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E/ESCWA/AGR/1993/9 Add.2
4 November 1993 c.3
ORIGINAL: ENGLISH

UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA

Agriculture Division

REHABILITATION OF THE AGRICULTURAL SECTOR IN THE OCCUPIED PALESTINIAN TERRITORIES

Project Document No.2

Rehabilitation of Springs and Related Irrigation Canals in the Occupied Palestinian Territories

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93-0829

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I. BACKGROUND

The rainfall in the West Bank varies from a minimum of 150 mm to a maximum of 850 mm annually. Nearly all rainfall comes in winter months between December and March. Fortunately, the agricultural area with the least rainfall, the Jordan Valley, has springs with high discharge. In the Gaza Strip, the water table is close to the ground surface, often less than six meters. However, because of the closeness to the sea (and also due to over pumping), much of the ground water in the Gaza Strip is brackish. This water is, however, well used for irrigated agriculture which covers nearly 40% of the cultivated area.

Springs or seeps are common in the OPT (primarily in the West Bank) and represent water that reaches the surface from some underground supply, appearing as small water holes or wet spots on West Bank hillsides or along the banks of the wadis. The flow of water from springs and seeps may come from small openings in porous ground or from joints or fissures in solid rock.

There are two categories of springs in this region: gravity and artesian.

Gravity springs: They can be classified into three principal types.
1- depression springs which are formed when the land surface dips and makes contact with the water table in permeable material. Yield will be good if the water table is high, but the amount of available water may fluctuate seasonally. A gravity depression spring is not a reliable source of water since it may dry up on a seasonal basis depending on previous rainfall and especially during a hot dry summer.
2 - gravity contact springs are formed when downward movement of underground water is restricted by an impervious underground layer and the water is pushed to the surface. This type of spring usually has a very good flow throughout the year and is a good and reliable source of water.
3 - fracture and tubular springs which are formed when water comes from the ground through fractures or joints in rocks. Often the discharge is at one point and protection of the water source is relatively easy. Fracture and tubular springs also

offer a good source of water for the development needs of the community.

Artesian springs: Artesian fissure springs result from water being under pressure and reaching the ground through a rock fissure or joint. Water yield is very good and this source is excellent for community development. Artesian flow springs occur in the West Bank hills and valleys when confined water flows underground and emerges at a lower elevation. This type of spring occurs on hillsides and will also offer an excellent supply of water.

The conditions necessary for spring formation and the discharge of significant amounts of water in the West Bank part of the OPT are numerous and are related to many and various combinations of geologic, hydrologic, hydraulic, climatic and even biologic controls. Therefore, there is no single basis of classification of springs. Among the logical classifications that could apply to the springs in the Occupied Palestinian Territories are shown in the following table:

Classification according to the magnitude of the spring discharge:

Magnitude Number	Discharge
1	> 10 cum/sec
2	1-10 cum/sec
3	0.1-1 cum/sec
4	10-100 liters/sec
5	1-10 liters/sec
6	0.1-1 liters/sec
7	10-100 milliliters/sec
8	< 10 milliliters/sec

Classification according to variability and permanence of discharge:

Perennial (springs that discharge continuously)
- constant — variability not more than 25%
- sub variable — < 25% but less than 100%
- variable — variability 100% or more.

Intermitent (discharge which occurs only at specific times of the year).

A. The Importance of Springs to Irrigated Agriculture in the OPT

It is estimated that nearly 50% of the water consumption in the West Bank originates from springs with about 25% of the West Bank springs being used for drinking water. Spring flow in the West Bank can be an important component of the water resources available for irrigated agriculture if the sources are developed to their full potential. The underlying importance of spring flow in the Occupied Palestinian Territories lies in the fact that most of the springs are not government owned, i.e., they are either community or privately owned, and are not under military control in most cases. Thus, their rehabilitation does not pose a serious problem and development could be rapid if funds are available and with less constraints than any other water resource for the benefit of the agricultural sector and the rural areas. Spring development will positively affect many farmers and hundreds of rural Palestinians will become the beneficiaries.

There are approximately 100 springs that are officially monitored by the West Bank Water Department with regard to flow rates usually on a monthly basis. These springs are the ones with the larger flows. All over the West Bank, however, there are an estimated 527 to 622 to even 724 springs and probably many more smaller springs and seeps that can be "discovered" and then utilized in such a way as to allow for small irrigated plots for the farmers in the area.

The total flow of springs has been estimated to be over 57 million cubic meters (MCM) annually and can be divided by district in the table below:

District	Number of Springs	Average Annual Flow (million cubic meters)	Percent of Total Annual Flow
Jordan Valley-Jericho	200	47.28	82.8%
Jenin	42	1.64	2.9%
Tulkarem / Qalqilia	12	.34	0.4%
Nablus	45	2.43	4.3%
Ramallah / Jerusalem	137	2.97	5.2%
Bethlehem / Hebron	91	2.44	4.3%

Many springs have the highest discharge either during or just after the winter rainy season. In the summer months, a considerable number of them dry up. However, the flow of perennial springs, except the very large ones, declines during the summer and autumn months when water is most needed for irrigation. This is in contrast to the deep wells which give a more or less constant flow of water. In other words, for the purpose of having a reliable water source for agriculture, springs are of secondary importance in comparison to wells, unless adequate water storage is provided .

As mentioned earlier, there are only a limited number of springs with a(size-able) daily discharge throughout the year. Moreover, the amount of discharge between the summer and winter months varies sharply. Although the reliability of the data may be in doubt, the table below which covers 331 springs (i.e., springs with available discharge recordings) is a good indication of the wide difference in daily discharges among springs in the West Bank. The following observations could be made:

(i) Out of the 331 springs, 69% have an average daily discharge of 50 cubic meters or less. This feature is prominent among the springs located in the districts of Jenin, Ramallah and Tulkarem.

(ii) Another 54 springs (16.3% of total) have an average daily discharge of 50-200 cubic meters. Of the 37 springs that have a daily discharge exceeding 300 cubic meters, most are found (11.2%) in the Jordan Valley (5%), but every district of the West Bank has at least one large spring.

(iii) In each district there is a considerable difference between the winter and summer discharges, especially in the districts of Jerusalem, Tulkarem, Nablus and Hebron .

(iv) One or two major springs in each district account for a fairly large share of the total discharge, especially in the summer months. For example, in Tulkarem one spring out of 12 accounted for 38% of the total summer discharge. The same percentage applied to the Bethlehem District with 21 springs.

DISTRIBUTION OF SPRINGS IN THE WEST BANK PART OF THE OPT AND AVERAGE DAILY DISCHARGE

			Average Daily Discharge in Cubic Meters								
District	Villages having Springs	No. of Springs	50 or less	50 to 100	100 to 200	200 to 300	above 300	Per Summer	Spring Winter	Main Summer	Spring Winter
Jenin	16	35	33	-	1	-	1	66.3	112.5	2998	5003 (1)
Tulkarem	6	12	8	1	1	1	1	16.0	99.2	103.7	691.2 (2)
Nablus	31	45	29	8	4	2	2	44.1	251.7	1037	5184 (3)
Ramallah	45	119	101	5	4	2	7	17.0	54.3	691	1469 (4)
Jerusalem	8	11	6	1	1	-	3	32.8	299.6	172.8	2160 (5)
Bethlehem	7	21	11	4	4	1	1	60.6	153.2	518	1037 (6)
Hebron	12	59	38	9	6	3	3	19.1	102.7	86.4	864 (7)
Jordan Valley	-	200+									
Reported		29	1	6	-	4	18				

1) Al-Fara'h Spring
2) Al-Matwah Spring
3) Al-Bathan Spring
4) Wadi Dalab Spring
5) Fara Spring
6) Irtas Spring
7) Al-Majnoon Spring

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ote: The Jordan Valley has over 200 springs of which 29 have reported discharge rates. There are t least another 170 springs with smaller daily discharges that need to be documented and developed.

At present the total land area under irrigation in the West Bank is about 105-110 thousand dunums utilizing about 80-90 million cubic meters of water. Due to the lack of research data, there is no precise figure for the land that could be economically brought under irrigation. Nevertheless, the prevailing view is that the total land area that could possibly be irrigated in the West Bank may be as high as 530,000 dunums which can be divided - not by district - but by topographical area as follows:

ESTIMATE OF IRRIGATABLE LAND BY TOPOGRAPHICAL AREA		
Topographical area	Approximate Number of Irrigatable Donums*	Amount of Water Needed to Irrigate the Land (MCM)
Jordan Valley	100,000	100 MCM
Jenin and Tulkarem	110,000	110 MCM
Hilly Uplands	250,000	108 MCM
Eastern Slopes	70,000	37 MCM
Total	530,000	355 MCM

Note: The number 530,000 donums is stated as a maximum in order to point out the upper availability limit of irrigatable land. 355 MCM of water is stated in order to emphasize Palestinian agricultural water needs and legitimate rights to water resources for domestic and development purposes.

* One Donum - one tenth of a hectare.

The present estimated irrigated area could more than double if some changes take place in agricultural practices by providing financial start-up costs for high value crops that have a low water requirements and which have proved to be successful in the West Bank and Gaza Strip, such as jojoba.

It can be readily seen that the spring flows available in the agricultural districts of the West Bank, e.g. the Jordan Valley, Jenin, and Tulkarem/Qalqilia could, if properly utilized, be a major source of water needed to bring more land under irrigation and to be able to substantially increase agricultural production. It is estimated that 42% of the springs in the West Bank are used for irrigation at some level. Of course, many of these springs need basic structural improvements and system maintenance. Another 36% of West Bank springs are unused.

Many of the current proposals regarding water supply in this semi-arid region center around the premise that "water is scarce and not enough, so we must import water from outside the region". The fact is that there are adequate quantities of water on and under Palestinian land and whatever amount of water there is should be used in the most efficient and productive way. Utilizing spring flow is essentially a first priority step in watershed management. Runoff, although important, is secondary. Therefore, it is essential to take a close look at the available water sources from spring flow that could be utilized for agricultural purposes and to develop these sources into technologically-sound and easily maintainable and manageable irrigation systems.

B. Length of Canals for Each Spring and Type (Earth Canals, Cement Canals, Cement Pipes, etc.)

The conveyance systems for irrigation in the West Bank currently consist of dirt canals and or cement canals that are in poor condition. Existing canals need maintainance in order to repair cracks and seepage from the base, and dirt canals need to be replaced with cement canals in order to prevent infiltration. Existing irrigation systems dependent on springs need renovation in addition to the fact that many springs have no water source protection and water conveyance system which need to be put in place.

II. PROJECT JUSTIFICATION

Because of the restrictions on water use enforced by the civil administration authorities in the Occupied Palestinian Territories, it is essential that the best use be made of whatever water supplies are available to the Palestinians, especially for the farmers. Utilizing the existing and potential spring-flow in a more thorough and efficient manner would benefit the national economy and would allow individual farmers to have a more productive and diversified agriculture while at the same time providing stability to family income and food security.

The specific actions to be applied to improve spring utilization for the agricultural sector are:

- first, most important is the maintainance of existing spring structures
- development of spring sites in order to either maintain, increase and or preserve the spring flow for economic purposes.

- development of more efficient water storage and water conveyance systems
- development and dissemination of information on more efficient irrigation methods and maintenance of existing and or newly constructed infrastructure.
- development of know-how in planting profitable crops that utilize a minimum amount of water, such as jojoba.

The springs of the Occupied Palestinian Territories need to be classified according to magnitude of discharge in addition to reliability or variability in flow. In parallel, each spring should be judged on its economic potential based on available cultivable and irrigatable land within a feasible reach of the spring source or conveyance system.

Once prototype springs have been identified, the planning of the project must be done at the community level. If the spring is the property of the community, a committee must be established to oversee not only the functioning of the spring, but also to be responsible for its maintainance and for water sharing, storage and distribution. Any license needed for the development of the spring must be obtained by the village committee.

Once a common technologically sound plan is prepared, the village committee should appoint a technical group to make cost estimates for its improvement. If the work can be done by the villagers themselves, it should be-allowed to do so. More sophisticated structures will need a contracting company that will submit to the village committee a tender with costs and time tables for work completion.

Depending on funding and proper technical supervision, spring rehabilitation in the West Bank within the Occupied Palestinian Territories could take many years. However, some springs are badly in need of repair and maintainance and these should rank high in the priority list, especially if their contribution to rural development and irrigated agriculture is considered essential and crucial. Budget requests and project targets can be initially based on the implementation of, for example, 5 earth ponds, 5 cement reservoirs, 10 kilometers of irrigation canals, 40 kilometers of piping, etc., each year.

III. <u>OBJECTIVES OF THE PROJECT</u>

Development Objective

The development objectives of the project are to increase Palestinian agricultural production and improve rural life through a more efficient use of spring water for irrigation, increase farm family income and contribute to the social stability of the rural community surrounding the spring.

The immediate objective of the project is to initiate a spring rehabilitation program for Palestinians in the West Bank involving a series of improvements aimed at stabilizing and or increasing the flow of water for the benefit of the community and thereby paving the way for a larger program of spring rehabilitation in the future.

IV. **TARGET BENEFICIARIES**

The target beneficiaries of the project are the communities sharing the water of the spring and farmers and sharecroppers who can benefit from the spring by expanding the area under irrigation or by introducing more intensive agriculture. Workers will also benefit as the increase in the flow of spring water will enhance employment opportunities in agriculture. Since there are several hundred springs of which at least 25% need rehabilitation and development, several thousand Palestinian farmers and their dependents will be the immediate beneficiaries.

V. **PROJECT BENEFITS**

The major contributions of the spring rehabilitation project to agricultural development for Palestinians in the West Bank would include:

General

Aids for the up-grading of spring water sources in the West Bank will contribute to overall social stability and satisfy the community's rights in using itsindigenous water resource. Agricultural development will help achieve a better redistribution of income in the specific locality and at the same time maximize farm-family net income. Through the adoption of improved technologies, the output of Palestinian agricultural products will be maximized in order to achieve national self-sufficiency. In addition to maximizing the value of agricultural output, spring rehabilitation will also help maximize the return per unit of water, irrigated area and capital invested.

Specific

Spring rehabilitation will specifically contribute to an increase in the number of agricultural workers employed. This in turn will cause an increase in the cultivation of seas only-early produced vegetables and increase the highly valuable ban Anna production in the Jordan Valley, an increase in the number of greenhouses and the quantity of export-oriented crops.

Overall, the project's direct output will first of all increase agricultural land use area which should influence the establishment of well-planned cropping patterns and intensities by prompting the incentive to make cost-effective irrigation in areas where the soil and microclimate are suitable. In addition, spring development will aid in planning better and more efficient cropping and agricultural marketing calendars. The overall project should promote efficiency in water use in the conveyance systems and in field application. Investments in the initially costly but efficient drip irrigation systems will be done by farmers when a well-developed spring water supply through properly constructed cement canals or pipes are secured. No farmer nor community will risk investment in an expensive drip irrigation system unless the water supply is secure.

The 25 springs to be rehabilitated will be ~concentrated in the known agricultural areas of the West Bank. With a view to enhancing the impact of the project, it is proposed that the 25 springs be selected from the category with an average daily discharge of 100-200 cubic meters. This means that the concentration of the effort will be in the districts of Hebron, Bethlehem, Nablus, Ramallah and the Jordan Valley. However, at least two or three springs should also be selected in the districts of Jenin, Tulkarem, and Jerusalem. Also, at least one spring should be selected from the higher discharge categories of 200-300 cubic meters and over 300 cubic meters per day. This approach will serve as a prototype in order to ascertain the overall economic benefits of small versus large spring development projects. See annex for details of suggested spring rehabilitation analysis.

With regard to the overall benefits from the proposed rehabilitation of springs in the West Bank, the following can be assumed:

(i) If the average flow of the spring to be selected is 300,000 cubic meters per annum and with rehabilitation the flow to the field could be increased by 30%, there is then a net gain of 90,000 cubic meters of water per annum per spring.

(ii) Assuming that the average consumption of a dunum allocated to the production of vegetables and fruit trees is 600 cubic meters per dunum under modern irrigation (6000 cubic meters per hectare) the 90,000 cubic meters additional water will irrigate another 150 dunums, divided equally between vegetables and fruits trees.

(iii) If the net income derived from a dunum of vegetables is US $500 and of fruit trees is US $400, then the net annual income obtained from just 150 dunums will be: -

vegetables = 75 x $500 = $ 37,500
fruit trees = 75 x $400 = $ 30,600

(iv) If the average total cost of rehabilitating a spring is about $160,000, then the recovery period of the capital invested will be roughly 2.5- 3 years. (One must also consider that an irrigated land will utilize at least 10 times more laborers than the unirrigated rain fed lands.) However, if the cropping pattern were to include field crops (cereals which give relatively low net income per dunum), the recovery period may be stretched to 4-5 years. On the other hand, the introduction of exotic crops (e.g. flowers) will have the opposite effect.

Special Agro-industrial crops with very low water requirements, such as jojoba, have proved in the Jordan Valley to be as good or better in net return than crops or trees that are high water utilizers, such as citrus.

The project will also generate some indirect outputs, i.e.:

- dissemination of information regarding benefits of day versus night irrigation
- efficient use of irrigation systems for appropriate crops
- development of farmer decision-making processes related to crop selection and production
- community development and cooperation by implementing methods of trading irrigation turns
- settling of disputes - formally and informally.

VI. PROJECT ACTIVITIES

In order to develop, maintain and or rehabilitate the natural flowing springs in the West Bank portion of the Occupied Palestinian Territories, a few basic structures need to be built. These include spring boxes, holding and distribution reservoirs, and irrigation canals and pipes. The kind of structure to be built will depend on the degree of rehabilitation required. The cost of rehabilitating each spring will depend on its size and the amount of irrigatable land in the surrounding area. Different structures will require different types of materials and tools. In general, the following materials, tools and equipment will be needed for the implementation of these structures:

<u>Materials</u>
Portland cement
Clean sand and gravel
Reinforcing rods
Galvanized steel or plastic pipes
Screening for pipes
Boards and plywood for building forms
Old motor oil for oiling forms
Bailing wire, Nails

<u>Tools</u>
Shovels and picks for digging, Measuring tape or rods
Hammer, Saw, Buckets
Carpenters square, Mixing bin for mixing concrete
Crowbar, Pliers, Pipe wrench, Adjustable wrench
Screwdriver, Trowels, Wheelbarrow

<u>Equipment</u>
Tractor, bulldozer, jeep - all of which may be rented.

The following activities would be undertaken with the assistance of the project

1. Construction of spring boxes There are several possible designs for spring boxes, but generally their basic features are similar. Spring boxes serve as collectors for spring water. They are used either as storage tanks or distribution tanks. The two basic types are a box with one pervious side for collection of water from a hillside spring, and a box with a pervious bottom for collection of spring water flowing from a single opening on level ground. To determine which design to use, it is necessary to dig out around the spring outflow area until an impervious layer is reached, locate the source of the spring flow, and design to fit the situation.

2. Construction of holding and distribution reservoirs: These could be either earth ponds or circular concrete ground reservoirs complete with piping, inlet and outlet, but not including motor.

3. Installation of irrigation canals: This activity will include the construction of concrete irrigation canals, but not including gates, concrete diversion wirers, covers and distribution pipes.

4. Installation of irrigation pipes: This includes the laying out of galvanized pipes and PVC (Poly-vinyl carbonate) pressure pipes and the excavation for the pipes.

It should be noted that there are some very large springs with a considerable annual flow of water (*). These springs call for medium to large irrigation schemes and not just rehabilitation per se.

The irrigation schemes connected with these large springs are special cases and call for a different approach. The development of such irrigation schemes is not the primary objective of this project which is confined mainly to the rehabilitation of smaller springs. Such large-scale spring-fed irrigation projects could be phased over several years and each phase implemented in a sequential order, e.g. construction of cement or piped water conveyance systems followed by installing irrigation systems at the field level. However, as mentioned previously, at least two springs in the higher discharge categories will be rehabilitated in order to provide a prototype for comparison of economic benefits per dollar, per donum, per crop, etc.

Jordan Valley: Auja (30 MCM), Faysayal (39 MCM), Ein El-Beida (74-162 MCM), Nueima (31 MCM), Duyuk (31 MCM), Ein Sultan (31 MCM), Kilt (27 MCM)
Bethlehem: Artas (30 MCM)
Nablus: Fara'a (51 MCM)
Hebron: Si'ir (37 MCM)

VII. PROJECT COSTS

The estimated cost of each component of the project is as follows:

1. Spring Boxes

For a small spring the size of a 10 cubic meter box would amount to US $10,000. Multiple spring sources would require a larger structure and a higher cost, perhaps as much as US $25,000-30,000. Over the five years, it is expected to rehabilitate 25 springs at the rate of 5 springs per year. Three of these will be small springs and 2 springs with multiple sources.

The total cost will amount to:

Small springs (15)	= US $ 150,000
Springs of multiple source (10)	= US $ 300,000
TOTAL	= US $ 450,000

2. Holding and Distribution Reservoirs

2a. Earth ponds: It is envisaged to construct earth ponds with plastic lining for 15 springs over the next five years. Five ponds will be constructed in rock and 10 in soil. The unit costs are shown below:

TASK	UNITS	COST PER UNIT	TOTAL TASK COST
Excavation - in rock - in soil	 1000 cum 1000 cum	 $6 per cum $4 per cum	 US $ 6,000 US $ 4,000
Plastic Lining 1.5 mm thickness Backfill,20 cm	500 sqm 100 cum	$4 per sqm $6 per cum	US $ 2,000 US $ 2,000
Inlet, outlet and concrete manholes	2	-	US $ 2,000

Total for 1000 CUM earth pond in rock = US $10,600
Total for 1000 CUM earth pond in soil = US $8,600

The total cost will amount to :

Earth ponds in rock (5) = US $ 53,000
Earth ponds in soil (10) = US $ 86,000
TOTAL US $139,000

2b. Circular Concrete Ground Reservoirs complete-with piping, inlet and outlet:

The project will construct 10 such reservoirs in 5 years. The average volume of the reservoir will be 500 cubic meters. The estimated unit cost will be:

250 cubic meter = US $ 52,000
500 cubic meter = US $ 80,000
1000 cubic meter = US $180,000

The total cost of the 10 reservoirs will amount to US $ 800,000.

3. Irrigation Canals : The project is expected to construct 10 kilometers of concrete canals in 5 years. The canals will be 20 cm in thickness of walls and floor, 80 cm wide, and 50 cm deep. The standard cost per meter length is shown below:

Excavation in soil - trenching One meter standard size canal equals 0.84 cum of excavation	US $ 8 per cubic meter $ 6.72
Volume of concrete One meter of canal equals 0.44 cum of concrete	US $200 per cubic meter $88 reinforced concrete

Therefore, one meter length of a cement irrigation canal 80 cm wide and 50 cm deep with 20 cm thickness of walls and floor will cost US $ 94.72.

The total cost of 10 kilometers of irrigation canals will be US $ 947,200.

4. Piping for Irrigation: It is envisaged that the project will establish a 40 kilometer piping system for irrigation using the water from the rehabilitated springs. The average unit cost per meter will be of the following order.

Galvanized pipe:	6 inch	US $ 24.80 per meter
PVC (Polk-vinyl carbonate)	6 inch	US $ 14 per meter
Pressure Pipe:		
Excavation for pipes: (100-120 cm deep, 60 cm wide)		US $ 6 per meter
Backfill (labor)		US $ 2 per meter
Installation	6 inch	US $ 2.80 per meter

ALSO NEEDED WILL BE:

Riser (1.2 meters in length)	US $ 40
Gate valves	US $ 320-$400
Elbows	US $ 40 each
Water Meter, example 6 inch	US $ 800

The total cost of 40 kilometers of piping for irrigation will amount to:

(i) Galvanized pipes (6 inches) for 20000 meters
= US $ 496,000

(ii) PVC presure pipes (6 inches) for 20000 meters
= US $ 280,000

(iii) Excavation cost (40000 meters)
= US $ 240,000

(iv) Backfill (40000 meters)
= US $ 80,000

(v) Pipe installation (40000 meters)
= US $ 112,000

(vi) Other costs
(risers, gate valves, elbows, water meters)
TOTAL = 1,308,000

In summary, the total cost of the project over the five year period will amount to US $ 3,944,200 with the following breakdown:

(i)	Spring boxes	US $ 450,000
(ii)	Holding and distribution reservoirs	US $ 939,000
(iii)	Irrigation canals	US $ 947,200
(iv)	Piping for irrigation	US $1,308,000
(v)	Support to local organizations responsible for project overseeing management and implementation.	US $ 300,000

It is assumed that 50% of the total cost of the project will be absorbed by the farmers and the remaining 50% wilt be met by external donors on a grant basis. Thus, the external assistance component of the project will be US $1,972,100.

The community of farmers will also meet the operation and maintainance of the springs after rehabilitation and will share the expense of the staff of the non-governmental organization which will oversee the implementation of the project.

VIII. PROJECT IMPLEMENTATION

A. Institutional set-up

It is recommended that the spring rehabilitation project for the West Bank portion of the Occupied Palestinian Territories be a community-based project. The local farmers should be directly involved in the project in order to assure that they realize the benefit of the project both economically and socially.

A non-governmental organization could be given the responsibility to oversee the specific project identification and implementation. The local organization should be responsible for the technical appropriateness of the structures to be installed or erected. The non-governmental organization to be made responsible for the planning and implementation of the work envisaged must have experience and expertise in hydrology and construction engineering. There are a few non-governmental organizations whose experts have previous experience in implementing water projects which can undertake the responsibility for implementation of this task, e.g., ASIR Arab Scientific Institute for Research and Transfer of Technology (the oldest technical NGO in the OPT); the Palestinian Hydrology Group (which was established and is still administered by a trainee of ASIR); and CEP - the Center for Engineering and Planning. ASIR can work with either of the two mentioned organizations and the choice should be made once the project funding is secured.

B. Organization and Management

Each year, and with the full consent of the village committee, the project will select five springs in different parts of the West Bank for rehabilitation. Each spring would be treated as a sub-project and would be surveyed to assess the nature and extent of the rehabilitation work required. A brief report will be submitted to the village committee on the cost of rehabilitation and the share of the cost that will be borne by the village community. Once the village committee gives its consent, action will be taken to obtain the permit for undertaking the rehabilitation work. Such a permit from the authorities will be the responsibility of the village committee assisted by the project. After obtaining the permit, the village committee will make the first cash deposit as a symbol of the community's will to begin the rehabilitation work.

All procurement of supplies and equipment will be the responsibility of the non-governmental institution that will be responsible for overseeing the rehabilitation work. The non-governmental organization will establish a Special Unit for this purpose headed by a Manager with 2 or 3 technical staff. The Unit will have no other task except the rehabilitation of the springs. The village committee will select a smaller committee to assist the Manager of the Special Unit, particularly in the provision of the labor necessary for construction, etc. The monitoring of progress will be the responsibility of the village committee. On the completion of the work envisaged, the entire responsibility for maintenance will be shouldered by the community itself. The Special Unit will have no responsibility for any extension help required by the farmers once the rehabilitation work is completed. All assistance for extension will be secured through other means. Environmental impact statements and follow-up reports on the implementation side of the completed project will be the responsibility of the NGO overseeing the project.

IX. SUMMARY OF PROJECT PROFILE

The Occupied Palestinian Territories relies heavily on water from wells and springs both for domestic consumption and irrigation. Springs are mainly located in the West Bank. Their approximate number is 503-622 springs concentrated mainly in the Jordan Valley and the Ramallah Jerusalem area. The average annual flow of the springs is estimated at 57 million cubic meters.

Because of spring neglect during the past 26 years of occupation, many of these springs are not functioning at full capacity and are in need of rehabilitation. This project is intended to assist in the rehabilitation of such springs.

The project aims at rehabilitating 25 springs over the next 5 years, at a rate of 5 springs annually. Each spring will be selected after a survey of its conditions and a brief feasibility report for the selected spring will be prepared.

The cost of the five-year project is estimated at US $ 3,944,200. Half of the cost will be born by the communities in which the springs are located and the remaining half by the project on a grant basis. The nature of the rehabilitation work involved will include: construction of spring boxes and holding and distribution reservoirs; installation of irrigation canals and irrigation pipes.

The project will be implemented by a competent non-governmental institution with experience and expertise in hydrology and construction engineering and a previous record in study or implementation of water projects in the West Bank, such as ASIR in cooperation with the new engineering groups PHG or CEP. This institution will be designated after external assistance is secured. The non-governmental institution will create a Special Unit for the rehabilitation of springs with a full-time manager and the necessary staff. The rehabilitation of each spring would be treated as a sub-project. The village committee will have the authority to decide on behalf of the community, secure the cash contribution of the community and the labor to be supplied. It will create a Special Committee to assist the Manager of the Special Unit during execution. Environmental impact and follow-up reports will be required of the NGO designated to oversee the overall implementation of the springs development project.

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ANNEX

Once funding is secured, a survey should be made to classify the permanent springs into three size categories. At least one spring from each category should be studied and reported on as follows:

A. Selection of three springs
Small: 100-200 cubic meters discharge per day (Hebron)
Medium: 200-300 cubic meters discharge per day (Nablus)
Relatively large: above 300 cubic meters discharge per day (Jordan Valley)

B. The present status of each spring should be shown, i.e., location, population served, discharge in summer and winter, conveyance system and use made of spring water.

C. A description should be made of the nature of the rehabilitation work for each spring.

D. A calculation should be included for the rehabilitation cost in US Dollars for each spring.

E. For each spring category, relevant information should be presented in a form in order to document indicators "Before Rehabilitation" and "Expectations After Rehabilitation. Suggested line items in the proposed table for at least one spring in each daily discharge category are listed below:

Discharge (cubic meters) - Daily winter - Daily summer - Annual.

Amount of summer daily discharge used for irrigation (cubic meters).

Dunums irrigated by springs by crop, e.g., Crop 1, Crop 2, Crop 3.

Total output by crop (tons)

Cost of production by items (USD), e.g., water, fertilizers, seeds, pesticides.

Gross output (USD) - Per crop - Per Dunom - For spring as a whole.

Net output (USD) - Per crop - Per Dunom - For spring as a whole.

F. A brief cost-benefit analysis of the investment in the spring could be made by using two indicators:

a) Cost-benefit ratio = cost of total investment discounted net benefits at full development.
Calculation: Take the net benefits at the full year of development and discount them at a stated rate, for example, 10%.

b) Repayment period
Calculation: Take the discounted net benefits of each year until the year when the total cost of the investment in the spring is fully covered.