#4

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
MASTER PLAN REPORT

ECONOMICS OF IRRIGATION

TABLE OF EQUIVALENTS

LENGTH

1 - Millimeter (mm)	0.039	Inches
1 - Centimeter (cm)	0.394	Inches
1 - Meter (M)	39.37	Inches
1 - Meter	3.281	Feet
1 - Kilometer (Km)	0.621	Miles

AREA

1 - Square meter (M^2)	1.196	Square yards
1 - Donum	1,000.	Square meters
1 - Donum	0.247	Acres
1 - Square kilometer (Km^2)	0.386	Square miles

VOLUME

1 - Cubic meter (M^3)	35.31	Cubic feet
1 - Cubic meter	1.308	Cubic yards
1 - Million cubic meters (MCM)	810.7	Acre feet

WEIGHT

1 - Kilogram (Kg)	2.205	Pounds
1 - Metric ton (MT)	1,000.	Kilograms
1 - Metric ton	2,205.	Pounds
1 - Metric ton	1.102	Tons (short)

FLOW

1 - Liter/second	15.85	U.S. gallons/minute
1 - Cubic meter/second (M^3/Sec.)	35.31	Cubic feet/second
1 - Cubic meter/second	86,400.	Cubic meters/day
1 - Cubic meter/second	2,592,000.	Cubic meters/month (30 days)
1 - Cubic meter/second	31,536,000.	Cubic meters/year (365 days)
1 - Cubic meter/second	70.0	Acre feet/day
1 - Cubic meter/second	15,850.	U.S. gallons/minute
1 - Cubic meter/hour (M^3/Hr.)	4.4	U.S. gallons/minute

ENERGY

1 - Kilowatt (kw)	1.341	Horse power (HP)
1 - Kilowatt-hour (kwh)	1.341	Horse power hours
1 - Kilowatt-hour	367,100.	Kilogram meters

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MASTER PLAN REPORT

SUMMARY OF IRRIGATION FACILITIES

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
MASTER PLAN REPORT

SUMMARY OF IRRIGATION FACILITIES

This volume contains the analysis of the economic aspects of irrigation. The economics of security storage and power are separately presented in Volume VI.

Comprehensive development of the Yarmouk-Jordan Valley, with optimum conservation and efficient utilization of the water resources, has been the primary objective in the formulation of the Master Plan. Within the project area, 519,800 donums of land have been classified as either arable or potentially arable. After allowing a reduction of 3 percent for areas required for roadways, canals, buildings and other non-agricultural uses, the net irrigable area in the project becomes 504,200 donums. It is anticipated that most of the farm operators will live in villages located on non-arable land, rather than on the farms. In addition there are 9,500 donums of land under irrigation in the Wadi Fari'a outside the area classified. The Master Plan has, therefore, been developed on the premise of providing a full water supply for the irrigation of 513,700 donums of land.

The primary sources from which this water will be supplied are the Yarmouk River, the Jordan River, and wadis and springs within the project area. Minor consideration has been given to the development of ground water, since few wells used for irrigation within the project area have been in useful intensive production long enough to definitely establish the recharge rate, and in many of the wells the quality of the water is suitable only for the production of highly salt tolerant crops. It

is anticipated, however, that ground water may be used for domestic supply on some of the farms or communities within or adjacent to the project area. No consideration has been made in design for the use of return flows, since it is impossible to make a reliable estimate of the quantity, quality or distribution of such flows that might develop. If significant quantities of ground water or wastewater develop in the future, it will be possible in some instances to utilize them within the project area, and through exchange of water use to irrigate additional lands in other areas.

Optimum development of the water resources will include partial regulation of the flows of the Yarmouk River in a storage reservoir. Storage reservoirs on other tributaries of the Jordan are not justified for irrigation, since little additional water would be yielded because of small and erratic flood run-off, and since in general the reservoir volumes would be entirely disproportionate to the high, costly dams required at the available sites. The storage dam on the Yarmouk River will impound 47,000,000 cubic meters of water for irrigation use. Releases will be made through river outlets, or through the power generating facilities.

A diversion structure, known as the Adasiye Diversion Dam, is proposed at the mouth of the Yarmouk Gorge, upstream from the village of Adasiye. From the right abutment of this dam, water will be diverted through a flood channel to the north into Lake Tiberias, where additional storage will be available. Additions and improvements to the existing regulating and control works at the Jordan River Outlet from Lake Tiberias will be required to divert water at water surface elevation -212 meters into a feeder canal 10.8 kilometers long, with maximum capacity of 20

cubic meters per second. This feeder canal, which will be concrete lined, will deliver water into the Main Canal at the point referred to as "J-X", at an approximate water surface elevation of -214 meters.

The Main Canal will originate at the left abutment of the Adasiye Diversion Dam with an initial water surface elevation of -205 meters. This canal will have an overall length of 159.3 kilometers, of which the first 1,335 meters will be in concrete bench flume. The remainder, except for major wadi crossings, will be trapezoidal in shape, and concrete lined throughout. Major wadi crossings, including the crossing of the River Zarqa, will be elevated rectangular concrete flumes supported on rock masonry arches. At Station 62+730 a branch of the Main Canal will lead to the West Ghor through the Jordan River Siphon, which will be a combination of reinforced concrete pipe in the sloping reaches at either end of the siphon, and welded steel pipe in the comparatively level reach across the zor and the Jordan River. The westerly end of this siphon will discharge into a concrete division box about 8 kilometers north of Wadi Fari'a at approximate water surface elevation -265. From this division box laterals will be extended to the north and to the south, to provide service to irrigable lands lying immediately below the toe of the escarpment. The main branch of the West Ghor Canal will drop almost immediately to water surface elevation -275, and will continue in a southerly direction for approximately 46.1 kilometers. The East Ghor branch of the Main Canal will drop from approximate water surface elevation -227 to water surface elevation -240 immediately before crossing the River Zarqa, and from there it will continue in a southerly direction for approximately 47.3 kilometers. Nine pumping plants, diverting water from the gravity canal system, and the extension of the present

lateral system on eight wadis, will be required to provide service to irrigable lands lying above the Main Canal. This will permit maximum development of all irrigable lands to the toe of the escarpment, and fullest possible utilization of the unregulated flow of the wadis.

The distribution system, which will be lined with precast concrete slabs throughout, will furnish water through a network of laterals and sub-laterals to each farm unit at the high point of the unit. These farm units will range in size from approximately 13 donums (less than 4 acres) to approximately 35 donums, depending upon the classes of land represented, topography and other pertinent factors.

A drainage system will be provided to maintain a root zone a minimum of 1.4 meters in depth free of excess waters within all irrigable lands throughout the project, permitting the growth of almost any of the plants adaptable to the area. Surface drainage will be carried in open channels, and insofar as practicable will be discharged into the canal or distribution system. Subsurface drainage will be in closed rock type drains, to permit fullest land utilization and facilitate weed control.

Farm unit development will provide the work necessary to condition the surface of the lands within the farm units for irrigation, in order to permit optimum correlation of the land and water resources and to promote long-time, successful utilization of soil and water by maintaining soil fertility. Technical assistance will also be provided to cooperate in attaining efficient use of available resources. Permanent buildings, tools and equipment, and a communications system required for proper operation and maintenance of the project are also included in the Master Plan.

Cost estimates for the irrigation features of the project, based on unit prices as of October, 1954, are summarized by major components in the following tabulation:

Yarmouk Dam and Reservoir	$ 11,350,000 1/
Adasiye Diversion Dam	1,155,000
Pumping Plants	3,740,000
Canals	23,495,900
Laterals 2/	30,117,900 2/
Drains	9,131,900
Farm Unit Development	14,907,000
General Property	1,818,000
Tiberias Features	12,003,900
Regulating and Control Works	(2,000,000)
Canals	(10,003,900)
Railroad Relocation	1,000,000
Total	$108,719,600

1/ The cost for the Yarmouk Dam and Reservoir is the estimated cost of the Khalid Dam which provides for 47 MCM of storage at spillway elevation -40. Equivalent storage at a lower cost could be provided as a component of a multiple use storage reservoir if the costs were allocated among the several uses. Therefore the cost of $11,350,000 used in this analysis is considered the maximum estimated allocation to irrigation.

2/ Complete distribution system.

VOLUME VIII

YARMOUK-JORDAN VALLEY PROJECT
MASTER PLAN REPORT

PART 1. Present Economy
General Economy
Agricultural Economy

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
MASTER PLAN REPORT

PART 1. PRESENT ECONOMY

General Economy

Jordan is experiencing very serious economic stresses characteristic of an over-populated and under-developed nation, which have been accentuated since 1948 by the acceptance of several hundred thousand refugees from Palestine. The Jordan economy, based primarily on agriculture, is unable to support the population because of relatively undeveloped agricultural resources. As a result, the country is obliged to place an increasing dependence upon foreign assistance for economic sustenance.

Foreign Trade

Jordan's balance of trade, one of the key indicators of economic health, has developed an increasing deficit every year since annexation of West Jordan and acceptance of refugees from Palestine. Table 8.1-1, Foreign Trade of Jordan, summarizes the foreign trade situation during recent years.

Table 8.1-1

Foreign Trade of Jordan
1950-1953[1]

Year	Value of Imports (thousands of dollars)	Value of Exports[2]	Balance of Trade
1950	30,260	13,322	-16,938
1951	35,787	4,071	-31,716
1952	39,808	4,298	-35,510
1953	51,506	5,874	-45,632

1/ Department of Statistics, Ministry of Economy, Jordan.
2/ Includes value of items re-exported.

Common items of food and clothing comprise over one-third of the deficit in trade, as shown in Table 8.1-2, Foreign Trade in Staple Commodities.

Table 8.1-2

Foreign Trade in Staple Commodities[1/]

Item	1950	1951	1952	1953
		(thousands of dollars)		
Sugar	-2,632	- 2,783	- 2,646	- 2,598
Rice	-1,434	- 977	- 1,870	- 1,907
Wheat and Flour	+ 574	- 5,485	- 3,735	- 6,720
Oils and Fats	+ 302	- 1,044	- 711	+ 314
Dates	- 185	- 1,126	- 862	- 526
Cotton Goods	-2,957	- 1,884	- 3,676	- 3,433
Hair and Wool	+ 619	+ 1,355	+ 179	+ 148
Livestock	- 571	- 442	- 652	- 1,495
Fresh Fruits and Vegetables	+ 143	+ 95	+ 291	+ 137
TOTAL	-6,141	-12,291	-13,682	-16,080
Percent of Total Deficit	36	39	39	35

1/ Department of Statistics, Ministry of Economy, Jordan.
Note: Net Imports are designated (-), Exports (+).

Syria has been Jordan's best customer during recent years while the United Kingdom is the main source of imports. These relationships are shown in Table 8.1-3, Principal Countries of Trade.

Table 8.1-3

Principal Countries of Trade

	1950	1951	1952
	(thousands of dollars)		
Exports			
Syria	4,192	3,755	1,588
Saudi Arabia	75	42	288
Iraq	28	78	143
Egypt	92	95	1
Imports			
United Kingdom	7,854	6,342	8,492
Syria	3,713	5,351	5,407
Iraq	1,190	4,970	2,066
Italy	2,632	2,232	3,497

Relief and Other Foreign Aid

Foreign aid and contributions of various kinds help to offset the persistent deficit in balance of trade. The military is subsidized mainly by the United Kingdom. A Five-Year Plan which proposes many economic developments is financed largely by foreign loans, grants-in aid, and technical assistance programs of the United Kingdom, United Nations and United States of America.

Foreign loans and grants comprised about two-thirds of the receipts which were budgeted by the government during fiscal years 1952-53 and 1953-54 for ordinary functions and economic development. The United Nations Relief and Works Agency for Palestine Refugees spends about $12 million per year for the direct relief of refugees in Jordan and supports a number of activities aimed at economic development of the nation(1). A number of trust organizations and development societies are also contributing relief and technical assistance.

Population

Population figures for the Kingdom of Jordan are scanty and generally serve only as approximations. Prior to World War I, when the eastern part of Jordan (Transjordan) was under the rule of Turkey, the authorities made several attempts to enumerate the population liable for military service or subject to taxation. The people of Transjordan were aware of these purposes and, by united opposition, were able to prevent complete surveys. The uneasiness of Jordanians toward population surveys persisted in some degree even during the British Mandate. When rationing was introduced in August, 1943, as a World War II measure it was thought that a considerable number refrained from registration for fear of conscription or new taxes. The first complete census of population was

taken in 1952 as part of the economic development program.

Biblical accounts and the findings of archaeologists and others indicate that Jordan Valley had a flourishing agriculture which supported a large population during Roman rule. In 1945, Nelson Glueck estimated, on the basis of hundreds of ancient sites discovered, that the population in Transjordan during the Roman and equally populous Byzantine periods amounted to about a million and a quarter, compared to the present urban to nomadic 350,000. Under the Romans, hillsides were terraced, forests preserved, and available water resources conserved and developed for irrigation. If this population estimate is reliable, a large decline evidently occurred sometime during the centuries which bridge ancient and modern times. This is borne out by the 1915 estimate of 131,800 made by the Turks when they were vitally concerned with conscription and taxation for World War I. Contributing causes for this decline are found in the reported ravages of wars among the population and decadence of the conservation and irrigation developments which were established under Roman rulers.

The first estimate following delivery from Turkish rule placed the population at 200,000. This was revised in 1938 to 300,200 following a population survey made by district administrative authorities of the Transjordan Government. World War II imposed rationing on the people and through this count, a figure of 340,000 was established, after some adjustments supported by vital statistics.

Population changes of immediate concern to this report are high-lighted by rapid increases which accompanied hostilities between Arab and Israeli troops in 1948. Before this conflict, it is generally estimated that Jordan had a population of 400,000 of which only 70,000

were living in urban centers such as Amman, Irbid, Salt, and Karak. The war of 1948 sent 450,000 Palestinian Arabs streaming into Jordan and by the end of 1949 there were 502,000 of these refugees in the Kingdom. In April, 1950 "Arab Palestine", as West Jordan was called, was annexed, adding 450,000 persons to the population of the nation. The first census of population, taken in 1952, lists a total of 1,329,174 persons. Changes which have occurred in the estimated population over the past decades are summarized as follows:

Year	Number of Persons
1915	131,800
1924	200,000
1938	300,200
1943	340,000
1945	350,000
1948	400,000
1952	1,329,174 (census)

With a pre-war area of 90,000 square kilometers, the average density of population was about 4.5 persons per square kilometer. When compared with the cultivated area, however, the average density was 100 persons per square kilometer of cultivated area. Events of recent years intensified population pressures. Agricultural resources have not kept pace with population growth. Thus, with a 1952 population over three times that of pre-war, the average density was about 14 persons per square kilometer, including the area west of the Jordan River which was annexed in 1950, and the average density of the cultivated area was 190 persons per square kilometer.

In general, Jordan is a prolific country and the high rate in natural growth of population is not likely to slacken in the years immediately ahead. Some improvement in health conditions is taking place, which has recently been accelerated by foreign aid. These measures are

reducing death rates, especially of infants. Birth rates, on the other hand, may remain at their present high level since the economic and social structure tends to favor a high rate of birth. Statistical evidence, though incomplete, shows that natural growth is at the rate of about 2.9 percent annually; refugees are increasing at a rate slightly greater than that of the non-refugees population.

Population movement between Jordan and other countries was traditionally limited before 1948. Palestine received most of the Jordanian emigrants; many of these were agricultural workers who entered that country in quest of seasonal employment. Every season a number of these took up permanent employment and remained in Palestine. The sudden influx of Palestinians into Jordan occasioned by Arab-Israeli hostilities in 1948 constitutes by far the greatest population movement in which the country was ever involved. Statistical account of migration was instituted only recently. These data show that a net out-movement of 4,400 Jordanian citizens occurred in 1952 and 5,800 in 1953. The portion that left Jordan for permanent residence in foreign countries is not known.

Most of the Arabs are direct descendants of the Bedouin tribes that inhabited the Arabian Peninsula from time immemorial. Ethnic purity is perceptibly greater than in neighboring countries; the only exception in this respect, apart from minority groups, is the negroid descendants of immigrants from the Sudan, some of which were brought in as slaves. The most important minority group is comprised of Caucasians, who emigrated following conquest of their homeland. Like most of the Arabs, the Caucasians are Moslems, differing only in adherence to some of its doctrines. Other small groups are comprised of descendants of

Persian origin and the Armenians. Islam is the state religion and about 90 percent of the population is Moslem of which there are several sects. The remaining religious groups are largely composed of Christians, which include a number of denominations.

Though once a dominating influence in economic and numerical strength, the purely nomadic Bedouin way of life is losing ground to semi-nomadic agricultural pursuits. The nomadic Bedouins traditionally showed a contempt for farming and lived in the desert by raising camels and sheep, raiding rival tribes, and exacting contributions from neighboring farmers, travelers and the Government. Modern developments greatly restricted these activities and the Bedouins have turned increasingly to a semi-nomadic life under which they cultivate the land, at least during the winter rainy season, for a large share of their annual living. It is significant that in this transition to agriculture, the tribal heads or sheikhs continue to exercise considerable control over the land tilled by tenants and tribal members. Of a total 1948 population estimated to be 400,000, only 10 percent were thought to be nomads. The portion is considerably reduced as a result of recent sharp increases in population of other groups, particularly those of Palestinian origin. A large group of nomads moves seasonally from the desert and hill areas into the Jordan Valley to take advantage of the mild winter weather and lush grazing for their herds of camels and sheep.

Semi-nomadic Bedouins continue to occupy a large niche in the cultural and economic structure even after considerable dilution by Palestinian and West Jordan Arabs. It has been estimated that semi-nomadic Bedouin tribal members numbered about 140,000 in 1948(3); this group comprised 35 percent of the total population at that time. Although

their ratio is now considerably lessened as a result of recent influx of refugees, the semi-nomads continue to exert considerable influence on the economic life of the country by their vested and ancestral interest in grazing and farming resources. Some of the tribes who were the first to turn to cultivating the land for at least part of their living concentrated large areas of fertile land under the control of the sheikhs or tribal heads; much of the Jordan Valley came under their influence so that a feudal relationship grew up between sheikhs and peasants which persists even now, though lessened by land settlement operations of the Government.

Until recent years, Jordan was a nation devoid of urbanized life as it is known in western countries. Amman, the largest center, was formerly a village-like community of 35,000 persons and places such as Irbid, Salt and Karak held a total of about the same number out of 400,000 in the nation. The war in Palestine changed this. Within a span of 4 years 930,000 people were added to the pre-war population, many of whom are concentrated in and surrounding the main communities. Amman, the capital city, is experiencing accelerated expansion and the municipal population was listed as 108,000 in the 1952 census. Out of a total population of 1,330,000 listed in the 1952 census, 405,000 or 30 percent lived in 11 communities of 12,000 population or over, which might be termed "towns" by local standards. There are many thousands of refugees and others who live in the environs of the larger centers, in addition to the number enumerated in the towns, so that the "metropolitan" population of these communities is much greater. Only Jericho lies within the project area but several surrounding communities such as Amman, Jerusalem, Nablus, Irbid and Salt are also likely to be directly influenced by the proposed development.

Available statistics do not permit the classification of population into farm and non-farm groups. The presence of a large unemployed segment living by direct relief and casual labor also complicates categorizing the population. Some light is shed on the situation for the Jordan Valley, at least, by the U.N.Agricultural Economic Survey of 1953. This survey produced an estimate of 146,300 persons who were residing in the Valley in the summer of 1953. Out of this number 36,000 were listed as farm operators and their families, 93,000 were refugees, and the balance were either farm laborers or worked in town. In the refugee group there is a large pool of casual farm laborers. Among the farm population, the greatest concentration occurs in areas of the valley where irrigation development is most advanced. Thus the East Ghor North area embraces about 16,700 or nearly half of the total farm population, and the West Ghor area supports about 14,900 on farms. The East Ghor South area is least developed and contains a farm population of 4,400. Although "farm population", the farm operators and their families by tradition usually live in villages (built-up areas) and work the surrounding land.

The refugees of the Palestinian conflict represent a major group which is not integrated within the economy. Recent estimates place the number at 538,000 or 40 percent of the total population. Of this number 59,000 are estimated to have become assimilated and self-supporting within the economy, and the balance is either partially or fully dependent upon United Nations for sustenance. About 31 percent of these is largely concentrated in and near Amman and Zarqa. Of the remainder, 93,000 are living in the Jordan Valley, mostly near Jericho and at Karama and Ghor Nimrin. It is estimated that 256,000 of the 538,000 refugees are employable, but only 77,000 find substantial employment of any kind.

Employment and Income

Economic problems in Jordan are further complicated by a large unemployed and under-employed segment of the population. The phenomenon of under-employment is manifested by the pressure to share work; this discourages the use of labor-saving devices and keeps productivity at a low level.

The average wage of most workers is barely sufficient for a minimum level of consumption. According to the Ministry of Economy in Jordan, the annual wage of a full time unskilled worker in 1953 averaged $200. Considering prolonged periods of unemployment yearly income is less than $200.

The Palestinian refugees, while legally Jordanian citizens, represent a reservoir of idle or semi-idle manpower which is not integrated in the national economy. They depend for sustenance on international relief, aside from what casual employment they are able to secure in competition with the host population. This competitive pressure has tended to depress the level of living of the hostpopulation toward the minimum for sustenance.

According to recent estimates of the United Nations, about 256,000 refugees are employable, but only 30 percent find gainful employment to a substantial degree. Of these 77,000 persons, about 50,000 are employed in agriculture(2). About 10,000 refugees find casual employment on farms in Jordan Valley. Wage rates for farm labor, like those for unskilled workers in other fields, are low; they tend to discourage labor-saving operations and to perpetuate a low level of productivity per worker. The primary limitation on agricultural output, however, stems from lack of full irrigation development. Increased agricultural production through

irrigation is the key requirement for future economic viability.

Need for Project Development

Although economic and social effects of the existing low level of economic development are more widespread than indicated by the brief survey above, sufficient highlights are set forth to establish an urgent need for major increases in food production and employment. Water and land are the main undeveloped resources within the Kingdom; as such they offer the greatest opportunities for meeting immediate needs for greater food supplies and long-term opportunities for permanent employment.

The need for development is also expressed by the relatively high population density of this highly agricultural country. The ratio of total population to the area of cropped land (expressed in irrigated equivalent) is .63 persons per donum. This ratio is one of the highest among Arab countries of the Middle East. The most effective way to relieve the present population-production pressure is through accelerated development of irrigation. It is true that an improvement in agricultural productivity on presently cultivated land, and the expansion of local industry, will also help to relieve the pressure. However, these are long-range rather than immediate measures.

Agricultural Economy

Types of Farming

Descriptions of land and water utilization and crop production show that an extensive rather than in intensive type of farming is generally followed at present. On the small portion of the total cultivated area which receives sufficient irrigation water, relatively intensive agriculture is possible and farms are small.

On the basis of a farm-by-farm survey made in 1953, at least

three types of farms (truck, field crops, and general) may be distinguished according to the predominant source of income(3). Of the three types, truck farming is the most intensive and profitable. Truck farms are located to take advantage of the perennial flows of the spring-fed streams which enter the East Ghor and the West Ghor. Many farms particularly in the vicinity of Jericho also have small banana or citrus plantations. On the whole, however, fruit production in the Jordan Valley has not gained the importance of which it is capable. Citrus plantations in particular are on the increase. Truck farms account for 24 percent of all farms in the project area, Table 8.1-4, Types of Farms in Jordan Valley.

Field-crop farms generally are the least intensive of the three dominant types; they produce mostly winter cereals but may receive sufficient summer water for small crops of sesame, sorghum and vegetables. A two, three, or four-year rotation is followed on the larger farms of this group; much of the cultivable land is either idle or fallow for want of irrigation water or to comply with the age-old custom of allowing the land to "rest" periodically regardless of moisture conditions. Farms raising mostly field crops comprise 52 percent of all units.

General farms produce a wider variety of crops and have more livestock than the other types. These farms tend toward subsistence units; they have only small surpluses of food products for sale. General farms are the least important, but there is a large number of small units of this type.

Table 8.1-4

Types of Farms in Jordan Valley

Type of Farm	East Ghor North	East Ghor South	West Ghor	Total Project
	(Number of Farms)			
Truck	162	269	469	900
Field Crops	1,249	400	333	1,982
General	211	20	712	943
Total	1,622	689	1,514	3,825
	(Percent of Farms)			
Truck	10	39	31	24
Field Crops	77	58	22	52
General	13	3	47	24
Total	100	100	100	100

Sizes of Farms

Population pressure on cultivable land in the valley is accelerating the competition for farms and the overall tendency is toward a greater number of small units in comparison to extremely large ones.

Inheritance laws and customs provide that a specified share of the immovable property of the deceased shall go to each of his heirs. Considerable fragmentation of tribal and family holdings has occurred through this practice. Statistics of the Department of Lands and Surveys show that in a number of villages there has been an average reduction of 22 percent in the size of holdings within a period of ten years. Another source of competition for land is found among the refugee population. A survey made in 1953 reports that there has been a significant increase in demand and rental rates for land since the influx of refugees occurred. These pressures have resulted in an increasing tendency to operate smaller holdings.

The survey of 1953 mentioned above shows that existing farm

units range from less than 10 donums up to more than a thousand donums in size; however, farms consisting of less than 20 donums, including irrigated, non-irrigated and waste areas comprise about 23 percent of all farms. This group embraces less than one percent of the land in farms. Units consisting of over 1,000 donums comprise only three percent of the total number of farms but involve 68 percent of the total land. Table 8.1-5, Distribution of Sizes of Farms in Jordan Valley summarizes these relationships.

Table 8.1-5

Distribution of
Sizes of Farms in Jordan Valley

Donums per Farm	East Ghor North	East Ghor South	West Ghor	Total Project Farms Number	Total Project Farms Percent	Total Project Land Percent
Under 10	7	13	18	477	12	.25
10 - 20	11	13	11	432	11	.46
20 - 30	9	9	12	396	10	.95
30 - 50	18	14	19	684	18	2.58
50 - 100	25	16	24	876	23	5.89
100 - 200	17	12	9	487	13	6.60
200 - 1,000	11	18	5	387	10	15.13
Over 1,000	2	5	2	86	3	68.14
TOTAL	100	100	100	3,825	100	100.00

The smallest farms provide only part-time employment for the family and are incapable of furnishing even a minimum living unless they can be cropped intensively. The largest farms are operated mostly by hired labor and some operations such as plowing and reaping are done with the use of modern machinery. Operation of 3,825 farms in the valley employs about 12,000 persons on a full-time basis, including hired labor, and furnishes the sole livelihood of about 36,000 farmers and partial support of about 60,000 others, including those engaged in trade, services, etc. in surrounding communities.

Land Tenure

A number of Jordan's present land tenure problems originated through the operation of laws and customs which are opposed to the best use and conservation of land resources.

Until the present system of land settlement was instituted in 1933, most cultivable land in the country was held in a system of tenure in which the land of a particular village was divided among the landowners in proportion to the number of shares held by each. Each landowner cultivated the parcels of his allotment for an established period which varied from 2 to 9 years, depending upon the particular village. At the end of this period, the cultivator would have to move on to other parcels after a new partition of the village was made. Operation of this system was opposed to good farming because the cultivator, knowing that he would be forced to take other land after expiration of a definite period, was more interested in taking all the immediate production possible rather than in maintaining fertility of the land. It also discouraged production of perennial crops, particularly fruits.

Cadastral surveys and registry of land in the Jordan Valley have been almost completed in accordance with the Land Settlement Law of 1933(4). Settlement of ownership disputes is provided for under the law, and, of even greater benefit, the owners of village parcels now have greater security of tenure because they are no longer subject to periodic change according to the dictates of tribal sheikhs. Another result of the settlement program but not so beneficial to the peasant farmers in the long run, is the relative ease with which a landowner can mortgage his property. With an undisputed title as security, money-lenders and merchants are only too eager to find profitable use for their surplus

capital; the credit system results in a slow but inexorable transfer of agricultural land from the ownership of small-holders to that of money-lenders and large absentee owners.

why is this bad necessarily

As can be expected under the competitive conditions described, there is considerable non-operating ownership of land in the Jordan Valley. The agricultural survey of 1953 reported three categories of farm operators with respect to ownership. These are tabulated as follows:

	Percent of Operators
All land owned by operator	48
All land rented by operator	31
Part of land owned and part rented by operator	21
Total	100

There are various rental arrangements in use; 65 percent of all rentals in 1953 involved share-cropping. The annual rental per donum averaged slightly over $5.00 for land share-cropped; cash rent per donum averaged $3.50. In general, share rentals where employed, comprised 42 percent of the value of the harvested crops.

Tools, Power and Improvements

In the main, existing farm practices are relatively primitive, but a start has been made by a few of the large operators toward the adoption of modern methods of farming.

Equipment of the typical farmer in the Jordan Valley includes an ancient "nail" plow, a shallow-draft implement usually drawn by two oxen or one horse or camel. The nail plow is used for breaking the crust of the soil prior to sowing and for covering the seeds. A short-handled, heavy-bladed hoe is employed for essentially all cultivation, such as there is, and for irrigation. Cereals are mostly reaped with a hand

sickle; leguminous plants are pulled by hand. The cereals and leguminous plants are made into sheaves in the field and are then carried by women or beasts to the threshing floor. Threshing of grain is done by flails or by an animal-drawn wooden sled fitted on the underside with iron spikes or hard stones. After threshing, the grain and straw are tossed into the air with a fork. The wind blows the chaff away, while the grain falls to the ground. Women with sticks beat the remnants of the stalks which have escaped the threshing board or hooves of animals, and finally clean major impurities from the grain by means of hand sieves. A few power-drawn disc plows and grain drills, and some self-propelled combine harvesters are operated by large landowners. Some of these are available for custom work.

Farm animals are kept to the minimum required for draft, transport, milk, meat, hair and wool. Some families may have one or two lightweight horses or oxen. Camels are used occasionally for draft purposes, but more commonly for transport. Donkeys are used for transportation. A few goats and sheep are foraged in the uplands for hair, wool, meat, and milk. There is a prejudice among the men against keeping poultry; care for the few chickens in the project is in the hands of women. The birds are left to scavenge for feed.

The typical village consists of a cluster of adobe and straw huts which occupies an elevated area in the vicinity of a stream. Farmers live in the village and work the surrounding land. Usually there are no buildings of any kind on the farm itself; farm animals are tethered or kept in a "fold" in the village except when in use, or grazing the hills or crop residues of the harvested fields.

Net Farm Income

The average farm in the project area during 1953 produced an income of $752 including the value of produce consumed by the family. Cereals accounted for 50 percent and vegetables for 33 percent of the total income. Fruits produced were valued at $80, livestock $39, and $5 was received for work off the farm, Table 8.1-6, Estimated Farm Economy Without Project Development.

Expenses amounted to $562, principally for seeds, plants, manure and fertilizer, hired labor, transportation, and marketing. Net farm income, after other allowances for taxes, depreciation, repairs and other overhead was $190 per farm. This amount represents essentially the value of the farm produce consumed and the few purchased items which the average family was able to afford after meeting the usual farm expenses. Allowances for housing and interest on investment in tools and land owned come out of the $190. When these items are owned debt-free, the interest allowance is available for family living.

Level of Living

The typical farm family is able to secure only a bare existence bordering on destitution. The $190 available for living is about the same yearly income received in 1953 by the average unskilled laborer of Jordan and compares with $250 for shelter, food, fuel, clothing and miscellaneous items received from direct relief, employment, and other sources by the average refugee family during the same period(5).

The typical peasant family hut is fabricated from adobes, straw, and reeds. It has a dirt roof and floors. Some families use open-sided tents made of spun goat hair for shelter and sleeping, but this is more typical of the nomadic Bedouin than the farm family. Main foods

Table 8.1-6

Estimated Farm Economy Without Project Development (1)
(dollar figures are based on 1953 prices)

	East Ghor North	East Ghor South	West Ghor	Total Project	
Number of Farms	1622	689	1514	3825	
Farm Income (2)	(dollars)	(dollars)	(dollars)	Total	Per Farm (dollars)
Cereals	911000	254000	293800	1,458800	381
Vegetables	331500	278500	337000	947000	247
Fruits	152600	23200	129200	305000	80
Livestock	86000	40700	22700	149400	39
Other	9700	7600	-	17300	5
Total Farm Income	1490800	604000	782700	2,877500	752
Farm Expenses					
Taxes	22700	7600	16600	46900	12
Deprn., and Repairs	63300	34500	24200	122000	32
Seeds and Fertilizers	240000	96500	221000	557500	146
Hired Labor	243300	148800	204400	596500	156
Other Farm Expenses	409500	166600	253500	829600	216
Total Farm Expenses	978800	454000	719700	2,152500	562
Net Farm Income	512000	150000	63000	725000	190

(1) Based on "Agricultural Economic Survey, Jordan Valley", United Nations Organization, 1953.
(2) Gross income including the value of home-grown food and other items consumed by the family.

consist of cereals, mostly wheat, and vegetables. Fruits are eaten in season to supplement the diet. Except for home-made cheese, consumption of animal products is relatively low compared with western standards. Sheep and goats are favorite meat animals, but consumption of even this meat is not sufficient for an adequate diet. Cash purchases of sugar, tea, salt, etc. are kept to an absolute minimum. Straw, weeds, dried manure and twigs are continuously gathered for fuel wherever possible because other fuels are too scarce and expensive.

Basic work clothing for male members of the family consists either of pantaloons or a long outer garment made of cotton. Sandals may be worn, but more often all family members are barefooted. Women wear simple cotton garments of black or gray.

Marketing

The marketing of produce from Jordan Valley involves transportation, terminal handling, and selling. In most instances, these functions are performed by commission agents, but some produce, particularly wheat, is sold directly to processors located in larger communities. Most grain, however, is marketed through agricultural merchants who may have financed its production or advanced credit for family living until harvest time. Direct trading between producer and retailer or consumer is negligible, involving mainly poultry and small lots of fruits and vegetables. Some farmers in the northern end of the valley regularly export fruits and vegetables directly to commission agents in Syria or Lebanon.

Transportation of surplus farm produce to centers of consumption involves mostly trucks for hire, but small lots are moved by taxi or bus. Principal market centers for Jordan Valley farmers are

Amman, Jerusalem, Nablus, Jericho and Irbid. Most villages in the valley are within 75 kilometers of one of these communities.

Although services performed are relatively simple, the cost of marketing, including transportation, containers, commission, weight corrections and other incidentals, amounts to about 12 percent of the price received by farmers at market centers.

Very little grading or re-packing of produce is done at receiving centers; buying usually involves inspection of the commodity for sale as there are no quality standards or grades in use. Prices are determined by negotiation; this is generally true of consumer as well as wholesale prices.

Storage or processing facilities for products of the valley are generally lacking and there is considerable fluctuation in volume offered for sale and consequently in prices received. Butchering is generally done on a day-to-day basis because of lack of refrigeration. Seasonal supplies of vegetables and fruits often glut the markets. Producers and buyers of grain have practically no storage facilities; carry-over supplies are not provided for years when harvests are low. A small start has been made toward relieving the grain storage problem.

Agricultural Credit

Jordan lacks an effective system of credit to fit the needs of the small farmer. Merchant buyers of farm products, particularly wheat buyers, often perform the function of supplying credit or advancing seed and other supplies until harvest. The farmer usually finds himself perpetually in debt to these money-lenders because the prices paid for farm products are usually at their lowest at harvest time and the cost for credit is usually high, reaching 50 percent per season or more.

Bank credit is usually not available to small operators due to security requirements or lack of funds.

The Jordan Development Bank was established in 1951 under the joint sponsorship of Jordan and United Nations Organization for the purpose of supplying agricultural and industrial credit at 6 percent per annum interest to individuals and cooperatives. Since the bank operates under the usual practices respecting security, the small operators characteristic of the Jordan Valley are unable to qualify for loans. In 1952 the Jordan Development Board, supported largely by foreign aid, allocated $532,000 for loans to increase agricultural production. Loans from this source bear 4 percent annual interest; the repayment period depends upon the purpose of the loan. The loans that were extended have been successful for the stated purpose, but funds are entirely inadequate to meet the needs.

References

(1) Letter (Ref. JR/E109/Ad-691), Acting U.N.R.W.A. Representative, Jordan.

(2) "Employment, Occupations, and Income of Palestinian Refugees in Jordan", United Nations Organization, 1954 (unpublished).

(3) Jordan Valley Agricultural Economic Survey, United Nations Organization, 1953.

(4) "Land Settlement in Transjordan", G. F. Walpole, Department of Lands and Surveys, Jordan.

(5) "Employment, Occupations, and Income of Palestinian Refugees in Jordan", United Nations Organization, 1954 (unpublished).

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
MASTER PLAN REPORT

Part 2. Anticipated Economy

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
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PART 2. ANTICIPATED ECONOMY

Introduction

Development of a full water supply for arable lands in the Jordan Valley opens the way for a greatly expanded economy. Unless present farming practices are improved, however, much of the agricultural potential will be unused. This would be a wasteful, inefficient use of project resources; it would be in opposition to the idea of maximum settlement opportunities; and it would be inconsistent with the agricultural research, extension, and school teaching programs which have been initiated. The medieval system of farming, efficient enough to provide subsistence for a small semi-nomadic population, a system based only on wheat alternating with fallow and sometimes summer crops, must give way to a more efficient use of the land and water resources.

Economic studies were carried out on the basis that some improvements in farming methods would likely develop as a result of extension of agricultural education carried out over many years. The principal purposes of economic investigations were to describe the farm economy likely to develop as a result of primary emphasis on maximum settlement of refugees and to survey the outstanding potential overall economic and social effects of the project.

Procedure

The anticipated economy of the Jordan Valley was projected by means of farm budgets for representative anticipated farm operations. The farm budgets were prepared from information assembled from a number

of sources. Land classifiers furnished information regarding the amount of arable land; engineers provided cost estimates for irrigation, drainage, and land development; crop adaptability and potential crop yields were derived by comparison with fully irrigated areas of similar climate and resources. The farm budgets are based on representative crops adapted to the area, rather than all crops which may be grown in the future. Allowance was made for some improvement in farming practices. Details associated with farming practices were derived firsthand by observation and through numerous farm interviews during more than one year. Much valuable information was derived from reports and memoranda of and consultation with technicians and officials of the Jordan Government and agencies engaged in various agricultural programs. Considerable background information concerning agrarian economics in Jordan, particularly its social implications, was gathered from published reports.

Basic Assumptions

On the basis of information assembled, it was possible to frame a number of points of reference to guide the economic analysis. Some of the more important points are stated below; others are stated or implied in various places in the economic analysis.

Farm budgets in this report were developed on the basis of anticipated farm input and output relationships under conditions of full irrigation after allowing time for crop yields to reach potential levels. The time required will depend upon the quality of the land, abilities of the operators, and the effectiveness of agricultural education.

Farming systems were devised to provide productive employment for as many families as possible and to enable each family to attain an

adequate level of living, measured by basic requirements for food, clothing, shelter, education, and general welfare.

Farms were organized to enable the average family of 5.3 members to perform essentially all required labor, and to provide a maximum of home-grown food toward meeting total living requirements.

Farms were organized to enable operators to meet project costs which may reasonably be borne consistent with the objective of maximum settlement. For this analysis, it was assumed that irrigators shall be expected to pay the total annual cost of operating and maintaining the irrigation system and possibly a small annual amount toward retirement of capital cost of irrigation facilities without interest.

For lack of data, no attempt was made to forecast future price levels. Information was assembled representing average prices received by farmers and prices paid by them for items used in production during 1953. The relationship between prices received and prices paid which existed in 1953 was used as a matter of convenience and not because it is expected to prevail in the future.

According to land classification information, the amount of non-irrigable land within farm units which is suitable for sustained agricultural use is insignificant due to a number of limiting factors. For this reason, it is not anticipated that non-irrigable land would contribute materially to agricultural income. Therefore, this land is not included in the farm budgets.

Only the land classed as suitable for irrigation agriculture was included in farm budgets. The areas embraced in the analysis consist of the net amount of land available for irrigated crops. It was further assumed that sizes and shapes of proposed farm units could be established

without particular reference to existing ownership lines. In other words, no attempt was made to fit the proposed units to the existing ownership pattern or to adjust sizes to economic units by land exchange or other means.

A plan for the acquisition of project land and its subsequent settlement and disposition is not considered within the scope of this report. For purposes of economic analysis of agricultural potential, however, it was necessary to make certain assumptions respecting anticipated land tenure. In order to provide for land costs, the farm budgets include an annual charge for land equal to 10 percent of the average annual gross crop value. On this basis the rental would be variable; the weighted average is estimated to be $7 per domum annually. It is believed this amount will be adequate for meeting negotiated annual farm costs associated with either leasing or owning agricultural land embraced by the project.

Types of Farms

Potential crops, discussed in Volume III, are indicative of a trend toward a more intensive agriculture in the future. Farm budgets were prepared to represent this anticipated condition, but no attempt was made to include all crops which would be cultivated in the area. The crops included in analysis of farm sizes reflect the general pattern of crops recommended for desirable agronomic and farm management relationships within the limits of subsistence-type operations; thus, the area devoted to forage crops reflects the feed requirement of livestock maintained for various farm uses, with consideration of the quantity of other feeds, such as crop residues, which would be available during the

year. Crops were also selected to reflect desirable crop sequences and intensity of cropping. In the budgets, crops were also selected to afford opportunities for productive employment of family members throughout most of the year.

Anticipated types of farms are representative of the above factors and the quality of the land involved. According to land classification information, the productivity of Class 1 and Class 2 lands would be essentially the same under full irrigation development. These lands were, therefore, grouped in the analysis of potential agricultural economy. Class 1 and Class 2 lands are expected to produce more truck crops and support more double-cropping than Class 3 land. Although basically diversified for subsistence purposes, some farms will likely emphasize particular groups of crops for required cash income. Thus, on Class 1 and Class 2 lands, some farms would produce mostly truck crops for cash income while others would produce mostly fruits, rice or cotton. Also many general farms will likely produce both sugar beets and vegetables for cash income.

On Class 3 land, general or diversified sources of income will likely typify predominant farming situations. A combination of truck and fruit crops will provide cash income for one of the types of farms anticipated. A second type will produce some livestock for sale by utilizing forage and sugar beet by-products; this is in addition to the sale of diversified crops.

Farm Budgets

The analysis of projected agricultural economy was made on the basis of farm budgets which employ many agricultural, economic and

social factors. In brief, the budgets reflect productive capacity of the land, farm income and expenses, family living, and annual cost of operating the project.

The projected farms are related to particular classes of arable land. Class 1 and Class 2 lands are represented by three farming situations, truck, fruit, and general farming. Class 3 land is represented by two types of farms, including a truck-fruit combination, and a general farm including livestock for sale. These data are summarized in Tables 8.2-4 to 8.2-5, Farm Budget Summary. A variety of combinations in types of crops and farming are likely to develop--much greater than is shown by the budgets. The budget farms, however, do give a general picture of farming expected in the project area.

Sizes of Farms

Projected farms are near the minimum sizes for meeting anticipated requirements for family living, and annual charges for project water. Since farm work can be done mainly by the farm operator and his family, the farms meet the requirements for family-size units.

With primary emphasis on subsistence-type operations, farm units are small. The budgets show that sizes of farms vary inversely with the quality of the land. For Class 1 and Class 2 lands an average of at least 15 donums per farm is needed to meet minimum living requirements and project costs. In order to provide a similar amount by operation of Class 3 land, an average of at least 26 donums per farm is required. On this basis, 1.7 donums of Class 3 land are equivalent to 1 donum of Class 1 or Class 2 lands.

Due to small sizes, most farms are likely to consist entirely

Table 8.2-1

FARM BUDGET SUMMARY

Classes 1 and 2 Land

Irrigable Cropland - 16 Donums | Type of Farm - Truck

Representative Conditions With Project Development

Crop and Livestock	Donums or Number	PRODUCTION Yield Kgm./ Donum	Amount Kgms	Price $/ Kgm.	Value $	DISPOSITION ($) Farm Use	Home Use	Sales
Wheat	2.0	210	420	.090	38	15	23	
Corn	(1.0)	350	350	.050	17		17	
Sorghum	(1.0)	360	360	.053	19		19	
Potatoes	2.3	1,600	3,680	.040	147			147
Cucumbers	(1.1)	1,500	1,650	.042	69			69
Cabbage	1.7	2,200	3,740	.028	105			105
Squash (Marrow)	(1.7)	1,800	3,060	.053	162			162
Tomatoes	4.2	1,900	7,980	.053	423			423
Eggplant	(2.6)	1,700	4,420	.021	93			93
Garden (2 crops)	1.0				73		73	
Berseem	4.8	1,400	6,720	.012	81	81		
Gross Crop	23.4				1,227			
Other Income (livestock)					102	20	82	
TOTALS					1,329	116	214	999

CURRENT FARM EXPENSES ($)	
Taxes	60
Repr.,Depr.,Mchy.&Equip.	35
Planting Materials	118
Fertilizer	77
Pest Control	43
Machinery Hire	17
Land Rent	123
Livestock Expenses	15
Miscellaneous Expense	36
Transp. and Marketing	179
	703

INVESTMENT ($)	
Land	-
Livestock	104
Mchy. and Equip.	122
Total Invest.	226

FARM WORK	Man-Days
Crops	474
Livestock	-
Miscell.	67
Total	541
Work By:	
Opr. and Fam.	541
Hired	-

FINANCIAL SUMMARY ($)	
Total Farm Income	1213
Total Farm Expenses	703
Net Farm Income	510
Interest on Investment	11
Family Living Allowance	450
Payment Capacity	49
Project Opr. and Maint.	30
Repayment Capacity	19

NOTE: Figures in parenthesis indicate double-cropping.

Table 8.2-2

FARM BUDGET SUMMARY

Classes 1 and 2 Land

Irrigable Cropland - 13 Donums

Type of Farm - Fruit

Representative Conditions With Project Development

Crop and Livestock	Donums or Number	PRODUCTION Yield Kgm./ Donum	Amount Kgms	Price $/ Kgm.	Value $	DISPOSITION ($) Farm Use	Home Use	Sales
Wheat	2.0	210	420	.090	38	15	23	
Corn	(.9)	350	315	.050	16		16	
Sorghum	(1.0)	360	360	.053	19		19	
Potatoes	(2.0)	1,600	3,200	.040	128			128
Garden (2 crops)	1.0				73		73	
Bananas	3.6	2,700	9,720	.044	428			428
Oranges	1.6	1,700	2,720	.090	245			245
Lemons	.9	1,500	1,350	.095	128			128
Berseem	3.9	1,400	5,460	.012	66	66		
Gross Crop	16.9				1,141			
Other Income (livestock)					102	20	82	
TOTALS					1,243	101	213	929

CURRENT FARM EXPENSES ($)

Taxes	53
Repr.,Depr.,Mchy.&Equip.	49
Planting Materials	47
Fertilizer	84
Pest Control	21
Machinery Hire	99
Land Rent	114
Livestock Expenses	15
Miscellaneous Expense	34
Transp. and Marketing	167
	613

INVESTMENT ($)

Land	-
Mchy. and Equip.	144
Livestock	105
Fruit trees	555
Total Invest.	804

FARM WORK

	Man-Days
Crops	459
Livestock	-
Miscell.	69
Total	528
Work By:	
Opr. and Fam.	528
Hired	-

FINANCIAL SUMMARY ($)

Total Farm Income	1142
Total Farm Expenses	613
Net Farm Income	529
Interest on Investment	40
Family Living Allowance	450
Payment Capacity	39
Project Opr. and Maint.	24
Repayment Capacity	15

NOTE: Figures in parenthesis indicate double-cropping.

Table 8.2-3

FARM BUDGET SUMMARY

Classes 1 and 2 Land

Irrigable Cropland - 16 Donums

Type of Farm - General

Representative Conditions With Project Development

Crop and Livestock	Donums or Number	PRODUCTION Yield Kgm./ Donum	Amount Kgms	Price $/ Kgm.	Value $	DISPOSITION ($) Farm Use	Home Use	Sales
Wheat	2.0	210	420	.090	38	20	18	
Sesame	(1.0)	350	350	.050	17		17	
Sorghum	(1.0)	360	360	.053	19		19	
Sugar Beets	6.7	3,200	21,440	.015	322			322
Squash (Marrow)	(1.6)	1,800	2,880	.053	153			153
Beans	(1.6)	1,500	2,400	.073	175			175
Carrots	(.8)	1,500	1,200	.021	25			25
Tomatoes	1.6	1,700	2,720	.053	144			144
Garden (2 crops)	1.0				73		73	
Berseem	4.7	1,400	6,580	.012	79	79		
Gross Crop	22.0				1,045			
Other Income (livestock)					266	82	102	82
TOTALS					1,311	181	229	901

CURRENT FARM EXPENSES ($)

Taxes	52
Repr.,Depr.,Mchy.&Equip.	44
Planting Materials	53
Fertilizer	69
Pest Control	17
Machinery Hire	61
Land Rent	104
Livestock Expenses	17
Miscellaneous Expense	34
Transp. and Marketing	162
	613

INVESTMENT ($)

Land	-
Livestock	176
Mchy. and Equip.	147
Total Invest.	323

FARM WORK

	Man-Days
Crops	418
Livestock	22
Miscell.	63
Total	503
Work By:	
Opr. and Fam.	503
Hired	-

FINANCIAL SUMMARY ($)

Total Farm Income	1130
Total Farm Expenses	613
Net Farm Income	517
Interest on Investment	16
Family Living Allowance	450
Payment Capacity	51
Project Opr. and Maint.	30
Repayment Capacity	21

NOTE: Figures in parenthesis indicate double-cropping.

Table 8.2-4

FARM BUDGET SUMMARY

Class 3 Land

Irrigable Cropland - 25 Donums — Type of Farm - Truck-Fruit

Representative Conditions With Project Development

Crop and Livestock	Donums or Number	PRODUCTION Yield Kgm./ Donum	Amount Kgms	Price $/ Kgm.	Value $	DISPOSITION ($) Farm Use	Home Use	Sales
Wheat	6.2	160	992	.090	89	61	28	
Sorghum	(4.5)	270	1,215	.053	64	42	22	
Potatoes	2.0	1,200	2,400	.040	96			96
Cauliflower	2.5	1,300	3,250	.050	162			162
Corn	(4.5)	250	1,125	.050	56	46	10	
Tomatoes	3.0	1,450	4,350	.053	230			230
Garden (2 crops)	1.0				73		73	
Alfalfa	4.5	1,100	4,950	.014	69	69		
Bananas	3.8	2,000	7,600	.044	334			334
Oranges	2.0	1,600	3,200	.090	288			288
Gross Crop	34.0				1,461			
Other Income (livestock)					266	82	102	82
TOTALS					1,727	300	235	1,192

CURRENT FARM EXPENSES ($)

Taxes	69
Repr.,Depr.,Mchy.&Equip.	48
Planting Materials	101
Fertilizer	103
Pest Control	49
Machinery Hire	47
Land Rent	146
Livestock Expenses	17
Miscellaneous Expense	43
Transp. and Marketing	222
Hired Labor	39
	889

INVESTMENT ($)

Land	-
Livestock	176
Mchy. and Equip.	153
Fruit trees	490
Total Invest.	819

FARM WORK

	Man-Days	($)
Crops	545	
Livestock	20	
Miscell.	81	
Total	646	
Work By:		
Opr. and Fam.	600	
Hired	46	39

FINANCIAL SUMMARY ($)

Total Farm Income	1427
Total Farm Expenses	889
Net Farm Income	538
Interest on Investment	41
Family Living Allowance	450
Payment Capacity	47
Project Opr. and Maint.	46
Repayment Capacity	1

NOTE: Figures in parenthesis indicate double-cropping.

Table 8.2-5

FARM BUDGET SUMMARY

Class 3 Land

Irrigable Cropland - 27 Donums | Type of Farm - General

Representative Conditions With Project Development

Crop and Livestock	Donums or Number	PRODUCTION Yield Kgm./ Donum	Amount Kgms	Price $/ Kgm.	Value $	DISPOSITION ($) Farm Use	Home Use	Sales
Wheat	6.7	160	1,072	.090	96	13	83	
Carrots	(3.2)	1,100	3,520	.021	74			74
Eggplant	(3.2)	1,300	4,160	.021	87			87
Sugar Beets	8.6	2,400	20,640	.015	310			310
Squash (Marrow)	(3.2)	1,350	4,320	.053	229			229
Garden (2 crops)	1.0				73		73	
Alfalfa	6.3	1,100	6,930	.014	97	97		
Grapes	4.4	900	3,960	.040	158			158
Gross Crops	36.6				1,124			
Feeder lambs	35				595			595
Other livestock					102	20	82	
TOTALS					1,821	130	238	1,453

CURRENT FARM EXPENSES ($)

Taxes	49
Repr.,Depr.,Mchy.&Equip.	44
Planting Materials	63
Fertilizer	101
Pest Control	38
Machinery Hire	47
Land Rent	112
Livestock Expenses	20
Miscellaneous Expense	50
Purchase of range lambs	385
Transp. and Marketing	260
	1,169

INVESTMENT ($)

Land	-
Livestock	122
Mchy. and Equip.	147
Vines	88
Total Invest.	357

FARM WORK

	Man-Days
Crops	502
Livestock	52
Miscell.	30
Total	584
Work By:	
Opr. and Fam.	584
Hired	-

FINANCIAL SUMMARY ($)

Total Farm Income	1691
Total Farm Expenses	1169
Net Farm Income	522
Interest on Investment	18
Family Living Allowance	450
Payment Capacity	54
Project Opr. and Maint.	50
Repayment Capacity	4

NOTE: Figures in parenthesis indicate double-cropping.

of either Classes 1 or 2 land, or of Class 3 land. However, many will probably be comprised of various mixtures of land classes. A number of variations in standard farm sizes is justified under these conditions in order to provide approximately equal opportunities for the support of the average family.

Level of Living

A key factor in estimating farm sizes involves provision for a reasonable chance for the average settler family to attain an adequate level of living. In estimating farm sizes, consideration was also given to the desirability of providing maximum settlement opportunities. If sufficiently high, the level of living may be a desirable incentive toward securing greater production. If the level of living is too high, the number of farms will be reduced significantly.

The level of living assumed for purposes of this report provides, according to nutritionists and home economists, adequate diet, clothing, household, personal and miscellaneous items for an average farm family of 5.3 persons living in the Jordan Valley. Most of the required calories may be provided from common home-grown foods and this is reflected in the farm budgets. Derivation of family living allowance is shown in Table 8.2-6, Annual Requirement for Family Living. The allowance totals $420. For purposes of this report, an allowance of $450 is assumed for the average family, of which the equivalent of $225 could be furnished by direct consumption of farm produce. Annual cost of housing development is not included in farm expenses and no rental value of housing is included in the farm budgets. For convenience in the presentation of all family living items, however, an annual allowance

for improved housing is included in the total. Thus, the assumed level of living represented by $450 would allow more than twice the present annual rate of consumption per farm family.

Another approach to the estimate of family living allowance involves valuation of the amount of productive work performed by the operator and his family. The average farm provides 535 man-days of productive labor annually. This work can be done mainly by the operator and his family. If compensated at a minimum living wage of, say, $0.85 per day the total value amounts to $455 or approximately the living allowance of $450 based on the cost-of-living approach.

Table 8.2-6

Annual Requirement for Family Living
(dollars)

Item	Furnished on Farm	Purchased	Total
Food	213	32	245
Clothing	-	35	35
Shelter and Household	68	58	126
Health and Welfare	-	14	14
TOTAL	281	139	420

Equipment and Labor Requirements

Basic problems involve the need for maximum utilization of hand labor adjusted to meet the need for timely and adequate performance of certain farm operations for which common equipment in current use is not adapted.

In order to meet these needs at least partially, estimated labor requirements were based on a continuation of predominant use of hand labor, but with some simple improvements in hand tools and animal-

drawn equipment common to more advanced agricultural areas with small farms. Certain specialized equipment required for such jobs as deep plowing, spraying orchards and the like would be rented or provided by other arrangement. Some of this equipment is presently available for hire.

Basic farm tools required for proper and timely preparation of land and planting, care, and harvesting of crops include a small animal-drawn mold-board or disc plow, a spike tooth harrow, a small drill, a cart or wagon for transport, a hand sprayer or duster, and small hand tools such as hoes, garden rakes, shovels, sickles and scythes. Some special equipment would be required on fruit farms for handling bees and for harvesting. Small mechanical threshers for cereals should be considered to replace existing methods in the interest of timely operations and conservation of crops. These could be collectively owned or made available on a rental basis.

The average projected farm, using the equipment described, would provide a fairly high level of family employment, averaging 535 man-days out of a total of 600 man-days available from the average family of 5.3 persons.

Livestock

In general, anticipated farm operations provide for the maintenance of animals required to perform farm work and to furnish meat, milk, wool, and hair toward meeting the family requirements for these items. Outside grazing or forage is not anticipated, therefore, full utilization of crop residues, forage, sugar beet by-products and other animal feeds not required for fuel or other household use is important

to the farm economy.

The average projected farm would keep horses, mules, or oxen for draft and transport, some milk goats or a cow, and a few hens. Some farms would likely have a few sheep rather than goats.

The feeding of lambs offers good possibilities in connection with anticipated availability of by-products from processed industrial crops, crop residues, and forage. For example, a ton of sugar beets can be expected to provide about 140 kilograms (70 percent dry matter) of tops and 275 kilograms of wet pulp. When fed with a suitable amount of alfalfa or other forage, sugar beet tops and pulp can replace most of the daily requirement for grain in the fattening ration for lambs. **

Net Farm Income

In this report, farm income and expenses are based on local prices which prevailed during 1953. No attempt was made to forecast probable future prices and cost rates and their relationship. Average monthly prices received for agricultural products at principal marketing centers as reported by the Department of Statistics were used in placing values on items sold. Prices received by farmers include transportation and other expenses of marketing farm products sold at the various marketing centers. Data were not available from which to estimate a future level of prices as related to the anticipated changes in production and marketing. Farm expenses are based on retail prices of equipment, seeds, fertilizers, and similar items normally purchased; current tax rates; and estimated costs of transportation and marketing. A number of expense items, including rates of depreciation and repair of farm equipment, are based on information assembled in "Agricultural

Economic Survey of Jordan Valley", by United Nations Organization. Farm inputs are based on seeding rates, fertilizer use and other agronomic practices which are recommended and are believed to be attainable by the average farmer after many years of extension-type agricultural education.

The average gross income per farm comprised entirely of Class 1 and Class 2 lands is estimated to be $1,161; and $1,559 for farms operating Class 3 land. Almost one-fifth of the income of all farms is represented by food and other items produced for family living. Most income is derived from the sale of vegetables (44 percent) and fruits (23 percent).

Farm expenses, including current expenses and overhead, total $643 for farms on Class 1 and Class 2 lands, and $1,029 on Class 3 land. Principal expense items include seeds, plants, fertilizer, rent, and marketing. As previously pointed out under "Basic Assumptions", an item for land rent has been included to cover estimated annual costs of either leasing or owning agricultural land depending upon the system of land tenure adopted.

Net farm income represents a return for the labor of the operator and his family, a return on investment in tools, livestock, fruit trees, vines, and other farm capital and a return for irrigation water. If tools, livestock and other farm investments are debt-free, the return otherwise required on this investment would be available for family living or other uses. Table 8.2-7, Estimated Net Income of Farm Units, summarizes the estimated net income according to size of farm and quality of land. This analysis shows that a farm of 15 donums of Class 1 and Class 2 lands, or 26 donums of Class 3 land, is estimated to provide

sufficient net income, based on 1953 prices, for meeting costs of family living, interest on private investment and to at least pay estimated annual charges for irrigation water. In terms of these requirements, the referenced sizes are adequate. A small surplus may be available toward retirement of the capital cost of project development or for capital accumulation by irrigators. In the budgets net farm income represents a residue after deducting usual farm production costs except water charges; it also represents a measure of the direct irrigation benefits attributable to project development when compared with net farm income without project development. Additional explanation and evaluation is included in the discussion of benefits, costs and economic evaluation.

Table 8.2-7

Estimated Net Income
of Farm Units

Item	Average per Farm: Class 1 and Class 2 Lands	Average per Farm: Class 3 Land
Irrigable Cropland, donums	15	26
	(dollars)	
Gross Farm Income		
Cereals	57	72
Vegetables	541	439
Fruits	267	390
Other Crops	180	228
Livestock	116	430
Total Farm Income	1,161	1,559
Farm Expenses		
Taxes, Depreciation, Repairs	98	105
Seeds and Fertilizer	149	187
Other Crop Expenses	63	110
Other Farm Expenses	333	627
Total Farm Expenses	643	1,029

Table 8.2-7 (Cont'd)

Estimated Net Income
of Farm Units

Item	Average per Farm: Class 1 and Class 2 Lands	Average per Farm: Class 3 Land
Net Farm Income	518	530
Family Living	450	450
Interest on Private Investment	22	29
Available for Water Charges	46	51
Annual Operation and Maintenance	28	48
Available for Debt Retirement	18	3

Summary

A study of the economic phases of the Yarmouk-Jordan Valley Project was made for the purpose of describing the agricultural economy likely to develop under conditions of maximum settlement of subsistence-type farms. The study also provides basic information and estimates useful for planning marketing facilities and other improvements in the general economy, which may be realized after development of the project. The economic potential of the project in fulfilling these aims depends upon the validity of a number of points of reference which are specifically set forth or implied in many places throughout the report. The findings are based on: 1) results of surveys involving land resources and recommended use; 2) methods and techniques generally accepted for making such analyses; 3) a number of specific assumptions, most of which pertain to the future and the validity of which only future events can determine; and 4) agricultural and economic objectives of the various interests involved in developing the project, as nearly as these goals can be ascertained at this time.

Detailed information summarized in the farm budgets for lands of different qualities was projected to major geographical areas of the project. The expansion is based on the donums of irrigable land of each class within the major area. An estimate of the total agricultural economy of the project is provided by combining the information assembled for each major area. These summaries are shown in Table 8.2-8, Estimated Farm Economy with Project Development. Additional explanation and evaluation is covered in the discussion of benefits, costs, and economic evaluation.

Table 8.2-8

Estimated Farm Economy With Project Development
(Dollar Figures are Based on 1953 Prices)
(Sheet 1 of 2)

	East Ghor North	East Ghor South	West Ghor	Total Project
Net Irrigable Cropland (Table 3.1-7 minus 3%)				
Classes 1 and 2 Land, Donums	143,900	147,600	109,100	400,600
Class 3 Land, Donums	25,600	36,000	42,000	103,600
Total Cropland	169,500	183,600	151,100	504,200
Number of Farms				
Classes 1 and 2 Land (15 donums average)	9,600	9,850	7,250	26,700
Class 3 Land (26 donums average)	1,000	1,400	1,600	4,000
Total Farms	10,600	11,250	8,850	30,700
	(Dollars)	(Dollars)	(Dollars)	(Dollars)
Farm Income (From Table 8.2-7)				
Cereals	619,200	662,250	528,450	1,809,900
Vegetables	5,632,600	5,943,450	4,624,650	16,200,700
Fruits	2,953,200	3,175,950	2,559,750	8,688,900
Other Crops	1,956,000	2,092,200	1,669,800	5,718,000
Livestock	1,543,600	1,744,600	1,529,000	4,817,200
Total Farm Income	12,704,600	13,618,450	10,911,650	37,234,700
Farm Expenses (From Table 8.2-7)				
Taxes, Deprn., and Repairs	1,045,800	1,112,300	878,500	3,036,600
Seeds and Fertilizers	1,617,400	1,729,450	1,379,450	4,726,300
Other Crop Expenses	714,800	774,550	632,750	2,122,100
Other Farm Expenses	3,823,800	4,157,850	3,417,450	11,399,100
Total Farm Expenses	7,201,800	7,774,150	6,308,150	21,284,100

Table 8.2-8

Estimated Farm Economy With Project Development
(Dollar Figures are Based on 1953 Prices)
(Sheet 2 of 2)

	East Ghor North	East Ghor South	West Ghor	Total Project
Net Farm Income	5,502,800	5,844,300	4,603,500	15,950,600
Family Living	4,770,000	5,062,500	3,982,500	13,815,000
Interest on Private Investment	240,200	257,300	205,900	703,400
Available for Water Charges	492,600	524,500	415,100	1,432,200
Annual Operation and Maintenance (Table 8.3-7)	315,889	342,167	281,598	939,654
Available for Debt Retirement	176,711	182,333	133,502	492,546

Substantiating Data

The essential findings of this study which concern estimates of farm sizes and settlement capacity of the project are based on analysis of five representative farm situations; three for Class 1 and Class 2 land, and two for Class 3 land. A large part of the significant information about each of these farms is presented in the farm budget summaries, Tables 8.2-1 to 8.2-5. The following tables provide representative detailed information and standards used in the development of the several farm situations.

Table 8.2-9

Prices Received by Farmers
for Agricultural Products
1953

FIELD CROP	Dollars per Kg.	VEGETABLES	Dollars per Kg.	FRUITS	Dollars per Kg.
Wheat	.090	Tomatoes	.053	Bananas	.044
Barley	.042	Marrow	.053	Oranges	.090
Sorghum	.053	Eggplant	.021	Grapefruit	.075
Corn (Maize)	.050	Cucumbers	.042	Lemons	.095
Sesame	.154	Broadbeans	.023	Grapes	.040
Peanuts (shelled)	.183	Onions	.036	Dates	.028
Sugar Beets	.015	Cabbage	.038	Pomegranates	.260
Alfalfa Hay	.014	Cauliflower	.050		
		Potatoes	.040		
		Carrots	.021		
		Watermelons	.013		
		Green Beans	.073		

LIVESTOCK	Dollars per head	Dollars per Kg. (live wt.)	LIVESTOCK PRODUCTS	Dollars per Kg.
Sheep	20	.43	Hens	.56
Lambs, range	11	.41	Wool	.70
Lambs, slaughter	18	.50	Eggs, each	.02
Goats	14	.34	Milk	.10
Kids	8	.36	Hair	.80
Oxen	75		Honey	1.12
Cows, dual purpose	87	.19	Butter	.49
Calves, slaughter	34	.21		
Horses	100			
Mules	143			

NOTE: Average monthly prices received by farmers at Amman, Irbid, Nablus, and Jerusalem during 1953. Prices for items not now produced, such as sugar beets, were estimated.

Table 8.2-10

Prices Paid by Farmers for
Items Used in Production
1953

SEEDS	Dollars per Kg.
Wheat	.140
Barley	.070
Sorghum	.112
Corn (Maize)	.224
Sesame	.182
Peanuts	.190
Sugar Beets (est.)	.700
Alfalfa (est.)	.990
Potatoes	.090
Cowpeas	.900
Carrots	2.240
Broadbeans	.280
Beans, Green	.982
Peas	.672
Marrow	6.720
Cucumber	2.800

TRANSPLANTS	Dollars per Dozen
Eggplant	.070
Tomatoes	.070
Cauliflower	.070
Cabbage	.060
Peppers	.070
Onions (1,000)	.350

ROOT STOCK	Dollars per Piece
Banana	.154
Citrus	.422
Date	5.600
Grape (local)	.039
Grape (French)	.042
Pomegranate	.168

INSECTICIDES AND CHEMICALS	Dollars per Kg.
DDT, 5%	1.54
"Ceresan"	.84
Nicotine Sul.	4.04
"Paranox"	1.82
Sulphur, dust,	.17
"Folidol" (1,000 c.c.)	7.98

FERTILIZERS	Dollars per Ton	Formula, Percent (1) (N)	(P_2O_5)	(K_2O)	Dollars per Kg. Element (N)	(P_2O_5)	(K_2O)
Superphosphate	64	0	16	0		.40	
Treble-superphos.	134	0	45	0		.30	
Ammonium Sulphate	84	20	0	0	.42		
Ammonium Nitrate	109	33	0	0	.43		
Sheep Manure, dry	8						

(1) Percentage of available (water soluble) fertilizer elements:
N - Nitrogen; P_2O_5 - Phosphoric Acid; K_2O - Muriate of Potash

Table 8.2-11

Recommended Basic Equipment
and Annual Cost

EQUIPMENT	Inventory (1) Value Dollars	Annual (2) Depr. Dol.	Annual Repr. Dol.
Plow, walking, moldboard, 12"	18	2.70	1.20
Harrow, spiketooth, one section	8	1.60	.50
Cultivator, walking (est.)	42	7.90	3.50
Cart, 2-wheel, farm-made (est.)	24	3.60	1.60
Sprayer or Duster, hand 3-gal. cap.	9	2.10	.70
Miscellaneous small tools and equip.	30	11.50	2.00

(1) 60% of new cost, based on 10 percent salvage value
(2) Straight-line depreciation with 10 percent salvage value

Table 8.2-12

Planting Rates

SEEDS	Kg. per Donum
Wheat	10.2
Barley	11.3
Sorghum (Durra)	3.4
Corn (Maize)	1.2
Sesame	2.0
Peanuts	3.4
Sugar Beets	1.2
Alfalfa	1.4
Potatoes	114.0
Cowpeas	3.4
Broadbeans	14.0
Beans, Green	6.8
Peas	8.5
Marrow	.5
Cucumber	.4
Watermelon	.7

PLANTS	Dozen per Donum
Eggplant	113
Tomatoes	113
Cauliflower	150
Cabbage	150
Onions (1,000)	25
Peppers	150

TREES AND VINES	Number per Donum
Banana	110
Citrus	50
Date	16
Grape	110
Pomegranate	100

Table 8.2-13

Livestock Inventory Value,
Annual Depreciation and Death Loss

LIVESTOCK	Dollars per Head	
	Inventory Value	Dprn. and Death Loss
Oxen	59	3.00
Cow, dual-purpose (1)	81	2.50
Mule	71	11.90
Horse	50	8.40
Goat, per doe (1)	12	1.12
Sheep, per ewe (1)	14	1.57
Hens, per 25 (1)	24	2.50
Lamb, feeder (100 days)	5	.15

(1) Includes replacement stock

Table 8.2-14

Livestock Feed Production and
Equivalent Feeding Values

KIND OF FEED	Yield, Tons per Donum	Kilograms to Equal Feed		
		Alfalfa per Kg.	Wheat per Kg.	Grazing (a.u.m.)
Alfalfa Hay	1.350	1.0		
Bean straw	.125	1.0 (1)		
Corn Stover, Dry	.280	2.0		
Peanut Vine Hay	.100	1.5		
Sesame Oil-Cake	.045		.6	
Alfalfa, Green (soiling)	4.450	3.0		.30
Pea Vine Hay	.125	9.0		
Sugar Beet Tops	.450 (2)		2.0	
Sugar Beet Pulp, Wet	.890 (3)		16.0	

(1) Fed to lambs with equal amount of alfalfa hay.
(2) About 140 kilograms of beet tops (70% dry matter) per ton of sugar beets.
(3) About 275 kilograms of wet beet pulp per ton of sugar beets.

Table 8.2-15

Livestock Production Rates

KIND OF LIVESTOCK	Kilograms of Product per Head or Unit			
	Milk	Meat (livewt.)	Eggs (each)	Wool and Hair
Cow, dual-purpose	1,000	130		
Goat, per doe	300	24		.5
Sheep, per ewe		30		3.5
Hens, per 25		25	2,500	
Lamb, per feeder		34		

Table 8.2-16

Estimated Requirement for Family Living

	Daily Food Requirement per Capita		Annual Family Requirement (1) Total		Farm Furnished	Purchased
	Calories	Grams	Kilo	Dollars	Dol.	Dol.
FOOD						
Cereals and Pulses	1,676	475	920	65	65	
Vegetables, Fresh	76	152	350	20	20	
Fruits, dried and fresh	67	99	200	16	16	
Oils and Fats	129	20	40	12	12	
Meat and Animal Products	262	269	500	100	100	
Sugar, Coffee, etc.	135	46	90	32		32
Total	2,345	1,061	2,100	245	213	32
CLOTHING						
All Items				35		35
HOUSEHOLD AND MISCELLANEOUS						
Shelter and Household				126	68	58
Health and Welfare				14		14
Total				140	68	72
TOTAL ALL ITEMS				420	281	139

(1) This represents the minimum for the average family of 5.3 persons.

Sources: a. "Composition of Foods Used in Far Eastern Countries", U. S. Department of Agriculture, Bureau of Human Nutrition and Home Economics, March 1952.
b. United Nations Relief and Works Agency for Palestine Refugees in the Near East.

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
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PART 3. Benefits, Costs and Economic Appraisal

Introduction
Benefits
Costs
Period of Analysis
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Supplemental Information

VOLUME VIII
YARMOUK-JORDAN VALLEY PROJECT
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PART 3. BENEFITS, COSTS AND ECONOMIC APPRAISAL

Introduction

The project has been conceived as a partial solution, at least, to a number of economic and social pressures that are accentuated by the presence of several hundred thousand refugees of the Arab-Israeli conflict. While refugee settlement ranks high among immediate objectives, the project also opens the way to a number of improvements in the general economy of the Kingdom. This section is primarily concerned with bringing to light a number of these tangible benefits and in offering bases for judging their real values against an existing background of economic stagnation. Various changes of an intangible nature which are likely adjuncts to economic development are mentioned, but they elude adequate description and measurement. Finally, as a supplementary yardstick of comparable values, benefit-cost ratios are included as an orthodox measure of economic feasibility.

Procedure

In general, the method of analysis employs procedures in use by the United States Bureau of Reclamation and those recommended by the Federal (United States of America) Inter-Agency River Basin Committee in "Proposed Practices for Economic Analysis of River Basin Projects", May, 1950. In view of the unusual circumstances underlying project construction, however, emphasis of respective kinds of benefits has been modified to more nearly fit local conditions. Thus, the qualitative benefits of the project are placed in the foreground; monetary comparisons of benefits

and costs, such as benefit-cost ratios, are given secondary importance.

Some of the most far-reaching effects of the project can best be expressed only by narrative description. Comparable measurement of some diverse project effects must depend primarily upon their evaluation in monetary terms by the use of assigned market prices or assigned values. A portion of the evaluation, the ratio of benefits to costs, involves comparison of annual equivalent values over a period of analysis. The period of analysis, 100 years, is geared to the expected economic life of major project features.

Benefits

In broad usage of the term, "benefits" cover a diversity of social and economic improvements. The scope of this report does not permit quantitative or, in some instances, even qualitative appraisal of many impacts on the economic and social way of life which the project could bring about. Principal attention is directed to real or physical benefits manifested by reduction in relief expenditure, increases in employment and income, production of food, level of living, and improvement in balance of trade. Social effects, such as rehabilitation and stabilization of family and community organization of a now homeless people and provision of incentives for productive labor and self-support are recognized among the many intangible potentials of project development.

Population Capacity

Under present development the Jordan Valley is able to provide the minimum necessities of life for a farm population consisting of 36,000 farm operators and their families and the full-time equivalent of 21,000 farm laborers and their families. In addition to those whose livelihood is directly dependent upon farming, the area gives rise to the support of 24,000 persons in surrounding towns whose income is derived

from crafts, trade, professions, services, and similar activities dependent upon farm production in the area. Thus, for approximately every 2.5 persons supported directly by farming, the Valley indirectly provides a livelihood for at least one additional person and the overall population which is more or less dependent upon farming is about 81,000. **

Under proposed development, subsistence-type farms are anticipated, which will provide for maximum use of family labor. The irrigated cropland per farm should be about 15 donums of Class 1 and Class 2 lands or about 26 donums of Class 3 land. Full use of the entire irrigable area of 400,600 donums of Class 1 and Class 2 lands and 103,600 donums of Class 3 land would support about 160,000 farm operators and their families on approximately 30,700 units. On the basis of the existing ratio of farm and dependent population, 2.5 to 1, secondary industries created by the project would support at least 64,000 people. In view of proposed local processing (cotton, vegetable canning, sugar beets, oilcrops) and increased attention on marketing and agricultural advisory services, it seems likely that the secondary population supported by the project would exceed this number. Table 8.3-1, Estimated Full Time Equivalent Population Capacity, presents a conservative summary of the anticipated changes in population of the project and nearby towns. The overall expansion of 143,000 persons represents an increase of 177 percent in population capacity which could be brought about by the proposed plan of development.

Table 8.3-1

Estimated Full Time
Equivalent Population Capacity

Source of Population	Present Population	Anticipated Population Increase	Anticipated Population Total
Farm	57,000	103,000	160,000
Secondary	24,000	40,000	64,000
Total	81,000	143,000	224,000

Reduction in Relief Rolls

The United Nations, through U. N. Relief and Works Agency for Palestine Refugees, reports that the annual cost of relief in Jordan including all relief services, (basic subsistence, shelter, medical services, welfare services, and administrative expenses) is $12 million. This amounts to about $130 annually per eligible refugee family and is so low that it must be supplemented by wages from at least part-time employment or relief from other organizations to bring the total income to around $250 annually per refugee family. While it is true that the low level of relief set by U.N.R.W.A. operates as an incentive for refugees to seek employment, it also has a depressing effect on wages, particularly those of the mass of unskilled workers. From this it appears that any development which removes a substantial number of workers from the relief rolls and places them on an economic footing would also register a favorable influence ultimately on employment and wages of labor in general. The absorptive capacity of the project, therefore, is of key interest with respect to anticipated mitigation of unemployment and relief.

It has been estimated that 30,700 farm units in the project could ultimately provide for 143,000 additional persons either on farms

or in other employment arising from farming operations. If these additional persons are drawn from the refugee population, one of the first impacts would be a reduction in the need for direct relief. With the present annual rate of expenditure at $24 per capita, relief expenditures could ultimately be reduced by about $2.5 million as a result of project resettlement and by another $1 million through the placement of refugees in secondary employment arising from the expanded farm operations. Immediate reduction in relief would result from employing refugees in constructing the project.

Increased Food Production

A vital contribution to "real" benefits is the large increase in food supplies which could be brought about through irrigation and intensive cultivation of project land. With the exception of employment created by project construction, probably no other benefit would be more immediate or tangible.

Perennial shortages in home-grown staple food supplies have reached very serious proportions during recent years. Occasional surpluses such as those reported for wheat and barley following the good harvest of 1954 are due chiefly to lack of storage space for cushioning temporary market gluts. The trend in food shortages is manifested by the net imports of certain staple products. This situation is represented by the statistics abstracted from annual reports of the Ministry of Economy presented in Table 8.3-2 which follows:

Table 8.3-2

Trade in Staple Foods
and Other Essentials

Item	1950	1951	1952	1953
	(thousand metric tons)			
Sugar	- 15	- 14	- 14	- 19
Rice	- 8	- 5	- 9	- 8
Wheat and Flour	+ 4	- 84	- 54	- 60
Oils and Fats	+ 1	- 3	- 2	+ .5
Dates	- 2	- 24	- 14	- 10
Fruits and Vegetables	+ 6	+ 12	+ 25	+ 16
Livestock 1/	- 1	- 37	- 72	-130
Hair and Wool	- 1	+ 1	+ .4	+ .3
Cotton Goods	- 2	- 1	- 2	- 2

1/ Thousand head except for 1950, which represents metric tons live weight.

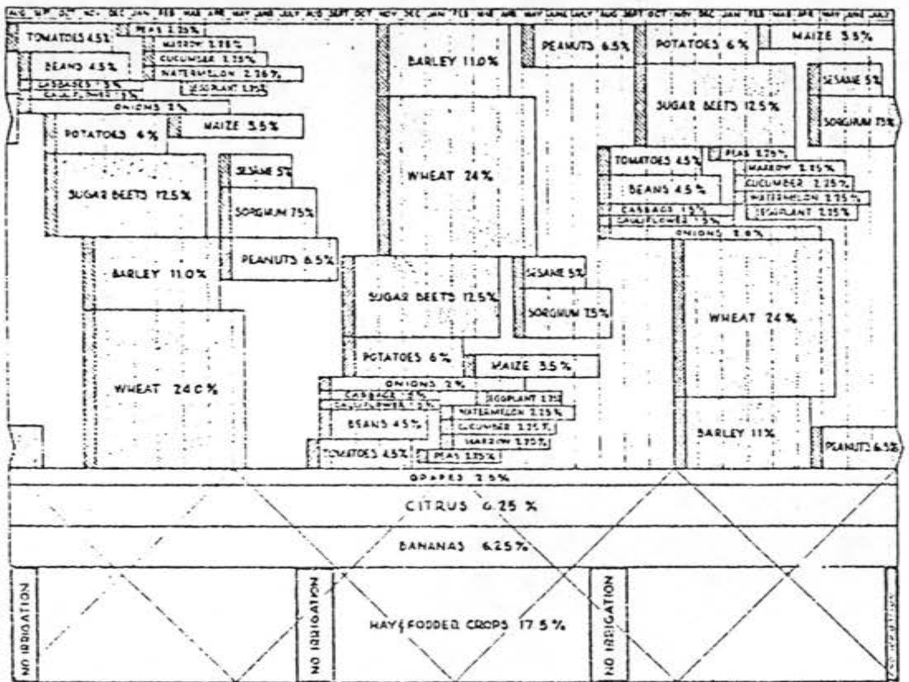
Note: - denotes net import
+ denotes net export

A general idea of the potential of the project in relieving food shortages is afforded by comparing the 1953 production, the only year for which data are available, with the estimated production resulting from cropping programs along the lines suggested by cropping patterns in Drawing DS-5-5. Table 8.3-3, Estimated Production of Food, presents these comparisons.

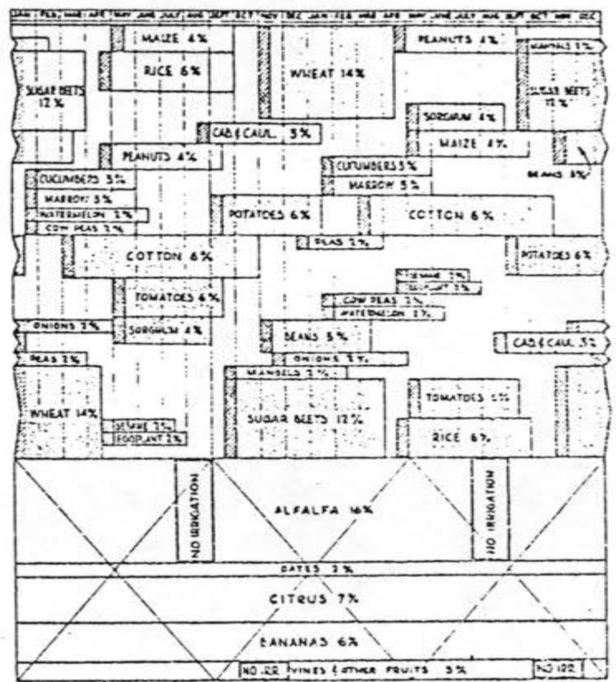
Table 8.3-3

Estimated Production of Food

Food Crops	1953 Cropping	Potential Cropping Pattern A	Potential Cropping Pattern B
	(production in metric tons)		
Sugar (refined)	-	29,300	28,200
Rice (un-milled)	-	-	11,500
Potatoes (rice substitute)	2,300	45,400	45,400
Wheat (un-milled)	12,600	23,000	13,400
Oils and Fats (refined)	320	4,600	3,200
Dates	100	-	12,100
Fruits and Vegetables	31,000	363,100	430,000
Totals	46,320	465,400	543,800



Cropping Pattern A — Based on 3 year rotation. Developed by UNRWA Agricultural Economist



Cropping Pattern B — Based on 2 year rotation. Developed by Baker-Harza incorporating tentative data from representatives of the Jordan Govt

IRRIGATION AND DIVERSION REQUIREMENTS (Cropping Pattern A)

		UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
NORTHERN	IRRIGATION REQ.	M³/DONUM	19	33	70	99	119	103	81	49	71	81	62	32	819
ZONE	DIVERSION REQ.	M³/DONUM	30	51	107	152	183	156	126	75	109	125	95	49	1260
SOUTHERN	IRRIGATION REQ.	M³/DONUM	64	81	107	200	123	107	84	50	70	82	80	84	1032
ZONE	DIVERSION REQ.	M³/DONUM	99	124	165	253	189	165	150	77	108	126	123	129	1588

IRRIGATION AND DIVERSION REQUIREMENTS (Cropping Pattern B)

		UNIT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
NORTHERN	IRRIGATION REQ.	M³/DONUM	16	25	59	76	112	125	108	36	95	77	49	26	856
ZONE	DIVERSION REQ.	M³/DONUM	25	45	91	117	172	189	166	132	146	118	75	40	1316
SOUTHERN	IRRIGATION REQ.	M³/DONUM	53	67	91	76	116	129	112	56	94	78	59	69	1042
ZONE	DIVERSION REQ.	M³/DONUM	82	104	140	117	178	198	172	132	145	120	106	106	1602

LEGEND

- AREA UNDER IRRIGATION
- AREA UNDER PREPARATORY TILLAGE
- FALLOW LAND
- CONTINUATION OF CROP
- PERMANENT CROP

THE COOPERATIVE DEPARTMENT FOR WATER RESOURCES DEVELOPMENT
HASHEMITE KINGDOM OF THE JORDAN

JORDAN VALLEY PROJECT — MASTER PLAN

DIVERSION REQUIREMENTS FOR
SPECIFIC CROPPING PATTERNS

MICHAEL BAKER JR. INC.
HARZA ENGINEERING COMPANY

ROCHESTER PENNA. | REVISED 3-55 | DWG NO. DS 5-5

DS-5-5

The contribution of the project toward relieving national food shortages is large, amounting to about 420,000 tons for Pattern A, and 497,000 for Pattern B; an overall increase in food of about 10 fold is indicated by these data, in addition to expanded supplies of animal products not included in the estimates.

Balance of Trade

Previous sections of this report have established the relationship between large deficits in balance of trade which have occurred particularly during recent years and the fact that over one-third of the unfavorable balance is due to net imports of common items of food and clothing. By providing greater local supplies of these essentials, the project will open the way for greatly reduced imports of some items and for exports of others so that overall improvement in foreign trade balance may be obtained. For example, if the project had been in full production during the period 1950-53, local supplies of such staples as rice, sugar, oils and fats would have been more than enough to offset the total imports of these items. A large reduction in importation of dates and smaller reductions in cotton goods, livestock and wheat would also have been possible, resulting in an overall decrease in imports of these items amounting to about $6.6 million annually, according to Table 8.3-4, Reduction in Import of Certain Commodities.

In addition to the reduction of imports, certain items such as fruits and vegetables, and even sugar and rice could have been exported, assuming that consumption of these items remained the same as in 1950-53. The "real" benefit from the increased production would be in the greater supplies of locally grown foods available for providing better diets for the present population, with additional provision for a rapidly increasing

Table 8.3-4

Reduction in Import of Certain Commodities
Annual Average Trade for the Period 1950-53

Item	Deficit Without Project 1/ (Tons)	Deficit Without Project 1/ (Thousand Dollars)	With Cropping Pattern B: Production Increase (Tons)	With Cropping Pattern B: Surplus (Tons)	With Cropping Pattern B: Deficit (Tons)	Net Reduction (Tons)	Net Reduction (Thousand Dollars)
Rice	7,500	1,550	11,500	4,000	-	7,500	1,550
Wheat and Flour	48,500	3,840	700	-	47,800	700	60
Cotton Goods	1,750	3,000	700	-	1,050	700	1,200
Oils and Fats	870	280	3,600	2,730	-	870	280
Sugar	15,500	2,660	28,200	12,700	-	15,500	2,660
Livestock	2,000	790	500	-	1,500	500	200
Dates	12,500	670	12,000	-	500	12,000	650
TOTAL	88,620	12,790	57,200	19,430	50,850	37,770	6,600

1/ Converted from reports of Department of Statistics, Ministry of Economy.

population. The capacity for sugar production, for example, is sufficient for many years in the future.

Farm Benefits

Farm or irrigation benefits consist of increases in the level of family living and greater net cash income as a result of the project. For all practical purposes, these benefits are identified with the estimated dollar increase in net farm income of all project land.

Farm budgets which were prepared for the analysis of farm sizes were also used in the estimate of farm benefits by projecting the information shown in the budgets to the total areas of land, by classes, for the main geographic subdivisions and for the entire project. Net benefits are identified as the difference between net farm income "without" and "with" the project.

Without project development, annual net farm income, including components for family living and interest on private investment, is estimated to be $725,000 for the entire project area, or an average of slightly less than $190 for each of the 3825 farms represented. Operation of the project is expected to provide a total annual net income estimated at $15,950,600, or about $519 per farm for the 30,700 farm units anticipated. Since the annual cost of housing development is not included in either private or project costs, its rental value should not be included in family living for estimation of benefits. The sum of $1,713,600, representing the equivalent rental value of housing development, is therefore subtracted from the total anticipated annual net income, leaving a residual of $14,237,000. Annual net irrigation benefits, represented by the difference between net farm income "without" and "with" the project, are therefore valued at $14,237,000 minus $725,000,

or $13,512,000. Farm benefits are summarized by geographic subdivision in Table 8.3-5, which follows.

Table 8.3-5

Estimated Annual Net Irrigation Benefits

	East Ghor North (dollars)	East Ghor South (dollars)	West Ghor (dollars)	Total Project (dollars)
Net Farm Income				
"With" Project	4,911,100	5,216,400	4,109,500	14,237,000
"Without" Project	512,000	150,000	63,000	725,000
Net Irrigation Benefits	4,399,100	5,066,400	4,046,500	13,512,000

Other Benefits

Damages to roads, bridges, agricultural land and growing crops are known to occur within the zor during periods of flooding. Bank erosion by flood flows periodically removes good cropland; the approaches to highway bridges are commonly subject to erosion so that highway maintenance becomes an increasing problem. For example, a section of the Amman-Jericho road near Allenby Bridge required extensive repairs following flooding conditions in February, 1954 and growing crops were destroyed by the same flood. Benefits, both tangible and intangible in nature, are anticipated from reduction in flood flows of the Jordan River by operation of irrigation storage features of the project. Ponding resulting from high water is a major factor in the incidence of malaria; health authorities recognize the beneficial effect which reduced ponding would have on the control of this disease.

Indirect tangible benefits in the form of increased taxes will accrue for the support of public services. Increased farm taxes, based on present levy rates, are estimated as the difference between present taxes and those after the project is developed, an increase of over

$1.6 million annually. Indirect benefits will also result because of increased profits of wholesalers, retailers, processors, transporters, and others who handle the increased volume of farm products and supply the increased goods and services required for farm operations and family living.

Intangible benefits elude adequate description. The provision of opportunities for productive labor and self-support would have far-reaching effects on the moral fiber of a people which now reels toward decadence and despair. Allied effects on family organization and incentives for responsible citizenship are equally worthy purposes to be served by the proposed plan of development.

No monetary value for these additional benefits has been included in the analysis of benefits and costs.

Costs

Private (farm or non-project) costs include farm operating expenses and farm investment which were considered in the farm budgets in arriving at the annual net farm income or direct irrigation benefits of the project. When compared on a similar time basis, net irrigation benefits and project costs constitute a measure of economic feasibility of the plan of irrigation development. It is recognized that this measure, commonly called benefit-cost ratio, is separate and distinct from plans for financing, amortizing or otherwise repaying the costs which may be considered reimbursable by irrigators or other project beneficiaries. Project costs include all construction costs, as well as the costs of operating, maintaining and replacing features required to provide continuing water service, for, and adequate drainage of the irrigable lands.

Cost of Construction

Construction costs of irrigation features include the costs of the Khalid Dam and Reservoir on the Yarmouk River as required for a capacity of 47,000,000 M^3, Adasiye Diversion Dam, Tiberias Features, all canals, laterals, pumping plants, drains, farm unit development and general property. For purposes of comparing the benefits and costs of respective major geographic subdivisions, the construction costs were distributed among these subdivisions on the basis of the area served by each feature and the applicable annual diversion requirement. Costs of features designed to serve only one major subdivision are classed "specific costs", and those such as for the Yarmouk Dam and Reservoir which are to serve more than one subdivision are termed "joint costs". Total estimated construction cost of all project features serving irrigation is $108,719,600. Table 8.3-6, Estimated Cost of Construction of Irrigation Features, summarizes project costs distributed among major geographic subdivisions.

Table 8.3-6

Distribution of Irrigation Construction Costs
Among Geographic Subdivisions

	East Ghor North (dollars)	East Ghor South (dollars)	West Ghor (dollars)	Total Project (dollars)
SPECIFIC COSTS				
Laterals	5,526,500	6,466,100	4,099,200	16,091,800
Pump Laterals and Wadi Extensions	5,507,900	4,250,400	8,007,800	17,766,100
Drains	3,773,800	3,172,300	2,185,800	9,131,900
Farm Unit Development	4,165,000	5,799,000	4,943,000	14,907,000
West Ghor Main Canal	—	—	9,377,200	9,377,200
East Ghor South Main Canal	—	5,210,100	—	5,210,100
Sub-Total	18,973,200	24,897,900	28,613,000	72,484,100

Table 8.3-6 (Cont'd)

Distribution of Irrigation Construction Costs
Among Geographic Subdivisions

	East Ghor North (dollars)	East Ghor South (dollars)	West Ghor (dollars)	Total Project (dollars)
JOINT COSTS				
Yarmouk Dam and Reservoir	3,257,400	4,437,900	3,654,700	11,350,000 1/
Adasiye Diversion Dam	331,500	451,600	371,900	1,155,000
East Ghor North Main Canal	2,556,800	3,483,300	2,868,500	8,908,600
General Property	521,800	710,800	585,400	1,818,000
Railroad Relocation	287,000	391,000	322,000	1,000,000
Tiberias Features	3,445,100	4,693,500	3,865,300	12,003,900
Sub-Total	10,399,600	14,168,100	11,667,800	36,235,500
TOTAL COST	29,372,800	39,066,000	40,280,800	108,719,600

1/ The cost for the Yarmouk Dam and Reservoir is the estimated cost of the Khalid Dam which provides for 47 MCM of storage at spillway elevation -40. Equivalent storage at a lower cost could be provided as a component of a multiple use storage reservoir if the costs were allocated among the several uses. Therefore the cost of $11,350,000 used in this analysis is considered the maximum estimated allocation to irrigation.

Annual Cost of Operation

It is planned that the project will be operated as one unit with one general supervisor and one central office, to provide most efficient operation and maintenance. Overhead costs, equipment purchases and supervisory personnel can thereby be held to a minimum. Within this general organization, facilities are anticipated for the segregation of actual field operations by natural geographic sections, in recognition of diverse requirements of individual areas.

Engineers' estimates of annual costs include operation, maintenance and replacement of replaceable items during a 100-year period of project analysis. The estimates are based upon methods developed

by the United States Bureau of Reclamation and reflect the experience of that agency and cooperating irrigation districts in operating similar features. A summary of the annual estimated cost, $1.86 per donum based on 1954 prices, is presented in Table 8.3-7, Summary of Annual Costs of Operation, Maintenance and Replacement. Additional information with respect to these estimates is included in the supplementary information of this part of the report.

Period of Analysis

The expected useful life of major project features is 100 years. The estimate of operation and maintenance costs provides for reserves to be accumulated for necessary replacement of property items as required during a 100-year period. Although operation of the project may exceed 100 years, economic analysis is limited to that period due to the low present worth of remote benefits accruing beyond 100 years. As the annual irrigation benefit will not be fully realized until after possibly 20 years or more of extension-type agricultural education, the benefits are reduced to an annual equivalent somewhat less than that of full immediate annual benefits, by application of a development period factor of 0.790.

Since the amount of expenditure contemplated for constructing this project has alternative opportunities for earning $2\frac{1}{2}$ percent interest in comparable long-term investments, that rate of interest is applied where appropriate as part of the overall financial cost of this project. The elapsed time between initiation of construction and the first delivery of water for each of the major subdivisions is estimated to be 6 years, although construction of all features will extend over a much longer period. Interest at $2\frac{1}{2}$ percent annually is applied to the average

Table 8.3-7

Summary of Annual Costs of Operation,
Maintenance and Replacement

Feature	Construction Cost	Operation	Maintenance	Total O & M
Khalid Dam and Reservoir	11,350,000	2,000	4,495	6,495
Adasiye Diversion Dam	1,155,000	2,000	1,137	3,137
Pumping Laterals and Wadi Extensions	17,766,100	17,186[1/]	18,700[1/]	35,886
Canals	23,495,900	5,731	58,740	64,471
Laterals	16,091,800	106,294[2/]	75,295[2/]	181,589
Drains	9,131,900	--	68,489	68,489
Farm Unit Development	14,907,000	--	--	--
General Property	1,818,000	--	10,551	10,551
Railroad Relocation	1,000,000	--	--	--
Tiberias Features	12,003,900	3,120	26,978	30,098
Sub-Total, O & M	108,719,600	136,331	264,385	400,716
General Expense		4,500	8,000	12,500
Energy		340,026	--	340,026
Replacement		--	186,412	186,412
Total Operation, Maintenance and Replacement		480,857	458,797	939,654
Cost per Donum (Wadi Fari'a area not included)				$1.86

1/ Estimated costs for pumping plants only
2/ Estimated costs for entire distribution system

Pumping Plants - Class .03. With the assumption that the duties of operating personnel will include other functions on the project, operation of pumps, except for power, is estimated to be $1.80 per KW or $1.35 per H.P.

Canals - Class .05.

Capacity M^3/sec.	Operating Cost per Kilometer
25 or more	$ 56
20	48
16	42
12	35
8	29
4	22

Distribution System - Class .06.

$ 4.66	per kilometer of canal or lateral
.0625	per net irrigable donum
2.50	per turnout or control structure

Basis for Estimates of Maintenance Costs

Annual maintenance costs were estimated from varied percentages of feature construction costs, as tabulated below:

Class	Feature	Percent of Constr. Cost
.01 & .02	Storage and Diversion Dams	
	Features not requiring replacement	0.02
	Features requiring replacement	1.00
.03	Pumping Plants	0.50
.05	Canals (concrete lined)	0.25
.06	Distribution System (all canals and laterals concrete lined)	0.25
.07	Drains	0.75
.15	General Property	
	Residences	2.00
	Other Buildings	1.00
	Storage Yards	0.50
	Communications Equipment (lump sum)	
	Fixed Radio Stations	$150 each
	Relay Radio Stations	200 each
	Mobile Radio Units	85 each

Power for Pumping

Power for pumping was estimated on the required motor capacity in kilowatts. The estimated annual energy requirement for the nine pumping plants proposed, based upon demand in an average year, is 22,668,400 kilowatt-hours. Pumping energy costs were calculated at the rate of $0.015 per kilowatt-hour. In the event that sufficient electrical energy to handle this load cannot be distributed competitively on the project, or cannot be made available from other sources, the costs of pumping with Diesel engines would closely approximate the figure used.

Replacement Reserve

The reserves to be accumulated for necessary replacement of various property items at the end of their periods of usefulness were determined on a 100-year, 2½ percent sinking-fund basis from the percentage of the respective cost of each item considered as replaceable and the estimated average life. Reserves required for replacement of works are summarized in Table 8.3-9.

Basis for Economic Analysis

In general, procedures in use by the United States Bureau of Reclamation and those recommended by the Federal (U.S.) Inter-Agency River Basin Committee in "Proposed Practices for Economic Analysis of River Basin Projects", May, 1950, were employed in the economic analysis.

In brief, these procedures provide that major weight be given to the benefit-cost ratio as a measure of project feasibility, except in unusual circumstances in which vital public non-monetary and intangible interests are involved.

Unusual economic and social circumstances around which this project was conceived made it appear appropriate to modify the usual

Table 8.3-9

Estimated Average Annual Depreciation Costs
of Replaceable Items
Sinking Fund Method - 2½% Interest, 100 Years

Feature	Estimated Cost	Replaceable Items %	Replaceable Items Cost	Useful Life, Years	Sinking Fund Factor	Annual Amount for Replacement
Khalid Dam and Reservoir	$ 11,350,000	2	227,000	50	.0102581	$ 2,329
Adasiye Diversion Dam	1,155,000	8	92,400	50	.0102581	948
Pumping Plants	3,740,000	30	1,122,000	50	.0102581	11,510
Canals	23,495,900	12	2,819,500	50	.0102581	28,923
Laterals 1/	30,117,900 1/	14	4,216,500	50	.0102581	43,253
Drains	9,131,900	30	2,739,600	35	.0182056	49,876
Farm Unit Development	14,907,000	-				-
General Property	(1,818,000)					
Structures and Improvements	529,800	50	264,900	50	.0102581	2,717
Office Furniture and Equipment	9,700	100	9,700	30	.0227776	221
Transportation Equipment	170,100	100	170,100	15	.0557665	9,486
Stores Equipment	24,300	100	24,300	35	.0182056	442
Shop	25,900	100	25,900	25	.0292759	758
Tools and Work Equipment	596,500	100	596,500	30	.0227776	13,587
Communications	461,700	100	461,700	35	.0182056	8,406
Railroad Relocation	1,000,000	-				-
Tiberias Features	(12,003,900)					
Regulating and Control Works	2,000,000	8	160,000	50	.0102581	1,641
Canals	10,003,900	12	1,200,468	50	.0102581	12,315
TOTAL	$108,719,600					$186,412

1/ Complete distribution system

procedure in economic analysis to the extent of giving primary emphasis to those project effects which are anticipated to accomplish most toward relieving population pressure, unemployment and other similar maladjustments of the existing economy.

Another variation in the usual procedure, made necessary because of lack of data, involved the substitution of current prices in estimates of future operation, maintenance, and replacement costs and benefits, rather than the preferred method of employing estimated long-term prices based on future price levels.

The benefit-cost analysis is based on the estimated construction cost of all irrigation features exclusive of some of the costs of relocating existing property and for acquiring land and land rights required for constructing certain project features. The addition of these costs could be counteracted by a reduction in the costs assignable to storage through allocation to other components of a multi-purpose storage reservoir. It is felt, therefore, that the benefit-cost ratio of 2.58:1 is substantially a correct presentation of the economic feasibility of the project.