authority Chief: ----------

BEST AVAILABLE COPY

Form 2-MR-Water

M/C Water Maintenance/Repair Record

Job Order No.	Date	Equipment Type and Manufacturer	Equipment Location	Type of Work Required	Spare Parts			Materials			Date of Completion	Signature of Receiver
					Item	Quant.	Price	Item	Quant.	Price		

BEST AVAILABLE COPY

Form 5-VR

Chief of _____ V/C

Dear Sir,

Please be informed that the following works have been performed over the last three months with regard to the execution of the V/C O & M plan:

1. Technical Status of V/C Water Projects per enclosed Form 6-VR

2. Materials and spare parts requirements list, Form 7-VR

3. Calculation of total quantity of water produced by water projects per enclosed Form 8-VR.

4. Calculation of total cost for all O & M work performed by the V/C as indicated in the enclosed Form 9-VR.

5. Total O & M expenditures for the three months period ending / /19 , Form 10-VR

Problems which have been encountered during the last three months:

1.
2.
3.
4.
5.

Requirements:

1.
2.
3.
4.
5.

Please take the necessary action to overcome obstacles and provide the V/C workshops with the above mentioned needs and requirements.

_____ V/C Maintenance Supervisor

Signature : _____

Dated : / /19

CC. Markaz Maintenance Coordinator
Markaz Water Engineer

Form 5-MR

Chief of Markaz Engineering Department
Governorate Water Maintenance Engineer

Dear Sir,

Please be informed that the O & M plan for water projects has been fulfilled in accordance with the O & M plan for the markaz and satellites. Quarterly activities are summarized below:

1. Water project operations and maintenance, including total cost, as conducted by the MMC, per enclosed Form 6-MR - Water

2. Materials and spare parts required for repairs as indicated in enclosed Form 7-MR.

3. Total quantity of water produced by city/V/Cs water sources for the last three months as indicated in enclosed Form 8-MR.

4. Technical status of water projects as indicated in enclosed Form 9-MR.

5. Total O & M expenditure for the last three months in accordance with Bab II clauses as indicated in enclosed Form 10-MR.

6. Form 11-MR indicates field trips proposed for the upcoming period.

7. Maintenance Productivity =

$$\frac{\text{User Fees}}{\text{Quarterly O \& M Expenditures}} \times 100 = \%$$

Problems and difficulties encountered during implementation:

1.
2.
3.
4.
5.
6.

Requirements (training, personnel, funds, etc.):

1.
2.
3.
4.
5.
6.

Please take the necessary action to overcome obstacles in securing the above mentioned requirements.

_____ Markaz Maintenance
Center Chief

Signature _____

Dated : / /19

Form 7-GR

Governor Housing Department Engr. _____
Governor Maintenance Coordinator Engr. _____

Please be informed that the following tasks were performed during the report quarter (-) and are on record at the MMC and V/C workshops.

The following summary forms are attached:

1. Technical Status of Water Projects, Form 4-GR - Water

2. O & M Repairs for Water Projects Performed during the report period by the Markaz/Governorate, Form 5-GR - Water

3. Water Production for Village Use during the report quarter, Form 6-GR - Water.

4. Repairs Requested for Implementation Outside the MC (V/C - markaz, governorate) and the recommended sector, Form 8-GR - Water

5. Spare Parts and Materials Requirements for Upcoming Quarter, Form 9-GR - Water.

6. Total O & M expenditures from the beginning of the FY to the beginning of the report period according to Bab items, Form 10-GR - Water

7. Field visits scheduled for the upcoming quarter, Form 11-GR - Water.

8. Maintenance Productivity = %

Problems obstructing implementation

1.
2.
3.
4.
5.

Requirements

1.
2.
3.
4.
5.

Please take the necessary action to overcome obstacles to implementation and to provide for the requirements above.

Gov. Water Maintenance Engineer

Signature :

Dated : / /19

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