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# MUNICIPAL WATER CONSERVATION IN JORDAN: REPORT OF A SEMINAR

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**WASH  
PROJECT**



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WASH FIELD REPORT NO. 36

FEBRUARY 1982

1611 N. Kent Street, Room 1002  
Arlington, Virginia 22209 USA

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The WASH Project is managed by Camp Dresser & McKee Incorporated. Principal Cooperating Institutions and subcontractors are: International Science and Technology Institute; Research Triangle Institute; University of North Carolina at Chapel Hill; Georgia Institute of Technology—Engineering Experiment Station.

Prepared For:  
USAID Mission to the Hashemite  
Kingdom of Jordan  
Order of Technical Direction No. 59

276.82M4-3056

**WATER AND SANITATION  
FOR HEALTH PROJECT**



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February 25, 1982

Mr. Walter Bollinger  
Mission Director  
USAID  
Amman

Attn: Mr. James Cassanos


Dear Mr. Bollinger:

On behalf of the WASH Project I am pleased to provide you with fifteen (15) copies of a report on the seminar on Municipal Water Conservation in Jordan. This is the final report by James L. Ogilvie and is based on his trip to Jordan from October 13 through 28, 1982.

This assistance is the result of a request by the Mission, and the work was undertaken by the WASH Project on October 5, 1981 by means of Order of Technical Direction No. 59, authorized by the USAID Office of Health in Washington.

If you have any questions or comments regarding the findings or recommendations contained in this report we will be happy to discuss them.

Sincerely,

  
David Donaldson  
Acting Project Director

DD:jml  
Enclosures

cc: Mr. Victor W.R. Wehman  
S&T/HEA

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WASH FIELD REPORT NO. 36

HASHEMITE KINGDOM OF JORDAN

MUNICIPAL WATER CONSERVATION IN JORDAN:  
REPORT OF A SEMINAR

Prepared for USAID Mission to the Hashemite Kingdom of Jordan  
under Order of Technical Direction No. 59

Prepared by:

James L. Ogilvie, P.E.

February, 1982

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Water and Sanitation for Health Project  
Contract No. AID/DSPE-C-0080, Project No. 931-1176  
Is sponsored by the Office of Health, Bureau for Science and Technology  
U.S. Agency for International Development  
Washington, DC 20523

## TABLE OF CONTENTS

<u>Chapter</u>	<u>Page</u>
SUMMARY OF RECOMMENDATIONS.....	ii
ACKNOWLEDGEMENTS.....	iv
1. INTRODUCTION.....	1
1.1 Background.....	1
1.2 Scope of Work.....	1
2. COMMENTS AND RECOMMENDATIONS.....	2
2.1 Coordination and Management of Water Related Activities.....	2
2.2 Technical Approaches to Water Conservation.....	2
2.2.1 Leaks.....	2
2.2.2 Public Awareness.....	3
2.2.3 Plumbing Standards and Codes.....	4
2.2.4 Superior Quality Pipes.....	5
2.2.5 Groundwater Use.....	5
2.2.6 Training Programs for Employees.....	6
2.2.7 Water Reuse in the Future.....	6
APPENDICES	
A. Itinerary.....	8
B. Water Conservation and Management Seminar.....	9
C. Coordination and Management of Water Related Activities of Agencies.....	10
D. Technical Approaches to Conservation.....	12

## SUMMARY OF RECOMMENDATIONS

It is recommended:

1. That legislation be adopted or regulations developed which will lead to the creation of a National Water Authority.
2. That the present program to prevent water leakage be continued and that methods be found to make it even more effective by increasing manpower for repair activities and by emphasizing the monitoring of the quantity of water produced compared to water delivered.
3. That immediate steps be taken to develop comprehensive public information programs to inform the public of the need to conserve water and to encourage the use of water but at the same time discourage waste.
4. That people be informed of the general water supply conditions in Jordan for all purposes--including domestic, agricultural and industrial use. It should be emphasized that each Jordanian plays an important part in determining whether the water supply is used wisely or not.
5. That all media be used in this information program including newspapers, radio, television and particularly schools where young people can be persuaded of the importance of using water wisely and without waste.
6. That water supply agencies such as Amman Water and Sewerage Authority (AWSA) and the Water Supply Corporation (WSC) and independent city suppliers initiate programs to modify old plumbing fixtures to save water and that appropriate steps be taken by public officials to enact ordinances or regulations requiring new plumbing fixtures to be of water-saving design.
7. That superior quality pipe and fittings be used as the individual case demands.
8. That adequate monitoring be done wherever groundwater is being used to promptly identify over-depleted areas. In this way pumping rates can be restricted to assure the long-term continued existence of a dependable, good quality, water supply. (Serious thought should also be given to establishing programs for recharging groundwater storage in selected areas as a means of conserving water supplies in efficient underground storage basins.)

9. That adequate on-the-job training programs be initiated in water supply agencies to encourage retention and advancement of employees in the field of water supply work.
10. That water supply planners and researchers in Jordan keep informed of new water re-use technologies in order that water supplies may be stretched by re-using available supplies.

## ACKNOWLEDGEMENTS

The work in Jordan was greatly assisted by both Jordanian government representatives and those of the U.S. Agency for International Development Mission in Amman.

Mr. Boulos Kefaya and Mr. Hussein Shafa'Amri of the National Planning Council helped greatly. Also Mr. Jim Cassanos, Mr. Stanley Stalla and Mr. Abdalla Ahmad of USAID were of great assistance with introductions and information regarding water conservation in Jordan. Mission staff also provided office facilities, typing, and communication services which were greatly appreciated.



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## Chapter 1

### INTRODUCTION

#### 1.1 Background

Negotiations were conducted over a period of several months concerning a water conservation seminar in Jordan. Initially both municipal and agricultural water use were considered. However, agricultural water use was too broad for inclusion in the first short-term seminar proposal. Accordingly, the scope of the seminar was limited to municipal water use. Early in October 1981, the U.S. Agency for International Development (USAID) requested the services of the Water and Sanitation for Health (WASH) project which resulted in Order of Technical Direction No. 59 dated October 5, 1981.

Accordingly, James L. Ogilvie was employed through a contract with the International Science and Technology Institute, Inc. (ISTI) to go to Jordan to develop and conduct the seminar.

#### 1.2 Scope of Work

The scope of work included the development of an agenda for a seminar on water conservation practices which would address conditions in Jordan with respect to water supply agencies. In addition, the consultant was to conduct the seminar with the participation of relevant and appropriate individuals and agencies in Jordan. Based on results of the seminar, consultations with appropriate officials, and USAID staff, the consultant was to prepare a report containing recommendations and a general plan for water conservation in Jordan.

The scope of work also included refinement of general objectives subject to variable conditions encountered in Jordan as work progressed.

## Chapter 2

### COMMENTS AND RECOMMENDATIONS

#### 2.1 Coordination and Management of Water Related Activities

Seminar participants for the most part were familiar with on-going efforts to create a National Water Authority, a primary function of which would be coordinating the water related activities of existing agencies. The consensus was that coordination is very desirable to assure that national water policies are carried out without conflict and without duplication of effort. It was also agreed that data and information be exchanged freely between agencies which would lead to more consistent water planning at all levels of government.

It was recognized that appropriation and allocation of water supplies in the future is of national significance and that national policies concerning priorities of use will be necessary to assure effective administration of water supplies for all uses. This will require top level and careful thought such as could be provided by a National Water Authority.

Based on these significant facts and based on personal knowledge of the importance of fully coordinating and implementing valid plans for water resource development in a timely manner it is recommended that serious thought and decisive action be taken to adopt legislation or regulations leading to the creation of a National Water Authority.

#### 2.2 Technical Approaches to Water Conservation

##### 2.2.1 Leaks

Leak detection programs were reviewed in detail and were primarily applicable to AWSA, WSC, and cities or villages providing water service to customers. System leaks were recognized as being responsible for major water losses of the magnitude of 30 or 40 percent. The major water supply agencies, AWSA and WSC, felt that on-going programs were desirable to combat and reduce water loss from leaks. This requires maintenance repair crews working on a continuous basis and repairing leaks as they are reported or found on the system. Radio dispatch of repair crews facilitates the repair of most leaks in a timely manner. Exceptions do occur, however, and the consensus was that reporting leaks and immediate repair was important and that improved ways of expediting this program should be implemented. One method of speeding leak repair is to encourage customers to report leaks.

Because pipes corrode with age, there were discussions about on-going programs for replacement of old pipe sections as a method of avoiding many leaks. The importance of an annual valve maintenance program was also discussed to be sure that valves are operable so that when leaks occur it is possible to stop the flow of water quickly so that repairs can be made without wasting large amounts of water.

It was agreed that timely leak repairs would save large amounts of water and that an on-going program was cost effective. Sophisticated leak detection equipment was also discussed and it was concluded that it would not be as effective as the methods now being used.

The possible use of selected isotopes in leak detection programs was suggested during the report review process: it was thought this method could be referred to the Royal Scientific Society for study and evaluation with regard to both effectiveness and health.

It is recommended that the present leak repair program be continued and that methods be found to make it even more effective. Probably the best way of doing this is to put additional manpower on the job where leaks are known to exist. When there is evidence that major amounts of water are being lost, this can be confirmed by careful comparison of water quantities being supplied to the system with quantities that are being metered and delivered to customers. These comparisons are now being made and are not new to the water supply agencies.

### 2.2.2 Public Awareness

The consensus of the seminar participants was that a good public awareness program is essential to the success of any water conservation program. It was agreed that without cooperation of the customers the conservation program would be doomed to failure or only marginally successful at best. There were also discussions of ways to involve the public including newspapers, radio and television. Printed inserts were considered to accompany each bi-monthly or quarterly bill. One of the best ways of informing the public of conservation programs is through school programs for all ages and particularly for the seven-, eight- and nine-year age level. Presenting interesting programs to students at these ages can be very effective in carrying the message home of why it is important to use water wisely and without waste. It was pointed out how excellent results have been achieved with school programs for children in the past.

It was agreed that every possible way should be used to educate people of the importance of water in their lives, of what it means to their standard of living, what it means to families in maintaining health for young and old alike, and fi-

nally, how important water is to the country's overall economy. It was recognized that some people in Jordan are not using enough water possibly because of inadequate supplies or because of past family customs. The impact a conservation program might have on these people was considered since they are actually using less water now than is recommended as a minimum by the World Health Organization. Jordan's long-range policy is to actually encourage an increase of per capita use, now at about 50 to 60 lcd, up to 80 lcd in the near future. It was emphasized that any public education program must be carefully prepared to avoid conflicts between providing more water for people and at the same time urging them to use less water. Actually, the prime objective is to encourage people to use water wisely without wasting it.

It was recommended that immediate steps be taken to develop public information programs to adequately inform the people of the need to conserve water, one of their most valuable resources, and that they be encouraged to use it wisely. It was recommended that people be informed concerning the overall status of the total water supply for Jordan--of how this supply must serve families, industry, and agriculture and that each Jordanian has an important part to play in helping to see that the water supply is not wasted. It was recommended that all news media such as television, radio and newspapers be used and that special emphasis be given to programs directed to children in school. This may cost the water supply industries some money, but it will be money well spent and will have a lasting impact on the conservation effort.

### 2.2.3 Plumbing Standards and Codes

Seminar participants were in agreement that standards should be set for plumbing fixtures in homes and places of business. Excess use of water in old-style plumbing fixtures is recognized as a fact. Old-style toilets use large amounts of water every time they are flushed. By placing plastic bottles in the toilet tank it is possible to reduce water used and not interfere with the satisfactory functioning of the fixture. This is a worthwhile water saver and can be done at practically no cost.

Old style shower heads use large amounts of water--particularly when prolonged showers are taken. It is possible to secure low-flow shower heads or place small restrictor rings in old heads and thus reduce the amount of water used for each shower.

There are attachments that can be made to sink taps reducing water use without interfering with its effectiveness.

A program of encouraging these kinds of modifications to existing plumbing fixtures can help to make the water supply

go further and such a program can be included as part of the public awareness program.

New ordinance or city codes can definitely help by providing that new fixtures be designed and built to conform with the objectives of water conservation standards. Toilet tanks designed to smaller size to save water with each flush can be required in all new construction. Water-saving fixtures can also be required for showers and sinks. The overall effect is that much water can be saved thus resulting in money savings to both the customer and the water supply agency. And, the overall end objective of stretching the water supply will be realized.

It is recommended that the water supply agencies such as AWSA and WSC and city suppliers initiate programs to modify old plumbing fixtures of water-saving ways that appropriate steps be taken by public officials to enact ordinances or regulations requiring new plumbing fixtures to be of water-saving design.

#### 2.2.4 Superior Quality Pipes

Seminar participants supported the idea that use of better quality pipes and fittings in water mains and laterals would minimize the potential of failure and malfunction of facilities. This is particularly true in areas where the soil is corrosive or where preventive maintenance is difficult or not regularly performed.

It is recommended that the use of superior quality pipe and fittings on a case-by-case study with installation where warranted. As a general rule, however, adhering to prescribed standards for each type of installation should be adequate.

#### 2.2.5 Groundwater Use

The general feeling persisted in the group that water supply sources should not be over-exploited. The feeling particularly applied to groundwater sources where there is some indication the water is being mined from some aquifer formations to the extent that water levels are dropping substantially. This indicates that water is being removed from the underground basin at a rate greater than recharge water is entering into the basin. Any basin where this condition persists over long periods will be depleted to the point where it no longer yields adequate quantities of water. It also may be subject to deteriorating quality because of drawing in poor water with excesses of dissolved solids or other serious pollutants. Loss of groundwater yield in a basin may be very serious to the overall required supply to meet ever-growing water needs--unless,

of course, alternate sources have been investigated and can be readily developed as the need occurs.

Once a basin is drawn down and polluted it may not recover again, even after many years of non-use and slow recharge. Because of the serious implications on already meager water sources in Jordan, the consensus was that great care should be exercised in the use of underground supplies to assure that this source will continue to be available for many years to come.

It is recommended that adequate monitoring programs be maintained throughout Jordan, where ever groundwater is being used, to promptly identify over-depleted areas so restricted pumping rates may be established and maintained to assure the long-term continued existence of a dependable, good quality, water supply. It is also recommended that serious thought and study be given to recharging groundwater storage in selected areas from surface supplies since underground storage with attendant benefits of quality enhancement represent a feasible and attractive means of conserving water for future use.

#### 2.2.6 Training programs for Employees

The ability to train and keep qualified operators and engineers in the water supply (and wastewater treatment) fields is evident. A serious need exists now for trained people who can be retained in the water supply field in all capacities ranging from planners and engineers to expert technicians as plant operators. Standards of water quality are being increased. Demand for better quality water in greater quantities each year as the standard of living improves makes it imperative that trained and qualified people are afforded opportunities for remaining and advancing in the water supply industry. One way of doing this is to make the jobs attractive and to provide on-the-job training programs for employees.

It is recommended that the adequate training program be initiated at work sites in the related water supply agencies so that on-the-job training can be given to greater numbers of people. This will encourage the retention and advancement of employees in this field of work.

#### 2.2.7 Water Reuse in the Future

During the seminar it was pointed out that progress is being made in the design of water treatment plants to actually take sewage effluent water after secondary treatment and then process and treat it to the point where it is completely potable and may be safely used as drinking water. Pilot plants are now being constructed, notably in Denver, Colorado, where existing fresh water supplies are projected as being insufficient to

meet future needs in conditions similar to these prevailing here in Jordan. Admittedly, this is advanced technology in action. Several years of pilot plant testing are needed to demonstrate the reliability of product water, also health affects testing will require several years to assure that the procedure is safe for people. Even so, water scarce regions will be forced to this action within a few years. Initially, recycled water from such a process may be used for industrial purposes or for agriculture. Ultimately, the recycled water will be needed for domestic use.

It is recommended that planners and researchers in the water supply industries in Jordan keep abreast of this new technology. Even though costly today, it may be the answer to new sources of potable water in the future. And, surely as methods are improved and larger plants are constructed, the cost will be acceptable. Jordan may find this to be an acceptable water source as demand for water increases and existing supplies are used up.

## APPENDIX A

### Itinerary

- October 13, 14 and 15 - National Planning Council (NPC), Amman Water and Sewerage Authority (AWSA), Water Supply Corporation (WSC), Jordan Valley Authority (JVA), Ministry of Agriculture, Natural Resources Authority (NRA), and USAID.
- October 16 and 17 - Inspected water service facilities of WSC at several field locations including towns and villages between Amman and Aqaba, the sea water desalination plant operated as part of Royal Scientific Society (RSS) research work, Aqaba water supply pipeline and supply wells at the Qaa Disi and a Ministry of Agriculture irrigation project where the water supply came from WSC wells and pipelines.
- October 18 - Made a field trip to Azraq to observe pipeline, wells and spring-fed pools, all part of Amman water supply from a major underground aquifer over 100 kilometers from Amman, water service facilities of AWSA located underground in Amman.
- October 19 - Jordan Valley where principal use of water is for irrigation.
- October 20, 21, 22 and 23 - Completed seminar agenda. Made final preparation for seminar and made final follow-up visits to some agencies before seminar.
- October 24 - Conducted seminar.
- October 25, 26 and 27 - Prepared draft of report with recommendations following seminar.
- October 28 - Returned to U.S.A.
- October 30 - Debriefing in Washington, D.C. with WASH and AID representatives.



## APPENDIX B

### Water Conservation and Management Seminar

#### AGENDA

#### October 24, 1981

- |             |   |   |                                     |
|-------------|---|---|-------------------------------------|
| 9:00 am     | - | Welcome - N.P.C.  | Boulos Kefaya                       |
| 9:10 am     | - | Introductions and Purpose   |                                     |
| 9:20 am     | - | Coordination and Management of Water Related Activities of Agencies - Remarks | James L. Ogilvie                    |
| 9:35 am     | - | Discussion by seminar participants moderated by                               | Boulos Kefaya<br>Hussein Shafa'Amri |
| 11:30-12:00 | - | BREAK   |                                     |
| 12:00 noon  | - | Continued Discussion  |                                     |
| 1:45 pm     | - | Summary   | James L. Ogilvie                    |
| 2:00 pm     | - | Recess to 9:00 am Oct. 25, 1981   |                                     |

#### October 25, 1981

- |             |   |                                      |                                     |
|-------------|---|--------------------------------------|-------------------------------------|
| 9:00 am     | - | Opening Remarks and Announcements    | Boulos Kefaya                       |
| 9:10 am     | - | Technical Approaches to Conservation | James L. Ogilvie                    |
| 9:25 am     | - | Participants discussion moderated by | Boulos Kefaya<br>Hussein Shafa'Amri |
| 11:30-12:00 | - | BREAK                                |                                     |
| 12:00 noon  | - | Continued discussion                 |                                     |
| 1:40-1:55   | - | Summary                              | James L. Ogilvie                    |
| 2:00 pm     | - | Adjourn                              | N.P.C.                              |

## APPENDIX C

### "Coordination and Management of Water Related Activities of AGENICES"

by James L. Ogilvie

Paper Present at the Water Conservation and Management Seminar  
Amman, Jordan - October 24, 1981

I am pleased to be in Jordan working with friends and talking about water resources development. A good fresh water supply is essential to all people for their health, for their social well-being, and their economic stability. Some countries are blessed with abundant water supplies, either from precipitation in the form of rain or snow, or from major streams. Many times fresh water sources are variable because of climatic conditions on a yearly basis or as a result of cyclic events referred to as abnormal, such as droughts when precipitation and run-off yields greater than normal water supplies.

One element of water conservation, the subject of this seminar, centers around our ability to store water in good years for use in poor years when supplies are below average. Constructing reservoirs and creating water reserves is an important way to practice conservation--a method sometimes overlooked and not taken advantage of as we endeavor to stretch the use of available supplies through novel technical methods. Recharging groundwater aquifers is another way of conserving water for future use.

These and other conservation practices to be discussed in greater detail later in this seminar, require much thought and planning by many people in many segments of government from the national level to the local areas where water is ultimately delivered to the customer.

The coordination of activities is the subject we shall concentrate on this morning--striving to determine the importance of coordinating all activities having a bearing on providing on-going water supplies to meet the growing needs of people. During the last few days, I have met with many of you to learn the part each plays in responding to the water needs of the people of Jordan. You have been most courteous in providing information--telling me how your organization functions--and throughout these talks I have been impressed with the complex nature of the water supply systems which you operate. I have been pleased to observe that there is much cooperation among your several agencies. The ones I have considered include: the Natural Resources Authority, the National Planning Council, the Amman Water and Sewerage Authority, Water Supply Corporation and the Jordan Valley Authority. The Ministry of Health

and the Ministry of Industries are also involved, and I am sure there are others as well.

Today, we will participate in discussion to get new ideas or to revive old methods of doing things for water resource management, enabling Jordan to use its water efficiently and providing for stretching existing supplies as far as possible to help meet foreseeable needs and to look even further to the future, we will discuss the need for coordinating each agency's activities as new plans are developed and refined into alternatives for the future.

To get the discussion started, I will comment briefly on a major responsibility of the Natural Resources Authority involving assessments of available water supplies, both surface and groundwater, and whether those estimates are reliable in the light of ongoing development that is taking place. This comment is particularly applicable to groundwater sources. A question that comes to my mind is "would extensive coordination and exchange of known facts result in updated and more reliable information as a base for planning future groundwater use based on reliable yield estimates and projected withdrawals?" "Could this help in avoiding excessive water mining and ultimate exhaustion of supply and quality deterioration in some groundwater basins?" "Are there cases where coordination and exchanges are desirable even within the several departments of a single agency?"

I was particularly interested to see that Ahmad Kilani in a speech delivered in Madrid, Spain, in September, 1980, made special reference to the urgency and need for all agencies to achieve greater degrees of coordination in their water resource activities. I see that Mr. Kilani is participating in our seminar, today. I am sure that he will have some pertinent remarks. With this brief introduction and comment, I now encourage each of you to participate in open discussion and exchange of information on the first subject we are discussing during our seminar today.

(Following these opening remarks, the seminar participants engaged in open discussion and advanced many worthwhile ideas and suggestions.)

## APPENDIX D

### "Technical Approaches to Conservation"

by James L. Ogilvie, P.E.

Paper Presented at Water Conservation and Management Seminar  
Amman, Jordan - October 24, 1981

Water Conservation - Technical Programs - Everyone talks about water conservation; no one does very much about it until there is a crisis, then everyone jumps in with many ideas, some good, some bad and the end result may not actually accomplish its purpose. To secure full value from a conservation effort one must carefully think out what the object is. Any worthwhile water conservation program must be long-lasting with permanent results. A poor program may have dramatic, immediate results, soon to be forgotten with the program discarded and old use patterns resumed.

All possible ways to save water must be examined in detail. Actions resulting in significant water savings should be placed at the top of the list and evaluated for effectiveness and acceptability. Regardless of how good an idea seems, if it cannot be implemented, it isn't worth much. Sometimes modest programs, fully activated and accepted, are better than dramatic programs poorly implemented and not accepted.

Water conservation has different meanings for many people. To some, building a reservoir to hold flood or surplus flows for future use is true conservation of water. To others, this same action may be viewed as excessive development, removing water from channels with free-flowing streams, resulting in overall detrimental affects. Personally, I do not agree with this view, nor do I think it is looked on favorably here in Jordan, where water is a precious resource so important to the health and welfare of its people.

For our purpose today, we will talk about ways of using water beneficially for people and at the same time, consider ways to save water by eliminating wasteful methods of using this precious resource. We will talk about reducing the amount of water we use without seriously affecting the health and welfare of the people. Actually, there are many circumstances where the per capita per day use of water should actually be increased, thus, benefitting the people that are served.

Many actions can be taken by water service organizations with minimal or no affect on the customers. For example, elimination of leaks within municipal pipelines may save large amounts of water and the customer will not be aware of this as he continues to receive water at his tap. On the other hand, if customers are asked to place restrictors in their taps, thus con-

serving water, he will be aware of this everytime he turns the tap on. Some customers may not object, others may resent cutting down the flow of water through their tap. Implementation of water conservation programs will require careful and complete explanation of why such programs are being initiated with careful explanation of the part to be played by the customer in helping to conserve this valuable resource. When fully explained, there are significant benefits to the customer from water conservation programs. His water heating bill will be less. The water service agency will be pumping less water and the net result will be saving water and pumping energy. The cost of chemicals to treat water will be less per customer. This is another plus for the utility company and may result in an actual saving to the customer as a result of a reduced revenue charge for the service rendered, and the real objective of saving water is being accomplished when the water supply available is stretched to serve more people over a longer period of time.

System leaks are sometimes very serious with as much as 40 or 50 percent of the water being lost before it reaches the customer. Leaks in some major U.S.A. cities such as Boston or New York have been estimated as high as 50 percent. This is largely attributed to the fact that the systems are old and have not been properly maintained over the many years that they have been in service. Conduits and mains, commonly known as water pipes, are wearing out through the process of corrosion. Valves and equipment are also wearing out because of long continued use. Individual house service lines are old and corroded. Water losses resulting from poorly maintained systems are costly to the water service utility and result in higher costs to the customer and require early capital additions to the system to provide additional water supplies to meet constantly growing demands. The overall effect is bad from the customer standpoint. Comprehensive leak detection programs with appropriate maintenance and repair follow-up actions is usually cost effective and follow-up actions by the water utility are steps in the right direction.

This gives you some idea of a few of the things we will be talking about as we consider conservation of water. There are many other ways of saving water and using it wisely. The main idea is to avoid wasting water. It costs too much to secure supplies of fresh water--to treat it and to deliver it to the customers--and the main reason for conserving water is to stretch the available supply as far as possible to meet ever increasing needs of an expanding population.

I have briefly mentioned two or three ways to save water. I am sure you will each have some good suggestions we may discuss as the day progresses. I hope we can agree on some practical ways of saving water that will mean much to the people of Jordan in the years to come. I will listen and comment when ap-

propriate and when our seminar is complete, I hope we can agree on some valuable water conservation programs.

(Following this brief presentation, as a kick-off, the seminar participants engaged in active and lengthy discussions of many appropriate ways to conserve and stretch water supplies.)