

Project Rainkeep:
A Plan for Increasing On-Site Retention
and Utilization of Rainwater in Jordan
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A. Project Purpose and Description

According to Mu'taz Belbeisi, director general of the Jordan Water Authority, explosive growth over the past three decades in Jordan's population, increased per capita consumption of water and rapid depletion of non-renewable underground water resources have heightened concerns that the country's water crisis will worsen significantly over the next two decades. The crisis is expected to lead to stricter rationing of water over the coming years and "will force Jordan to look for 'untraditional' sources of water" (Jordan Times July 25, 1992).

The purpose of Project Rainkeep is to act as a pilot project to encourage greater involvement by individual Jordanian citizens in water collection and storage through demonstrating to them that cisterns, which still exist by the thousands and have been used for millennia for collecting and storing rainwater, are a viable means even today for doing something about the country's water shortage. By encouraging people to restore their abandoned cisterns and/or to build new ones, pressure on the integrated water networks maintained by municipal governments could be relieved. This, in turn, could eventually reduce the pressure to over-pump limited underground resources, thus protecting Jordan's groundwater supplies for the future generations (See letter to Jordan Times August 8, 1992, Appendix A).

At the heart of Project Rainkeep is an exchange of sweat equity for parts and/or skilled labor. Agreements will be drawn up with individual households where, for example, in return for labor in cleaning out an abandoned cistern, or digging a hole for a new one, the project will pay for the cost of the cement and safety cap needed to complete the restoration or building of the cistern. A pump will also be included in most agreements. Compliance with the agreements will be monitored by project personnel in cooperation with the Ministry of Social Development.

The initial beneficiaries will be ten households, or an estimated 100 persons selected from within the Madaba Plains Project Area immediately to the south of Amman. One reason for concentrating on the Madaba Plains Project area is that hundreds of abandoned cisterns have already been identified by Madaba Plains Project archaeologists in this region. Another reason is that this region is experiencing very rapid agricultural intensification and at the same time is within easy reach of Jordan's capital city, Amman. The proximity to Amman also promises to make this a highly visible demonstration project.

A unique aspect of Project Rainkeep is its archaeological component. Since most abandoned cisterns were built by ancients, they represent antiquities which must be properly documented. Consequently, an integral component of Project Rainkeep is a plan to record and study all ancient cisterns slated for restoration in connection with the project.

Project Rainkeep will be implemented by Madaba Plains Project beginning in June and ending in August of 1994. The projected cost of the project is \$11,540 or an estimated \$120 per individual beneficiary. At the conclusion of the project there will be ten households whose experience with installing cisterns will have been studied. Their experience will form the basis for analysis of the pros and cons of implementing Project Rainkeep on a wider scale in Jordan and elsewhere.

B. Project Background

Jordan's water situation has been a major concern of government officials at least since the early-seventies when the Natural Resources Authority commissioned the German consulting firm Agrar-und Hydrotechnik (1977) to prepare a **National Water Master Plan of Jordan**. Since this landmark study was completed, a number of other investigations of the country's water problems have been carried out by various government ministries, United Nations experts and university-based researchers.

In 1992, Drs. Andre Garber and Elias Salameh brought out an important volume entitled **Jordan's Water Resources and Their Future Potential** (1992). This volume is the proceedings of a symposium held in 1991 in which Jordanian and foreign experts reviewed the current state of the problem and alternatives for dealing with it. In the final chapter of this volume, Dr. Salameh writes that "To bridge the gap between supply and demand, two basic solutions are proposed: to increase supply, and to decrease demand by promoting greater efficiency and conservation." (Garber and Salameh 1992: 115).

Over the past twenty-five years Madaba Plains Project archaeologists have been researching strategies used by previous generations of Jordanians for obtaining water. Perhaps the most disturbing finding which has come to light as a result of these investigations is the extent to which modern Jordanians have given up personal responsibility for collecting and storing rainwater in cisterns and reservoirs. Instead, they have come to rely on underground sources of water supplied via pipes and water trucks from pumping stations run by municipal governments and private entrepreneurs.

What led to this abdication of personal responsibility for collecting and storing water was the introduction of deep-drilling for groundwater and the establishment of the integrated water network whereby water is piped from pumping stations to users. Compared with the drudgery of having to haul water from cisterns, turning on a tap connected to the integrated network is obviously much easier.

Consequently, over the past half century, the majority of the population has turned away from the age-old practice of maintaining ones own cisterns and have instead become dependent on tap water. The ease with which water could be obtained via this network also appears to have retarded re-introduction of other water conservation practices which were widely used in antiquity, such as use of terracing, wadi embankments and diversion dams.

While it might be argued that in having come to rely on municipalities for their water supply, Jordanians are not unlike people in Europe and North America who have become similarly dependent on centralized systems. The crucial difference here, however, is that ground and surface water supplies are far more plentiful on these continents than they are in Jordan.

Consequently, unlike the situation on these other two continents, Jordan cannot afford to let its citizens abdicate their responsibility for collecting rainwater wherever they live. Yet, this is precisely what has happened as a consequence of individual households and farms having abandoned their rain-fed cisterns in favor of groundwater obtained via the integrated network.

In putting the emphasis on grass-roots citizen involvement in water collection and storage using cisterns, Project Rainkeep is unique. There exists at the present time no similar program in Jordan or elsewhere in the Middle East.

C. Project Analysis

Through interviews with villagers in the Madaba Plains Project area during the summers of 1987, 1989, 1991, and 1992, Dr. LaBianca along with Dr. Dorothy Irvin, an ethnographer with the Madaba Plains Project and Ms. Hanan Azar and Ms. Nazmieh Rida of the Department of Antiquities of Jordan were able to identify several ways in which Project Rainkeep would impact beneficiaries. The following represent their observations following "water interviews" with about seventy five village households.

First, it was discovered that cisterns have by no means gone completely out of use, and that indeed there are households that still use them. But for every cistern that was found to be in use it was discovered that at least three others had been abandoned. An important impact of Project Rainkeep will be that it will lead to many of these abandoned cisterns being put back into use.

Second, given the erratic supply of municipal water in village areas, it was discovered that access to a functioning cistern is a distinct advantage nutritionally and hygiene wise, particularly in the case of poorer families. For example, in most villages water is constantly being rationed, and in the village of Jalul the researchers were told that municipal water had been unavailable for months. In such instances families who maintain their own cisterns can rely on them for the water they need for cooking, washing, irrigating their kitchen gardens and giving to their animals. This water costs them nothing. In contrast, those families who have no access to cistern water are forced to use some of their limited income to buy water. This both reduces their limited sources of

income further and negatively affects their nutrition and hygiene. Another important impact of Project Rainkeep, therefore, is that it will help whole families experience better diets and better health as a consequence of year-around availability of water.

Third, in contacts with villagers the researchers encountered very positive reactions to the idea of each household being encouraged to return to the age-old practice of maintaining their own cisterns. This should come as no surprise as cisterns have served as the primary source of water for Jordanians for millennia.

Fourth, given the centrality of cistern-use to traditional Jordanian culture, there are no technical or cultural obstacles which need to be overcome for Project Rainkeep to succeed. Through interviews it was learned, for example, that there are in most villages experienced cistern-builders to whom beneficiaries could turn for assistance with restoring an old cistern or building a new one. Another goal of Project Rainkeep, therefore, is that it would provide work opportunities for such skilled laborers.

Fifth, Project Rainkeep will also stimulate other types of grass-roots conservation measures. For example, in order to make water collected in cisterns go as far as possible, hillside farmers will be encouraged to rebuild terraces and embankments so as to take maximum advantage of surface runoff during the rainy season, thus reducing the quantity of cistern water that will be needed during the dry season. Experimentation with various types of solar pumps and with different subsurface microporous tubing solutions for transporting the water from cisterns to crops will also be encouraged. A further goal of Project Rainkeep, therefore, is to increase awareness among villagers of modern methods of conserving both water and energy.

Sixth, because the majority of beneficiaries of this project will come from villages in the vicinity of two major population centers, namely Amman and Madaba, its potential for spreading to larger numbers of people is great. Given the added advantage that this is not a new technology, but an old one with which most Jordanian citizens are well acquainted, there is even more reason to be optimistic about the potential of the project for wide-scale adoption.

Seventh, the project will address the problem of water safety. Cisterns and other catchment-storage systems often contain a variety of organic and chemical contaminants that can be harmful. A heightened interest exists among the researchers to improve the quality of harvested water. One such group is the International Rainwater Catchment Systems Association (IRCSA) whose work is communicated in the Raindrop: Rainwater Harvesting Bulletin. The president of the association is Professor Yu-Si Fok at the University of Hawaii, Department of Civil Engineering, 2540 Dole Street, Honolulu, Hawaii 96822, Phone (808) 956-6561, FAX: (808)956-5044. The IRCSA's research has been focused on the discovery of the most effective measures to control the primary vectors of malaria and dengue fever, mosquitos harboring in open water containers such as cisterns. Thus far, they have evidence indicating that physical and biological controls can be implemented

at the community level thus reducing or eliminating breeding sites for mosquitoes, and either avoiding the need or complementing the use of chemical insecticides. Project Rainkeep will incorporate the controls recommended by the IRCSA's researchers.

As a physical control, all cisterns will be covered at all times with a screen that will keep debris out. In addition, various combinations of biological and chemical controls researched by the IRCSA will be implemented and, if necessary, modified during Phase I of the project in order to insure water safety. Primary focus will be on the combination of the physical and biological controls because of the lower cost, ease of implementation at the community level, and lack of significant side effects.

Finally, considering Jordan's dry climate, the amount of harvested water will be significant. A conservative estimate reveals that on the average 16 l/c/d can be collected in a roof cistern. This represents 160 l/yr for an average family, about 20% of its daily need! By harvesting rainwater, Jordanians will significantly reduce the pressure on their overused resources.

D. Project Design and Implementation

Project Rainkeep will be carried during June and July of 1994 out by Madaba Plains Project (MPP) in cooperation with the Department of Antiquities.

MPP under the direction of Project Director Dr. O.S. LaBianca will be responsible for drawing up "Rainkeep Agreement Proposals." MPP will also assist with monitoring beneficiaries' compliance, evaluating the impact of Project Rainkeep on participating households and communities, and educating the beneficiaries on water safety. MPP will sub-contract with various specialists and cooperating agencies.

In addition, the Madaba Plains Project's role will be to make available the services of several of its core staff members, including Dr. Oystein S. LaBianca and Dr. Dorothy Irvin.

The Department of Antiquities will be solicited for input in reviewing procedures developed for selecting Rainkeep sites and for cleaning, excavating and documenting such sites.

Dr. Dorothy Irvin, Madaba Plains Project ethnographer, will assist with identifying and selecting beneficiaries; developing procedures for use by field staff in drawing up Rainkeep Agreement Proposals; developing procedures for field staff and to use in monitoring compliance with Rainkeep Agreements; and educating the beneficiaries about the water safety measures. She will also assist with developing procedures for field staff and to use in measuring the impact of Rainkeep Agreements on beneficiaries' well-being. Finally, she will be responsible for training a Jordanian field staff assistant.

MPP will contract with Dr. Elias Salameh, irrigation expert at the University of Jordan, to assist Dr. LaBianca with carrying out periodic evaluations of the project.

Agreements between beneficiaries and MPP will be based on proposals drawn up by project field staff as discussed above. The

details to be included in Rainkeep Agreements have been identified by Dr. Irvin (see Appendix B).

Because circumstances will vary from household to household, each agreement will be tailored to fit the situation. In some cases, the beneficiaries will do all their own labor, and MPP will provide only materials. In other cases, MPP may agree to pay for both labor and materials in return for demonstration and promotion activities to be carried out by the beneficiaries among their peers. Appendix C contains an example of such an agreement drawn up by Dr. Dorothy Irvin in the summer of 1992, in conjunction with a "pilot" project involving the headman or sheikh of the village of Jalul.

Once an agreement has been arrived at that is satisfactory to all parties concerned, authorization to implement it, including disbursement of funds, will be sought from the Project Director. Beneficiaries will be able to call MPP at any time during the process of implementation to discuss unanticipated problems.

E. Evaluation

Dr. LaBianca and Dr. Salameh will evaluate the progress of the project in June of 1995. Among the questions which will form the basis for evaluation of the project's success are the following:

First, are the agreements being implemented according to schedule?

Second, to what extent are all partners involved in the implementation of particular agreements in compliance with their part of the agreement?

Third, what effect have the restored cisterns had on beneficiaries' diet and health? This will be determined by means of pre- and post-intervention interviews and questionnaires.

Fourth, to what extent have beneficiaries influenced neighbors and friends to follow their example in turning to cisterns as a means to provide for their water needs?

Fifth, to what extent has the local media reported on the experiences of beneficiaries and on issues brought to light as a consequence of this project?

Sixth, what sort of reception has Project Rainkeep had with government officials and the academic community in Jordan?

Seventh, how successful are the water safety controls in preventing physical injuries of users as well as providing safe water?

Answers to these and related questions will be obtained by the evaluators via interviews with project personnel; focus group interviews with beneficiaries, neighbors and government officials; and questionnaires filled out by beneficiaries.

F. Cost per Beneficiary

The cost per beneficiary of this project is estimated to be about \$120 per person. This estimate assumes that there are an average of ten persons included in each beneficiary household and that a total of 10 agreements are signed at a total cost of \$11,540

Future implementation of the project on a wider scale in Jordan would be far less expensive as MPP's consultant fees and related start-up costs would be eliminated.

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APPENDIX B

An agreement in Arabic with the landowner whose cistern is being repaired should review (then incorporate or omit) the following points:

The owner agrees to:

1. Give an intake interview describing the family's present situation as to work, food, and water supply.
2. Permit photographs of the existing premises, particularly the area around the cistern, garden and orchard, arrangements for watering flocks, and present water system (tanks on roof or on wheels, pump, municipal pipes, other cisterns, etc.)
3. Permit archaeological excavation of the cistern at our option.
4. Clean out the cistern ready for cementing and work on the catchment area as necessary.
5. Cooperate with our repair schedule, such as permitting access to premises and keeping onlookers away from the immediate work area.
6. Collaborate with us in using the cistern as a model by inviting family and neighbors to see it and telling people about its advantages.
7. Collect rainwater in it every winter (with owner being free to buy tankwater if the rainwater is all used up).
8. Maintain the cistern. This will usually include, annually, clearing or cleaning the catchment area, cleaning the inside of the cistern, opening and closing the rainwater inlet, and inspection and maintenance of screen and lid.
9. Keep large lid locked for child safety.
10. Keep small lid unlocked so that poor or landless people in need of water can use it. This is not simple. If it is a domestic cistern under the house or close to it, this should not be requested. It can be requested for a pastoral/agricultural cistern located in outlying fields. Also, if others use it so much that the owner gets very little water from it, the owner will have little incentive to maintain it. In the case of a family wishing to repair a cistern on land which they rent from the owner, we may request that the owner agree to a long-term, rather than an annual, lease agreement with those who took the initiative and did the work.
11. Cooperate with us in follow-up interviews and photographs to determine what benefit the family has derived from the cistern.

We agree to:

1. Ascertain that the cistern to be renovated is upslope from the cesspool or is otherwise unaffected by sewage.
2. Provide containers and transportation to haul away the trash from the cleaning of the cistern.
3. Collaborate in planning the catchment area, whether from the roof or on the surface of the ground. This may require furnishing gutters and pipes from the roof, or some grading of the surface, probably with hand tools by members of the family.
4. Pay for and supervise the renovation of the interior of the cistern, its rim, a screen for debris, an iron double-door safety lid, and in the case of a pastoral cistern, a watering trough.
5. The work is to be done by a contractor of our choice, to our satisfaction.

Further incentives include:

1. Fruit trees, olive trees, and seeds.
2. An electric pump capable of pumping water from the cistern to the roof storage tank, or to another cistern, powered by a solar panel and battery.

The Work Contract

The contractor should furnish us with a written bid, if not for every cistern at least for the first one, (not counting Sheikh Jarmaan's) with another every time the price changes, as well as a written receipt of payment. This is to prevent unexpected cost over-runs and ill will. If the cost of doing the work truly exceeds the estimate for reasons the contractor could not foresee, we may at our option pay more, in fairness.

A partial payment (up to 40%) for materials prior to beginning work is reasonable.

Final payment is to be made after the following have been completed to our satisfaction:

1. The inside surface of the cistern has been covered with waterproof cement to a proper thickness, yet to be determined, and continued up to the top of the rim.
2. A round rim approximately 60-70 cm high shall be built around the mouth of the cistern.
3. The rim shall have an opening of about 20 cm in diameter, at ground level, placed so as to

best admit rainwater, with a screen to filter out twigs, stones and debris. The screen shall be easily removable for cleaning. The rim shall be made of stones (probably local limestone, unhewn or semi-hewn) cemented together, and covered with cement on the inside and top surfaces. (We might later decide that the screen can be replaced by a cap in the summer to keep out debris, soil, and birds.)

4. The cistern lid shall have two hinged doors, a large one which admits a person to inspect and clean the cistern (this door should be made so that it can be locked with a padlock, for safety) and a small unlocked door through which water can be raised by bucket or by hose. The larger hinge and the hasp for locking shall be cemented into the top of the rim.
5. The construction area shall be cleaned up and all cistern debris and work debris hauled away (unless hauling away is done by separate agreement with someone else).
6. If renovation of the catchment arrangements is part of the agreement, this would also have to be satisfactorily completed before payment.

Structural problems and cistern expansion should be handled on an individual basis before work begins.