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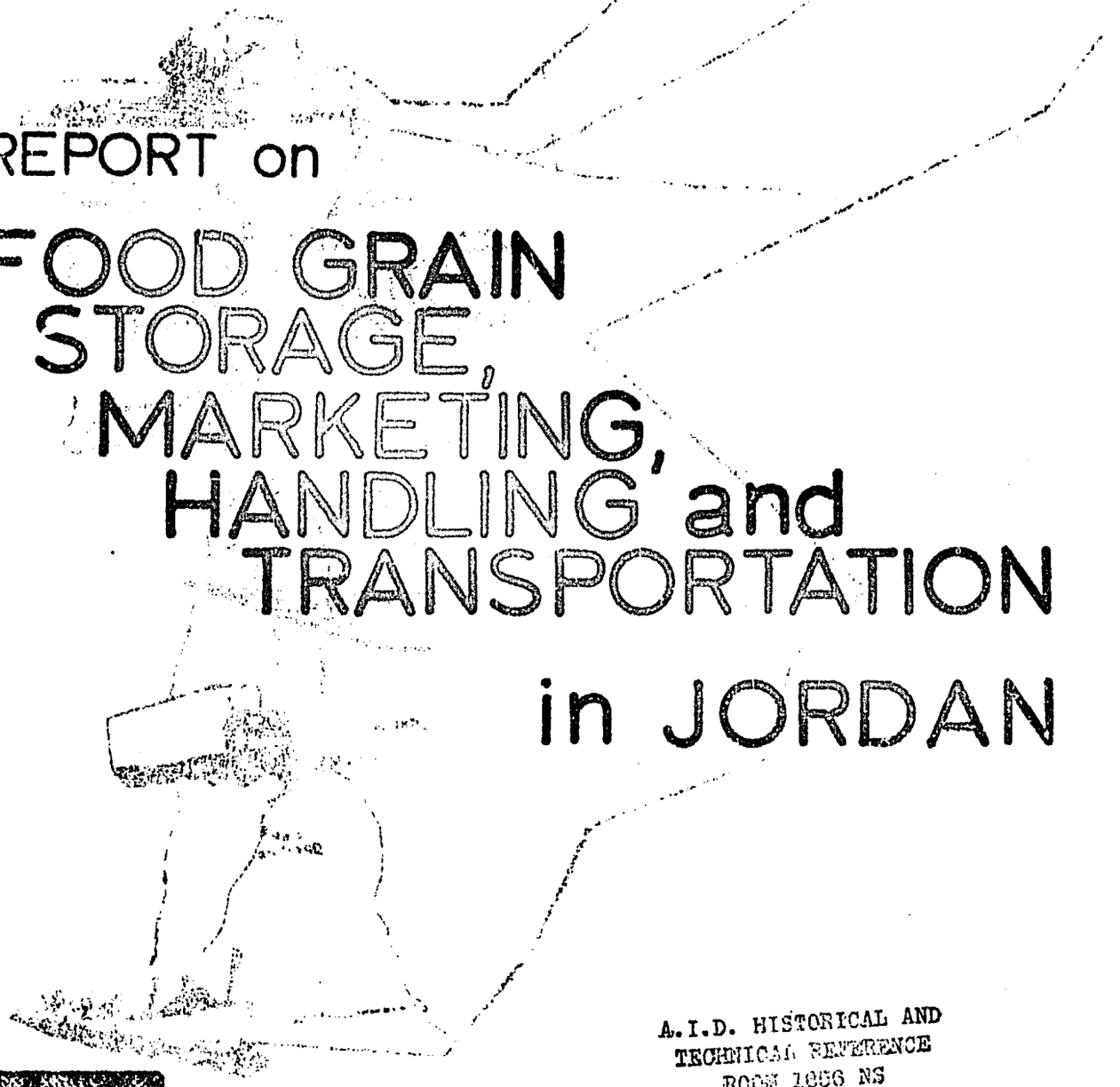
JULY 1968

REPORT on

FOOD GRAIN STORAGE, MARKETING, HANDLING and TRANSPORTATION in JORDAN



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Preface

The Hasemite Kingdom of Jordan, a country whose grain economy has been dependent on rainfall, may soon have the potential for being self sufficient in production. This self sufficiency may be realized through development of cultural and chemical techniques to increase production on existing dry land and irrigated areas.

Increased production requires increased and more efficient storage, improved handling and transportation methods, and a marketing and storage program to provide a constant consumable supply of grains at stable prices.

The initial study reported here was conducted after the Arab-Israeli conflict of June 1967. As a result of this conflict the West Bank of Jordan is now Israeli occupied. Storage within the West Bank of Jordan was not examined and for this reason is not discussed in this report.

It is difficult to accurately appraise the effect of the 1967 conflict on dispersion of the population, consumption and future food grain requirements. For the most part in this report, per capita consumption data and rates of population increase are based on data for East Bank and West Bank of Jordan combined. Population estimates are rough, but based on best available information for the East Bank of Jordan.

Present food and storage requirements are based on estimates for East Bank of Jordan only. Future political developments in Jordan may require a reevaluation of the overall grain situation.

I would like to express my appreciation to members of the AID Mission in Jordan and officials fo the Jordanian Government and acknowledge the assistance I received during my visit to Jordan. All were extremely helpful in supplying data and arranging visits to private and government storage sites and the Port of Aqaba. Special thanks are expressed to:

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GRAIN STORAGE, MARKETING, HANDLING, AND TRANSPORTATION IN THE HASHEMITE KINGDOM OF JORDAN JULY 4-18, 1968

I. INTRODUCTION

The purpose of this report is to outline the current status of grain storage, marketing, handling and transportation in the Hashemit Kingdom of Jordan and to make recommendations for further investigations into certain areas of the grain storage system. In addition, recommendations for modification of certain storage, marketing, handling and transportation practices are made which it is felt will reduce losses of both domestically produced and imported grains.

USAID/Jordan has outlined certain areas of the grain storage, handling, marketing and transportation systems within Jordan which they feel require modification and/or change to resolve problems associated with the systems. Included are (1) inefficient handling of grain throughout all phases of storage and transportation (2) inadequate storage capacity in farm, commercial and government sectors (3) inadequate terminal facilities (4) ineffective marketing system and (5) lack of pure seed laws.

USAID/Jordan requested services of one man for 8-10 weeks to assist in the resolution of the above listed problem areas. To adequately cover the areas outlined in the request would require a complete economic feasibility study of the grain production, storage, handling, marketing and transportation systems in the Hasemite Kingdom of Jordan. On the basis of past experience, studies of this magnitude have required from 6 to 10 individuals working 3 to 6 months with local counterparts and accounting firms to provide the required information for proper solution of the problem. In view of the above, it was felt that an examination of the grain storage situation by a member of the Kansas State University team working under a contract with AID/Washington on Problems of Grain Drying, Storage, Handling, Marketing and Transportation would provide a basis for pin-pointing areas for intensive study, providing immediate resolution to certain problems and generally outlining a program for developing improved grain storage, handling, marketing and transportation.

With this goal in mind, I have spent 14 days in Jordan observing grain storage, handling, marketing and transportation systems, and have formulated the recommendations itemized in the following paragraph. A complete discussion of conditions which prompted these recommendations are contained in the body of this report.

II. SUMMARY

Although present storage capacities were sufficient for the current years' production, additional storage will be required for high rainfall years and if proposed production increases are realized.

A problem of immediate concern is the proper use and maintenance of existing storage facilities both in the government and private sectors. Improper management of grain in storage is responsible for losses due to deterioration, insects and rodents.

An improved marketing system and storage program are necessary if prices are to be stabilized and an adequate stock of food grains maintained.

III. RECOMMENDATIONS

A. A program should be established to inform and advise individuals, both in the private and government sectors involved in grain storage, in methods of proper management of grain in storage. (See section on grain management in storage). There is a lack of knowledge and personnel trained in these methods in both sectors. First efforts toward improving storage conditions should be directed to government and flour mill storage. These two groups account for over half of the market storage capacity in Jordan and represent only a small number of individuals with which to work.

Greatest reduction in losses would be realized in these two areas since they are sole handlers of imported grains. Imported grains generally contain higher moisture content than locally produced and harvested grains and are thereby subject to more hazardous storage.

The next largest group (in capacity) is the grain dealers. Information on proper grain storage methods could best be disseminated through a grain dealers organization. I am not aware of such an organization in Jordan. This group would probably be difficult to reach for this reason.

Farmers who store grain can be reached through the Ministry of Agriculture's Extension Department, reported to be the largest unit in the Ministry.

The Food and Feed Grain Institute, Kansas State University can, through the Technical Assistance program in Food Grain Drying, Storage, Handling, and Transportation, supply information and assistance in establishing an information program on proper methods of management of grain in storage. Infor-

mation and assistance can be supplied through printed materials or through training sessions held in Jordan for individuals responsible for storage in government and private sectors.

A cooperative program also exists between AID and USDA in International Training whereby individuals from countries, such as Jordan, visit the United States on an organized training basis to study grain marketing, storage and handling procedures.

B. Metal silos at Government of Jordan storage sites should be placed in use for grain storage. A proposal has been submitted to equip metal silos with aeration and temperature monitoring equipment. (See Kansas State University, Food and Feed Grain Institute Report, "A proposal to Equip Metal Silos in Jordan with Aeration and Temperature Monitoring Equipment" August 1968.) This proposal is in two stages. First, to equip three silos on a demonstration basis and second, to equip remaining existing silos with similar equipment. This would put in use 35 existing silos with combined bulk capacity of 3500 metric tons. Between 40 and 50 silos remain unassembled at Ruseifa. If assembled and equiped as proposed, they would provide an additional 4000 to 5000 metric tons of bulk storage.

C. An unloading facility at Port of Aqaba should be given further consideration. The short term bulk grain scheme proposed by Rendel, Palmer, and Tritton (See Appendix B) should be modified to include portable pneumatic unloading equipment for ship unloading. Grain-Vators such as used at Ruseifa and Irbid could be used. Equipment such as this would reduce the unloading time to less than half that required at present. The storage structure, if of the proper type could be used with proper management for sack or bulk storage of grain over extended periods of time. If not in use for grain, it could be used for storage of UNRWA flour or other products.

D. Bulk transport of imported grain between Port of Aqaba and Amman should be considered as a first step in the development of a bulk handling system within Jordan (See Section on Bulk Handling of Grain). Bulk transport would necessarily have to be preceded by establishment of bulk unloading at Aqaba. Bulk handling of grain at this time would only be practical in movement of imported grain to government bulk storage in Ruseifa.

A proposal to demonstrate bulk transport of grain from Aqaba to Amman was made (See Appendix C) but not accomplished because no one of authority would assume responsibility for the grain involved (roughly 40 metric tons).

E. A formal feasibility study should be made of the grain marketing, storage, handling and transportation problems of Jordan to guide the Government of Jordan and USAID/Jordan in development of a grain marketing and storage program. Such a program will be required to stabilize prices and manage proposed production increases as a result of increased use of chemical fertilizers and herbicides, bare summer fallowing and other cultural practices.

The scope of work should follow, in general, the following outline:

1. General Conditions

   a. A contractor knowledgeable in the type of study proposed should be retained to fully evaluate the grain marketing, storage, handling, and transportation situation in Jordan.

   b. The contractor should conduct this study under conditions and in the form prescribed by the current USAID Manual Order 1221.2 "Feasibility Studies, Economic and Technical Soundness Analysis, Capital Projects" with amendments. Instructions in the manual are not included here but are made a part of this recommendation by this reference.

   c. Any and all drawings submitted with the contractors recommendations and proposals shall be in sufficient detail to provide estimates of cost and to illustrate construction recommendations to professional engineers.

   d. Cost estimates and cost-benefit analysis submitted by the contractor shall be in sufficient detail to allow professional engineers and economists to fully evaluate the recommendations and proposals.

   e. Recommendations shall be made by the contractor for training of personnel required to implement and maintain his proposal.

2. Scope of Study

   a. The contractor should fully familiarize himself with present conditions of grain production, storage, marketing, handling and transportation in Jordan.

(1) This report provides an abbreviated word and pictorial picture of the present situation.

(2) Listed references of this report and any subsequant reports or compilation of statistics should also be consulted.

(3) Progress on proposed production increases should be reviewed and considered in preparation of the recommendations.

b. The contractor should determine the consumption requirements of the Jordanian population and evaluate the present and proposed production potential with respect to consumption. Emphasis should be placed on:

(1) Rural and urban per capita consumption rates.

(2) Rural and urban rates of population increase.

(3) Refugee population and its effect on the supply and demand for food grains.

(4) Diet preferences for domestically produced and imported food grains.

c. The contractor should fully evaluate the present marketing system in relation to the overall grain storage, handling and transportation situation in Jordan. Recommendations for a Government of Jordan grain marketing and storage program should be made in view of present and expected production to provide stable prices and an adequate, constant consumable supply of food grains. Within the program the contractor should:

(1) Develop an organizational structure for the administration of the program.

(2) Prepare finanical recommendations for funding the program.

(3) Evaluate the need for a price stabilization program.

(4) Recommend capacity, construction, and location of storage structures in accordance with M. O. 1221.2 necessary to maintain the program through 1975.

(5) Develop a grading system consistent with maintaining the program.

(6) Recommend training requirements for personnel who will be responsible for administration and operation of the program.

d. The contractor, in his evaluation of the marketing system, should consider the available storage in:

(1) Farms, and determine:

(a) Farm storage capacity actually available and make recommendations for improved, low cost farm storage structures.

(b) The percentage of grain production actually maintained on farms for food and seed use as compared to the amount marketed.

(c) The expected effect of a Government price stabilization program on quantity of grain stored on farms.

(2) Commercial storage, and determine:

(a) The total capacity and condition of commercial warehouse space.

(b) The percentage of capacity occupied by the various grains (wheat, barley, pulses, lentils, etc.)

(c) The expected effect of a price stabilization program on quantity of grain stored in commercial warehouses.

(d) The feasibility of the Government of Jordan leasing commercial warehouse space for a storage program.

(e) The potential for increased commercial storage.

(3) Mill storage, and determine:

(a) The total capacity and condition of mill "covered" storage.

(b) The expected effect of a price stabilization program on quantity of grain stored at mills.

(c) The feasibility of the Government of Jordan leasing mill storage space for the storage program.

(d) The potential for increased mill storage.

(4) Supply Import - Export Department (Government of Jordan) storage, and determine:

(a) The total capacity, condition and location of SIED storage

(b) The modification needed in existing storage to conform to recommendations and proposals for the storage program.

(c) The technical training required for Government of Jordan storage site supervisors and operators.

e. The contractor should determine the economic feasibility of conversion from a bag system of handling to bulk handling of grain. He should determine:

(1) The effect of bulk handling on the overall economy of the grain marketing system.

(2) Whether the basic conditions for bulk handling of grain are in existance.

(a) A farm economy able to pay for a service rather than perform it.

(b) Payment for storage profitable for the storage owner.

(c) Facilities and equipment in existance to move grain in bulk.

(d) A marketing and grading system capable of co-mingling and replacement of grain on a grade basis.

(e) Total volume large enough to justify capital expenditure for bulk handling.

(3) The adviseability of limited bulk handling of grain, in particular, imported grains.

f. The contractor should evaluate the need for a grain unloading facility and storage system at the Port of Aqaba.

If a system is recommended the contractor should prepare a proposal indicating capacities and types of equipment and structures supported by drawings and cost estimates in accordance with M. O. 1221.2.

Factors that should be considered include, but are not limited to:

(1) Projected imports of grain.

(2) Potential for grain export.

(3) Capital investment, savings, and effect on the labor force.

(4) Bulk delivery to consumption or storage points.

(5) Effect on overall Port development.

g. The contractor should evaluate the transportation facilities available and determine:

(1) Status of present modes of grain transport (roads and equipment availability).

(2) Potential for growth with respect to expected increased production.

(3) Alternative modes of transportation if bulk handling is recommended.

h. The contractor should determine the availability of personnel technically and administratively qualified to establish and maintain programs and/or operations recommended or proposed.

He should further:

(1) Recommend training necessary to provide technically and administratively qualified personnel for programs and/or operations.

(2) Prepare job descriptions and manning requirements for programs and/or operations proposed.

i. The contractor should evaluate, investigate or consider any other aspects of the economy which he deems necessary in his study, and make recommendations for improvement of grain marketing, storage, handling and transportation of grain in Jordan.

3. Tentative estimates of feasibility study manpower requirements.

a.	Project manager (Supervision and Coordination)	16 man weeks
b.	Office Manager (Accounting and Office Services)	16 man weeks
c.	Agricultural Marketing Economist	16 man weeks
d.	Economist (Production and Distribution)	12 man weeks
e.	Economist (Accounting and Cost Estimates)	12 man weeks
f.	Agricultural Engineer (Grain Handling)	8 man weeks

g.	Structural Engineer (Storage Structures)	6 man weeks
h.	Secretary	16 man weeks
i.	Driver	12 man weeks
j.	Interpreter	12 man weeks

F. An agreement exists between the Agency for International Development and Mississippi State University AID-W-607 providing technical assistance in seed processing and handling. This contract should be consulted with respect to present and required seed laws.

IV. BASIC INFORMATION ON THE HASHEMITE KINGDOM OF JORDAN.

A. Land Area.

Jordan occupies 37,700 square miles with 35,500 miles of the land areas in East Jordan (East of the Jordan River). Approximately 12% of the total area (3,000,000 acres) is used in agriculture. Ten percent of the total is cultivated and of this 75% is planted to grains, primarily wheat and barley. Eighty percent of the total land area is desert. Figure 1 shows a map outlining the major districts and cities.

B. Population.

The population in Jordan is estimated to be increasing at a rate of 3.1% per year. Population for 1966 was:

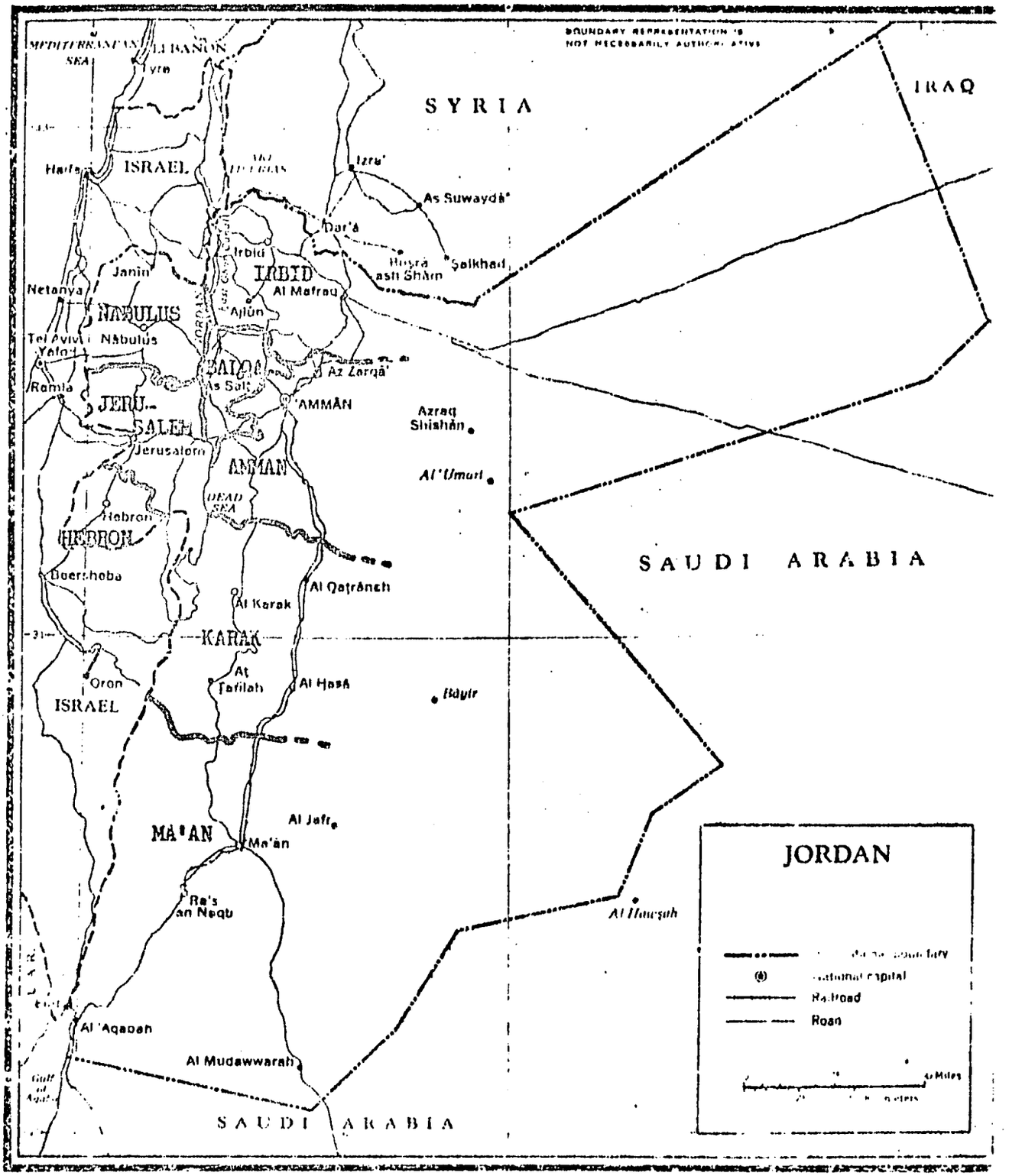
East Bank	1,118,572
West Bank	982,229
Total	2,100,801

Of the 2.1 million total approximately 700,000 were Palestinian refugees.

Since the conflict in June of 1967, populations in the various areas would be difficult to estimate. One figure given for the East Bank is 1,500,000 (1967). This figure presumably includes a majority of the rufugees (1,000,000 plus 500,000 refugees). Data supplied by Mr. Abdul Awad: AID/Jordan.

It is estimated that roughly half of the population lives in urban areas.

Figure 1. MAP OF JORDAN



C. Consumption.

Projected grain requirements of a country are generally based on per capita consumption figures. These figures in turn can be based on estimated population and total quantities of grain currently being consumed.

An average consumable supply of 274,000 metric tons of wheat (excluding seed) was calculated for East and West Bank Jordan in the years 1964, 1965, 1966 (See Table 1). Average estimated population (including refugees) for the period was 2,014,286. Using these averages, a per capita consumption of 136 kilos is calculated. It is interesting to note that Departments within the Jordanian Government do not agree on per capita consumption figures. One department uses 120 kilos and another 140 kilos per capita for planning purposes. I believe the 140 kilos per capita figure is the more accurate.

The effect of the June 1967 conflict on population, consumption, and distribution of grain and grain products has not been fully and accurately assessed. It would appear that approximately one-half of the demand for commercially milled flour was lost as a result of the loss of the West Bank Market. How much of the demand was shifted to small local mills is not known. At least part of the demand was probably shifted to supply the individuals leaving the West Bank for the East Bank after the June 1967 conflict.

D. Production.

Grain production is centered in the temperate highlands in areas where annual rainfall exceeds 200 mm. Some grain is produced in the Jordan Valley, however, the area is generally devoted to higher margin cash crops produced under irrigation. Roughly, 10 percent of the grain is grown in the valley and is harvested in May. Grain produced in the highlands is harvested in June and July.

Total production and yield are directly related to rainfall and for this reason have fluctuated considerably. Production of wheat in the East Bank of Jordan has averaged 113,107 metric tons per year over the period 1951 - 1966. In recent years with ample rainfall production has approached 225,000 metric tons.

Recent estimates by personnel from Oregon State University indicate the possibility of quadrupling dryland and doubling "wet" land wheat output. Increases would be achieved through use of chemical fertilizers and herbicides, bare summer fallowing and other cultural practices.

Production for recent years is shown in Table 2.

TABLE 1 CONSUMABLE WHEAT AND FLOUR SUPPLY FOR EAST AND WEST BANK JORDAN COMBINED *

	YEAR			
	1964	1965	1966	1967**
	(000 M.T.)			
Production	295	278	85	248
Imports:				
Wheat	16	2	20	20
Flour (Wheat Eq.)	112	87	71	72
Total Imports	128	89	91	92
Exports:				
Wheat	.3	.2	1.	--
Flour (Wheat Eq.)	3.	2.	2.	2.
Total Exports	3.3	2.2	3.0	2.0
Total Supply	420	365	173	338
Less Seed	26	22	17	20
Consumable Supply	394	343	156	318

* Data from Jordan, Department of Statistics and AID Mission.

** Estimated

Table 2. Production of Wheat, Barley, Pulses and Lentils - 1958 - 1968*

Year	Commodity					
	Wheat		Barley		Pulses	Lentils
	East Bank	West Bank	East Bank	West Bank	East Bank-West Bank Combined	
	(1000 Metric Tons)					
1957-1959 Average	103	27	31	10	5	7
1958	46	20	12	5	3	4
1959	80	24	16	10	5	4
1960	30	14	8	5	2	2
1961	103	35	44	18	5	6
1962	96	16	29	7	3	13
1963	50	26	12	12	6	4
1964	225	70	70	29	9	25
1965	224	54	73	23	4	29
1966	64	68	10	22	4	30
1967**	198	50	60	20	26	22
1968**	123	--	--	--	--	--

* Data from AID Records and Indices of Agricultural Production for the Near East, Table 12, p. 10, ERS, USDA, March 1968.

** Estimates

According to Mr. Abdul Raoaf Nabulsi, Ministry of Agriculture, the 1968 wheat production by area in East Bank of Jordan was:

Irbid	52,000 metric tons
Amman	33,000 metric tons
Balqa	8,000 metric tons
Karak - Ma'an	30,000 metric tons
Total	123,000 metric tons

Mr. Nabulsi also indicated that of the 2.2 million dunums (550,000 acres) of wheat planted, approximately 40 percent was of the variety Hurani Nawawi, 30 percent F - 8 and 30 percent other varieties including Gabo. Predominant varieties by area were:

Area	Variety
Irbid	Hurani Nawawi
Amman	F - 8
Karak	Hurani Nawawi
Ma'an	Hurani Nawawi

Any projected estimates for future production will depend on progress made in implementing chemical fertilizer and herbicide use, bare summer fallowing and other cultural practices. Recommendations for capacities and location of future storage facilities also depends on progress in increasing production.

E. Utilization.

Wheat requirements based on 140 kilogram per capita consumption are shown below for the East Bank of Jordan:

	Population			Consumption	
Year	Total	Non-Refugee	Refugee	Total	Non-Refugee
1961	905,000			127,000 M.T.	
1962	922,000			129,000	
1963	945,000			132,000	
1964	1,026,000			144,000	
1965	1,077,000			150,000	
1966	1,119,000			157,000	
1967	1,500,000	1,000,000	500,000	210,000	140,000 M.T.
1968*	1,545,000	1,030,000	515,000	216,000	144,000
1970*	1,639,000	1,093,000	546,000	230,000	153,000
1975*	1,900,000	1,267,000	633,000	266,000	177,000

* Based on 3 percent average increase in population

Of the 1,500,000 population estimated for East Bank of Jordan in 1967, probably 500,000 are Palestinian refugees who are supplied flour and other food products by UNRWA. This leaves approximately 1,000,000 persons in the East Bank of Jordan to be supplied by locally produced or imported wheat and wheat products.

Wheat requirements for the present estimated population would be about 144,000 metric tons. According to FAO Production Yearbook 1966 data, roughly 50 percent of the population is agrcultural. Although, exact consumption patterns are not known it is assumed that roughly half of the food grain is consumed by each half of the population.

In addition to food use, an average of 19,000 metric tons of wheat is used as seed annually.

An average of 5,300 metric tons of barley are used annually for seed. That portion of the average barley production of 40,000 metric tons which is placed in distribution is unknown. Most of the production is probably maintained on farms as seed or for human and animal food.

F. Climate

Jordan has three general climatic areas. The highland region, on the east side of the Jordan River Valley, has a temperate climate with rain fall concentrated in the winter months. The Jordan Valley has a tropical climate while the desert regions of eastern and southern Jordan have an arid climate.

Major grain production is centered in the eastern highlands and is directly related to the annual rainfall in Jordan. Roughly, the grain producing areas are confined to rainfall areas of 200 mm (7.9 inches) or more as shown on the map in figure 2. The relationship between grain production and rainfall for the two major grain producing areas is shown in Table 3.

Rainfall, concentrated in the winter months, is shown in Table 4 for two major wheat producing areas .

Figure 2. ISOHYETS OF 30 YEAR AVERAGE ANNUAL RAINFALL 1931 - 1960.

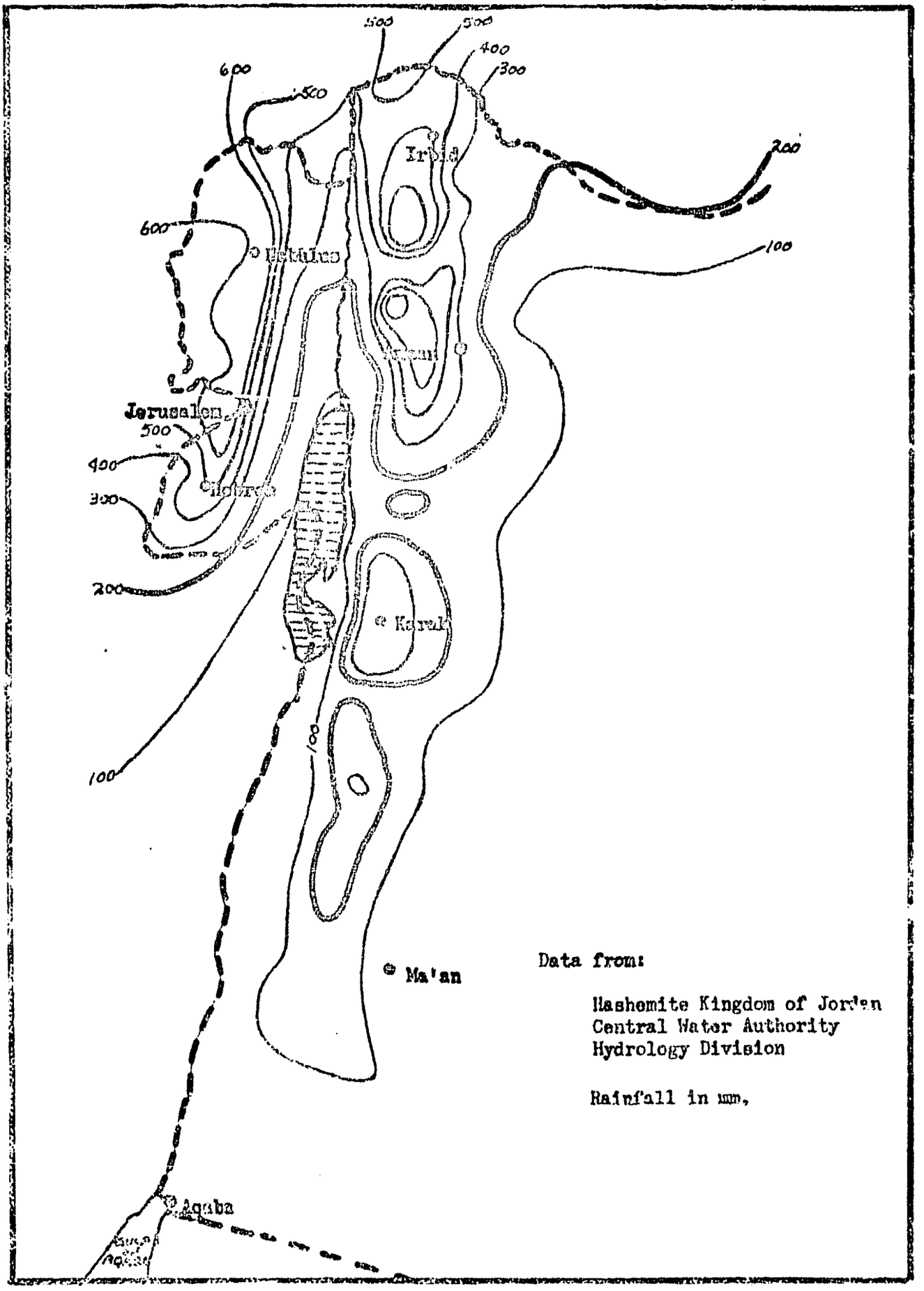


Table 3 RAINFALL AND WHEAT PRODUCTION IN TWO AREAS, 1951-1967*

	Amman		Irbid	
Year	Rainfall (mm)	Wheat Prod. (M.T.)	Rainfall (mm)	Wheat Prod. (M.T.)
1951	209.2	19,783	312.0	9,419
1952	428.0	51,624	685.0	71,437
1953	297.5	13,609	654.2	44,735
1954	438.7	47,621	375.5	90,365
1955	220.6	10,463	250.7	27,848
1956	408.8	51,152	641.3	74,010
1957	623.7	36,555	343.8	74,705
1958	280.8	6,976	322.0	30,184
1959	275.1	26,500	209.3	23,829
1960	172.1	5,168	212.7	10,769
1961	346.6	39,274	368.5	26,594
1962	309.8	29,657	520.8	45,470
1963	161.4	6,023	373.6	36,673
1964	480.1	66,844	519.9	71,949
1965	406.2	69,527	465.3	81,353
1966	289.2	15,787	389.6	29,348
1967	662.5	62,813	732.5	81,390
Average	334.2		415.3	

* Data from records supplied by AID/Jordan

Table 4 RAINFALL FOR TWO MAJOR WHEAT PRODUCING AREAS *
(16 year averages)

	Amman		Irbid	
Month	mm	Inches	mm	Inches
October	4.1	0.2	14.5	0.6
November	30.8	1.2	44.0	1.7
December	75.8	3.0	92.5	3.6
January	74.8	2.9	84.0	3.3
February	81.2	3.2	90.3	3.6
March	46.5	1.8	79.3	3.1
April	11.9	0.5	26.6	1.0
May	3.9	0.2	4.7	0.2
Total	329.0	13.0	415.3	17.1

* Data from records supplied by AID/Jordan

Temperature and relative humidity determine, in part, the harzards to storing grain. The table below shows the temperatures and relative humidities for Aqaba and Amman in an above average rainfall year - 1964.

Month	Aqaba - 1964			Amman - 1964		
	Temp. °F.	Temp. °C.	R.H. %	Temp. °F.	Temp. °C.	R.H. %
January	55.0	12.8	53	39.9	4.4	78
February	60.6	15.9	45	46.8	8.2	81
March	69.4	20.8	41	54.7	12.6	74
April	73.6	23.1	31	57.7	14.3	56
May	79.3	26.3	25	64.6	18.1	53
June	88.0	31.1	24	73.2	22.9	47
July	89.2	31.8	31	75.9	24.4	46
August	90.1	32.3	29	75.7	24.3	51
September	84.4	29.1	38	72.1	22.3	55
October	81.1	27.3	34	68.9	20.5	41
November	70.3	21.3	43	57.9	14.4	64
December	62.2	16.8	53	48.2	9.0	71

Data for Aqaba are presented to show the relative dryness of the area and to suggest the possibility of storage of imported wheats at the port until needed in the major consumption area. Data for Amman indicate favorable temperature and humidity conditions for safe storage of grain if it is properly managed.

V. DESCRIPTION OF PRESENT GRAIN STORAGE, MARKETING, HANDLING AND TRANSPORTATION FACILITIES

A. Harvesting Methods

Although grain harvesting is not directly a storage, handling or transportation function, it is related to the point where it affects or is affected by these functions. For this reason, a brief description of harvesting methods observed is presented here.

Grain is harvested by hand and by combine. Grain in extremely rocky areas and hilly or rugged areas is cut by hand using a curved sickle (Photographic Supplement, PS-1)* This method is also employed where grain has short straw. Heads and straw are bound into small bundles and carried to a nearby threshing area in the field. Grain may be placed on the ground and threshed by walking animals over the grain (PS-2) or by moving cogged-wheel devices and drags over the grain (PS-3 and PS-4). Portable threshers (approx. 1 metric ton per hour) may be used PS-5) to roughly remove grain from the heads and straw. Farmers may hire this type of combining at 600 fils, per hour. After grain is freed from heads by either of the methods above, it is winnowed (PS-6) to separate the chaff. Although no attempt is made to estimate grain loss at this point, certainly a portion of the grain is lost into the ground and into the chaff. Grain which is to be used for seed may be further cleaned by hand (PS-7).

In fields where conditions permit, grain is harvested by combine (PS-8). Mr. Abdul Raouf Nabulsi, Manager of the Wheat Production Project, Ministry of Agriculture, estimates that 50-60 percent of the wheat crop is combine harvested. Since the handling of grain from harvest to processing is in sacks, combines are equipped to place grain directly into sacks and drop them in the field. Improved operation of combines could probably result in improved efficiency in harvesting. Women and children were observed "gleaning" grain from fields which had just been combined (PS-9). In this case, grain is not lost but is used by those "gleaning" the fields.

From the fields, sacks of grain are hauled by animal or cart to storage facilities.

* A limited number of Photographic Supplements to this report have been prepared containing color photographs of storage conditions. PS-Numbers refer to the photograph in the supplement.

B. Grain Storage

1. Farm Storage. As indicated, most grain is stored in sacks throughout the distribution system. This is true also on farms although grain is also stored in small quantity bulk. Personal observation showed grain stored in sacks could occupy a place in or near the living tent (PS-10), be stored in a room of a dwelling (PS-11) or in larger farms in storage buildings (PS-15). Much of the storage utilizes available structures. Roman ruins, in at least one instance, have been modified to form reasonably good bulk and sack storage (PS-12, 13, 14 and 15). In this particular case, grain being held for seed was hand cleaned and stored in bulk. Grain for sale was stored in sacks. Mechanical means of handling grain on farms after harvest is non-existent. Grain is hand moved in sacks when used or transported (PS-16).

Although not personally observed, Mr. A. W. Awad, AID/ Jordan, indicated in a survey summary entitled, "Grain Storage in Jordan," September 18, 1967, that farmers store grain in cisterns and in bins constructed of mud and straw. Mud bins hold from 6-15 sacks (700-1800 kgs.) with size dependant on family numbers. This storage as well as sacked storage in dwellings, is primarily for personal consumption. Grain which is marketed, especially from smaller farms, is sold to grain dealers at harvest time.

A report prepared by Mr. Yusef Atieh, of the Jordanian Development Board, entitled, "Grain Storage in Jordan," and dated March 30, 1968, indicated farmers' stores as being constructed of cement or stones for sacked grain and used for storing quantities in excess of the farmers' needs.

An FAO report, "FAO Mediterranean Development Project-- Jordan Country Report, 1967" refers to "The East Jordan Valley, A Social and Economic Survey," prepared by the Jordan Department of Statistics, Amman 1961. According to this report, only 16 percent of the 1961 wheat and barley crop was marketed from this area with producers largely consuming their own production. (1961 was considered an average year with wheat production of 138,244 M.T.). Major wheat production does not occur in the Valley and it is doubtful whether the 16 percent figure is representative of all wheat production.

Current estimates of farm storage capacity in the East Bank of Jordan, is 8,180 M.T. total with breakdown by districts as shown in Table 5. Source of estimates is not known; however, they are referred to in AID and Jordanian Development Board reports. Reliability of the estimate is also unknown.

Table 5 GRAIN STORAGE FACILITIES IN THE EAST BANK OF JORDAN*

District	Dept. of Supply			Mills			Private			Total
	M.T.** Covered	Open	Total	M.T.** Covered	Open	Total	M.T.** Commercial	Farm	Total	M.T.**
Amman	12,000	-	12,000	21,000	17,000	38,000	33,253	4,000	37,253	87,253
Irbid	3,000	-	3,000	2,500	2,500	5,000	6,000	2,180	8,180	16,180
Balqa	-	-	-	-	-	-	2,000	500	2,500	2,500
Karak	1,000	-	1,000	-	-	-	3,500	1,500	5,000	6,000
Ma'an	-	-	-	-	-	-	-	-	-	-
Total	16,000	-	16,000	23,500	19,500	43,000	44,753	8,180	52,933	111,933

* Data supplied by Agriculture Division, USAID/Jordan, July 1968
** Metric Tons

Pest control appears non-existent on the farm level. No steps are taken to control rodents and insecticides are not used. Samples of grain taken at farm storage sites indicate moisture content of grain to be in the 9-10 percent range. If all grain is harvested and stored at this moisture, the potential for insect development would be considerably reduced. I observed no insect infestation in farm stored grain I examined. Most, however, was recently harvested.

Rc were not observed in farm storage, however, mice appeare. lentiful.

2. Grain Dealer Storage. Grain which is marketed, is sold by farmers largely at time of harvest. Some large farmers may hold grain for later sale.

Grain dealer storage may range from small quantities (PS-17 up to 100 M.T.) for sale to retailers to large quantities for sale to mills (PS-18 up to 3,000 M.T.). Structures used for storage are concrete warehouses or stores and grain is totally handled in sacks which are approximately 120 kilos (265 lbs.)

In general, there appears to be little attempt at preventive insect and rodent control in dealer warehouse storage. Conditions can range from fair to poor in manner of storage. Sacks of grain are stored on the floor, stacked against walls and stacked to the ceiling. Spillage occurs from sacks and provides ideal conditions for rodents.

Pest control measures consist of keeping spillage picked up to occasional fumigation if necessary. No preventive measures appear to be taken against insects or rodents.

Dealer storage in East Bank of Jordan is 44,753 M.T. total with district totals as shown in Table 5.

3. Mill Storage. Nearly all of the large flour mills PS-19) in the Amman area were visited and storage areas examined. All mills store grain in sacks only, using both warehouse type inside storage and outside or open storage.

Covered or warehouse storage practices at the mills are not good and I am certain considerable losses in grain quantity and quality occur because of the poor storage practices. The warehouse facilities are made of concrete and range in size from 3,000 to 5,000 metric tons. Most of the mill warehouses are such that with proper storage practices, they could provide safe grain storage. Here all grain is again stored in sacks (PS-20, 21, 22, 23 and 24). Storage practices are

similar to those of dealers in that sacks of grain are stacked directly on the warehouse floor, directly against the wall and completely to the ceiling of the warehouse. Grain is not stacked in lots or in parcels so that they are easily inventoried or fumigated if necessary but rather stacked in one huge pile completely filling the warehouse. In all mill warehouses there was evidence of spillage with varying degrees of housekeeping to remove the spillage.

In all warehouses there was insect and rodent activity. There is apparently no attempt to prevent insect or rodent activity and when fumigation is necessary, the entire warehouse must be fumigated because of the disorganized methods of storing the sacked grain.

Grain stored outside (in the open) is either stacked directly on concrete slabs or on wooden pallets to keep it off the ground. Portions of the grain stored in the open is covered with canvas tarps; the remainder is not. (PS-25 and 26). Grain stored in this manner is exposed to rodents, birds and insects from various sources and is not easily protected. Fortunately, the climate is such that rainfall occurs only during the months of October through May providing four months at or after harvest when grain can be stored in the open without loss to water damage. In general, outside or open storage cannot be considered adequate storage.

The present estimated storage capacity in East Bank of Jordan mill is 43,000 M.T. total. Of this amount, 23,500 M.T. are covered and 19,500 M.T. open storage. If proper storage practices were employed, this capacity would be considerably reduced. Personal observations indicated that at least 10,000 M.T. additional covered storage was under construction in the Amman-Zarka area.

4. Government of Jordan Storage. The Government of Jordan, Supply Import-Export Department (SIED) has storage sites at Ruseifa (Amman area), Irbid and Karak. The site at Ruseifa and Irbid were visited.

The SIED has both warehouse (sacked grain) and bulk storage structures. The bulk storage facilities are of two types -- 100 M.T. capacity metal silos and 500 M.T. capacity concrete bins.

Table 5 indicated a total of 16,000 M.T. storage capacity at SIED sites in Jordan. Personal observations indicated facilities and capacities as shown in Table 6. Capacities are those indicated by SIED personnel.

At Ruseifa there are five concrete warehouses (PS-27) approximately 130 feet long (39.7 meters), 36 feet wide (11 meters) and 14 feet high (4.3 meters). Each warehouse has 7 areas, 18 feet (55 meters) by 12 feet (3.7 meters) on each side of a driveway which is about 12 feet wide. Thirteen of the areas are used as storage bays and one as an office. See Figure 3, (PS-29). In general, the warehouses are of fairly good construction and can be used for safe storage of grain providing good storage practices are followed and minor repairs are made. (Screen windows, repair leaks in roofs, etc.)

In many of the storage bays in the warehouses at Ruseifa, there was evidence of mold growth on walls where it was obvious that sacked grain had gone out of condition (PS-30). In all storage bays there was evidence of past insect activity as shown by the large numbers of dead insects on the floors (PS-31). In addition, there was evidence of rodent and bird activity in the form of mouse droppings, bird excrement and bird nests in the warehouses.

As in farm, dealer and mill storage, grain stored by the SIED is stacked to completely fill the storage space (against walls and to the roof). No space for proper inspection or air circulation is provided.

Each of the warehouses, as described above, is reported by SIED personnel to have a capacity of 780 M.T. in storage bays and an additional 220 M.T. when the driveway area is used. This gives a total capacity of 1,000 M.T. per warehouse. This capacity would be reduced if proper sack storage practices were used.

Total SIED warehouse space according to observations and reports is 7,000 M.T. (5 warehouses at Ruseifa, 1 warehouse at Irbid and 1 warehouse at Karak). All warehouses are similar in construction and equal in capacity.

Pest control to a certain degree is performed at the SIED storage sites. DDT and Agricide (lindane) are used in combination as a residual spray in warehouses. No labels were present on the insecticide containers in which the insecticide dusts were stored. An SIED employee at Ruseifa indicated 1 kilo each of the DDT and Agricide dusts were mixed with 20 liters of water and used as a residual spray in the warehouses.

Phostoxin and Dow MC-2 (98% methyl bromide and 2% chloropicrin) are fumigants used by SIED personnel in grain fumigation. They indicated that when a warehouse is fumigated

with phostoxin, two cans each containing 16 tubes of 30 tablets each are used. If the warehouse is completely full, the manufacturer's recommended dosage of phostoxin would be 3 tablets per ton or 3,000 tablets. SIED personnel indicated they used a total of 960 tablets or only 1/3 the recommended dosage. An effective fumigation would probably not be achieved at this dosage.

In addition to warehouse storage for sacked grain, bulk storage facilities are also present at the Ruseifa and Irbid SIED storage sites. The bulk facilities are of two general types.

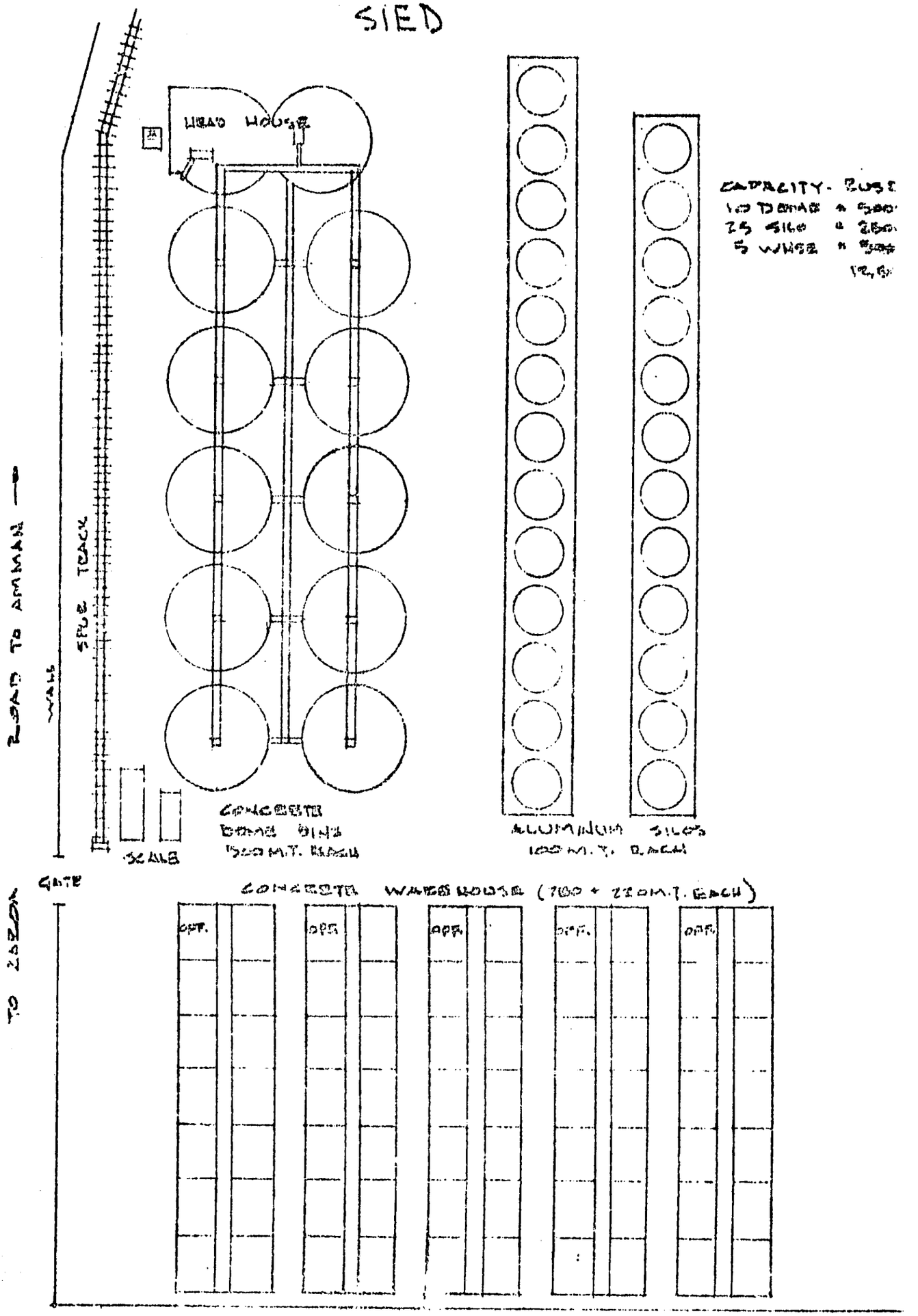
Ten concrete bins each having a capacity of 500 M.T. are located at the Ruseifa site (Figure 3) (PS-43). The bins are arranged in two rows of five bins each and are equipped with conveyors to both fill and empty the bins through an elevator system. Cleaning and elevating equipment are housed in two structures (head house) similar to the bins(PS-41). Grain can be received in bulk at the "elevator" by dumping the grain into a receiving hopper (PS-42). Equipment is provided for wieghing, cleaning and elevating grain into and out of the bins at 10-15 M.T. per hour (Figure 4). Grain can also be "turned" or moved from one bin to another by means of augers in the bins and conveyors to the elevator. (PS-42,44). This storage system, with the addition of a temperature monitoring system, would provide excellent bulk grain storage.

Birds appear to be the major pest control problem associated with the concrete bins. Sparrows and pigeons were present. Bird nests were at several locations in and on grain handling equipment in the head house (in scale hopper, on elevator heads, etc.) (PS-45,46). Bird excrement was also found in and on grain handling equipment. Birds should be kept out of the head house by screening windows and keeping doors closed whenever possible. Nesting should be discouraged by destroying the nests. Birds consume grain and can spread disease in their excrement.

In addition ot the concrete bins, the Government of Jordan has metal silos for bulk storage of grain. Unfortunately, because of grain being lost due to deterioration, the metal silos have not been considered suitable for grain storage by the SIED.

There are 25 metal silos constructed at Ruseifa (PS-47) and 10 at Irbid (PS-49). The silos were manufactured by the Frederick Brady and Co., Ltd. Ashton Gates Works, Bristol, England. It was not determined whether the silos were donated or sold to the Government of Jordan. Based on past reports by Mr. Harvey Bross (Nov. 2, 1957) and Mr. Ilhami Masar (Nov.

Figure 3 RUSEIFA STORAGE SITE SIED



FLOW DIAGRAM: ELEVATOR FOR 10 500M.T CAPACITY CONCRETE BINS

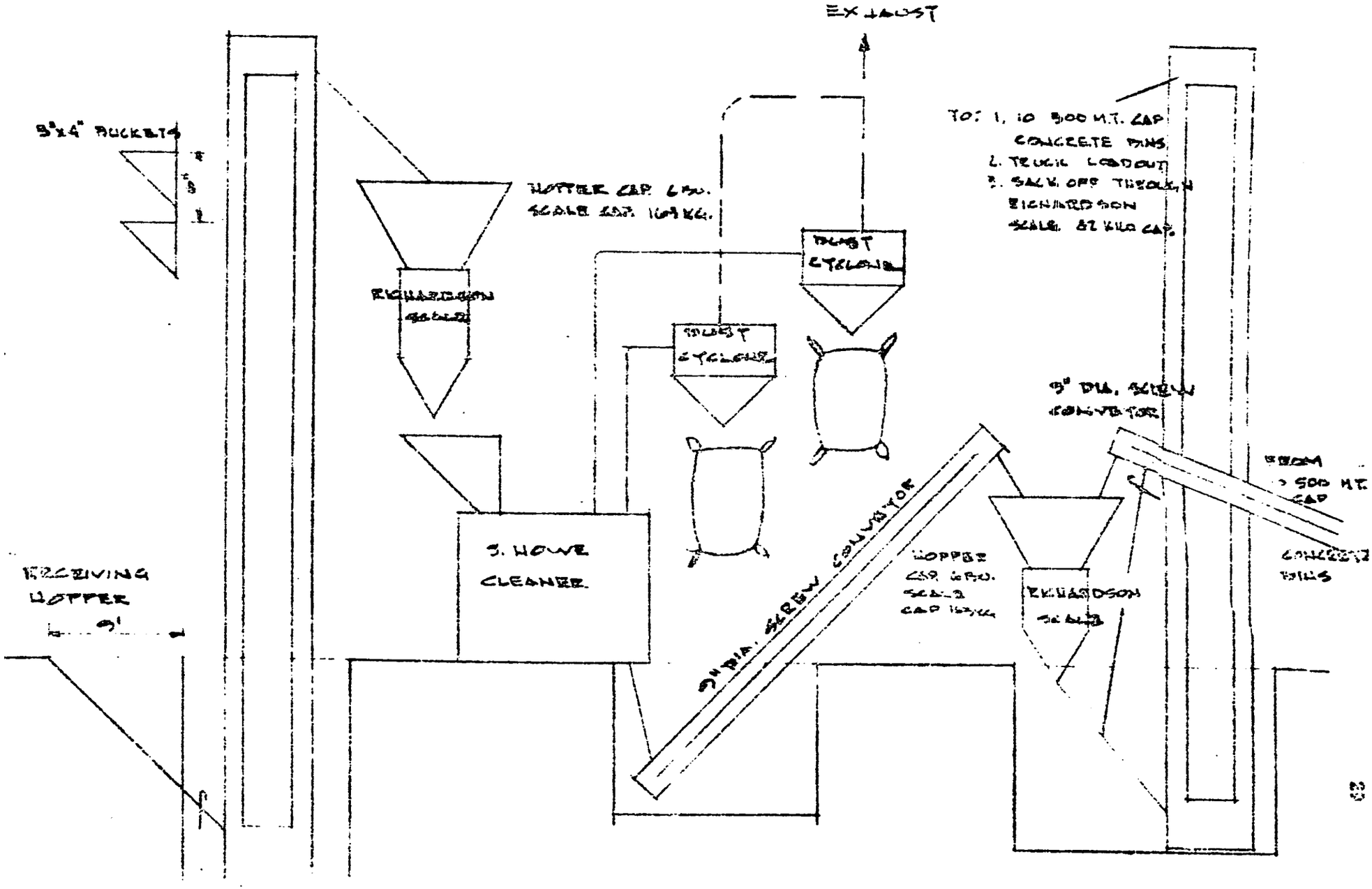
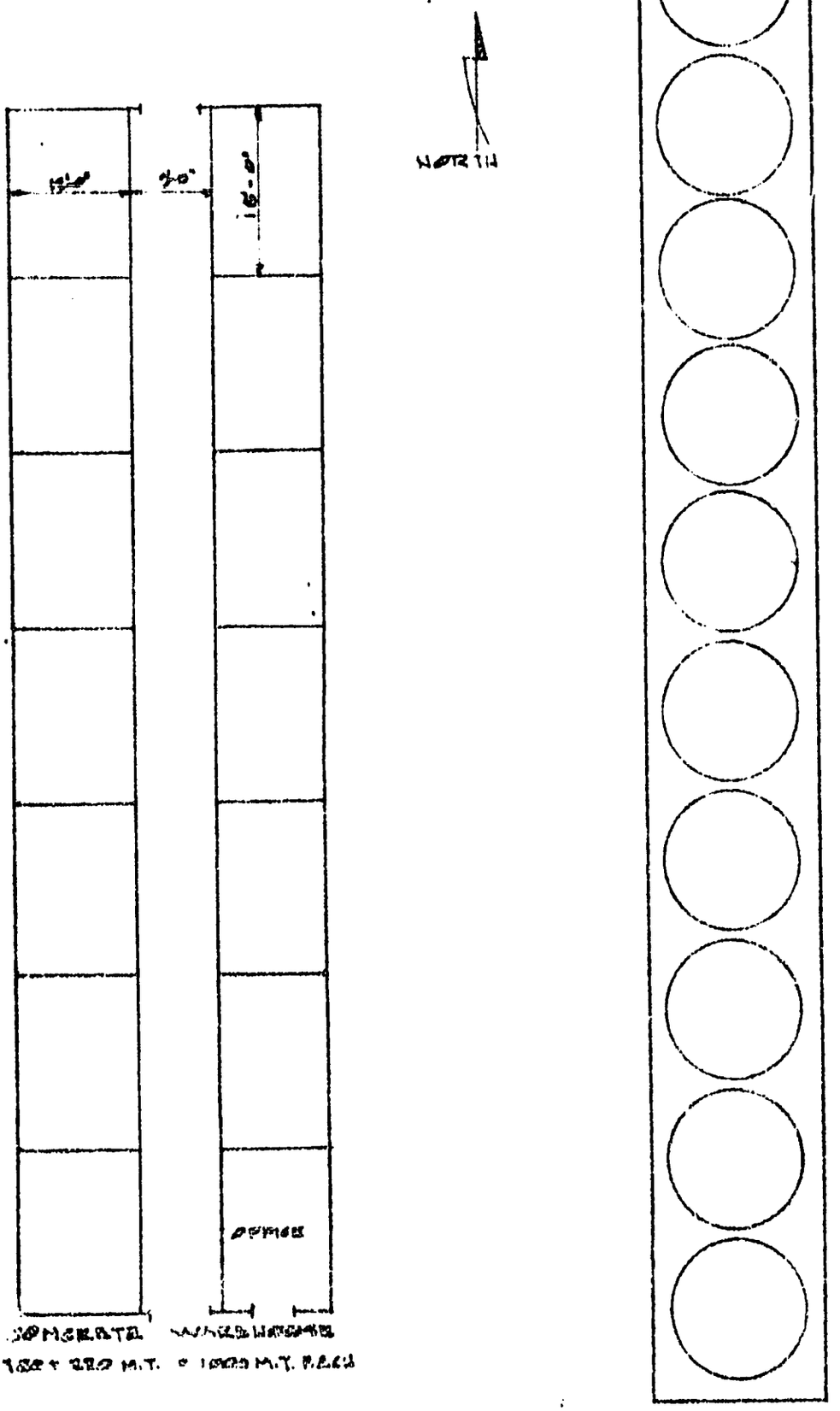


Figure 5

IRBID STORAGE SITE SIED



16, 1955) the silos were probably obtained sometime in 1956 or 1957. Mr. Masar recommended use of metal silos and Mr. Bross commented on their condition and use. He indicated the silos were reported to be leaking rain badly because they had not been properly sealed at the joints when constructed. He also recommended installation of temperature monitoring systems in the silos. This good recommendation was never carried out.

Fifteen of the metal silos had been constructed at El-Rabbeh. A report by Donald R. Yeaman (May 1, 1961) indicated the silos at El-Rabbeh had been blown down by wind because of improper supervision in construction.

At present, the SIED estimates there are approximately 50 of the metal silos stored at Ruseifa (PS-53) that have never been erected.

During my visit, the metal silos at Ruseifa and Irbid were inspected. The silos, both at Ruseifa and Irbid are erected on concrete foundations which extend about 3-4 feet (1 meter) above ground level. This elevates the silos somewhat and provides good drainage of any rain water. This height could also be of value if silos are modified for mechanical unloading of the grain.

Five of the silos had roofs badly damaged and most of the silos at Ruseifa had brackets that hold the roof to the silo wall either missing or loose (PS-48). This damage is probably a result of high winds. Several of the removable roof sections (used for filling the silos) were also missing. The loose roofs would provide an opportunity for rain damage to the grain.

Caps which form the very peak of the silo roofs were not sealed and could provide a point for blowing rain to damage the grain. Walls of the silos had a sealant material placed on the vertical seams but not on the horizontal seams. It is doubtful whether rain would leak into the silos at the horizontal seams but they could be sealed for safety.

The point at which the silos join the concrete foundation could provide an entry point for water to damage grain (PS-51,52). It was not determined whether the silo walls were imbedded in the concrete. It appeared that the silo walls were attached to a flange which was flush with the concrete foundation. The wall-foundation joint had been sealed with concrete and asphalt but the seal was broken around most silos.

According to SIED, the silos have only been used two or three times since they were erected. Each time they were used,

grain went out of condition and was lost. During our discussions at Ruseifa and SIED, it became apparent that grain went out of condition because of rain and/or mismanagement of the grain.

In my opinion, with proper modification of the silos and proper grain management, the silos can be used for safe bulk storage of grain. A proposal for modification of the silos has been prepared and a test to demonstrate safe storage in the silos outlined. See Kansas State University, Food and Feed Grain Institute Report, "A proposal to Equip Metal Silos in Jordan with Aeration and Temperature Monitoring Equipment" August 1968.

Mr. Hashem Dabbas, Director of SIED, indicated during discussion, that SIED had plans to dismantle the 25 metal silos at Ruseifa and erect a warehouse of 30,000 M.T. capacity on the site. Whether a 30,000 M.T. capacity warehouse is needed is a point for consideration; however, to dismantle the metal silos would be wasteful. If grain production is increased, as it appears will occur within the next several years, there will probably be a switch to more bulk handling of grains and a need for additional bulk storage. If plans are carried through for construction of the warehouse, serious consideration should be given to constructing the warehouse so that it could be converted to bulk flat storage of grain.

5. Availability of Storage. At present the Government of Jordan has 15,500 metric tons of good storage. Warehouse storage accounts for 7,000 metric tons, concrete bulk storage for 5,000 metric tons and 3,500 metric tons in metal silos (See Table 6).

Mills in the East Bank of Jordan have at least 30,000 metric tons of covered storage. One mill was in the process of adding 5,000 metric tons of warehouse storage and another mill was adding 1,500 metric tons in additions to that reported in Table 5. There is also reported space for open storage of bagged grain of 19,500 metric tons at mills (See Table 5).

Grain dealer storage is estimated at 44,753 metric tons (See Table 5). Many of the grain dealers also function as dealers in other commodities. It is difficult to estimate whether all or part of capacity indicated would be used for grain storage under varying conditions. The warehouse storage is flexible and can be diverted to other uses.

Total covered storage exclusive of farm storage is 90,753 metric tons. An additional 19,500 metric tons of open storage can be used immediately after harvest until the winter rains begins in October. Open storage could provide adequate temporary storage for 3 months if properly utilized.

Table 6 GOJ GRAIN STORAGE CAPACITY - SIED

I Ruseifa (Amman area)		
Concrete Warehouses		
5 units each 1000 M.T.		5000 M.T.
Concrete Bins (with elevator & cleaner)		
10 units each 500 M.T.		5000 M.T.
Metal Silos (unused)		
25 units each 100 M.T.		2500 M.T.
	TOTAL	12,500 M.T.
II Irbid		
Concrete Warehouse		
1 unit each 1000 M.T.		1000 M.T.
Metal Silos (unused)		
10 units each 100 M.T.		1000 M.T.
	TOTAL	2000 M.T.
III Karak		
Concrete Warehouse		
1 unit each 1000 M.T.		1000 M.T.
	TOTAL	1000 M.T.
	TOTAL GOJ PRESENT CAP.	15,500 M.T.
IV UNASSEMBLED METAL SILOS (Ruseifa)		
About 50 units each 100 M.T.		5000 M.T.
TOTAL GOJ PRESENT POTENTIAL CAPACITY		20,500 M.T.

During my visit in July, three of the mills in the Amman area indicated wheat on hand at about 20 percent of capacity of covered storage. About 85 percent of the wheat was U.S. and 15 percent local. Most of the local harvesting was completed at this time.

The Government of Jordan had only 100 metric tons of grain in storage at Karak in July. In addition the SIED was importing 30,000 metric tons of U.S. Wheat. Adequate storage space for this grain is available in present mill storage.

An assumption has been made that the rural population produces and stores its own requirements for food and seed. This would indicate that roughly 91,000 metric tons of wheat (72,000 metric tons for food and 19,000 M.T. for seed) are stored on farms each year. This figure is at least 11 times greater than the farm storage capacity indicated in Table 5, the assumption is easily challenged, however. All of the agricultural producers are not necessarily wheat producers and a certain percentage may draw their food requirements from the marketed supply. Indications are that the greatest part of the agricultural population does store its own food supply.

If farm storage does approach 90,000 metric tons and persent off-farm storage is roughly 90,000 metric tons, then total storage capacity is sufficient to handle annual consumption requirements of wheat for the estimated population (excluding refugees) until 1975.

A more accurate estimate of a farm storage and grain dealer storage is necessary before accurate estimates of additional storage capacities can be made.

6. Grain Management in Storage. The relative dryness of the grain producing areas in Jordan would suggest that grain is harvested at relatively low moisture content. No reliable data are available on moisture content of grain at harvest or in storage. This is a result of not having grain moisture testing equipment available at any point in the grain distribution system from field to mill.

Limited numbers of samples of local grain were checked on farms, in dealer storage and in mills with a device for measuring relative humidity in inter-seed air. This method gives a rough approximation of the moisture content in the grain. Local wheat and barley showed moisture contents in the 10 to 11 percent range. Generally, 12 percent moisture grain is considered safe for storage if properly managed.

It was obvious from observations made in farm, dealer, mill and government grain storage situations that proper grain management methods are not understood or used. As a result, undetermined losses occur to stored grain.

Moisture content of grain is probably the single most important factor involved in storage of grain. High moisture in grain (above 13.5 percent) provides an ideal environment for development of insects and molds. Insects and molds respire producing heat and moisture and can produce conditions which will cause total loss of the grain if not properly controlled. Differences in temperature in different sections of a quantity of grain (whether in large piles of sacks or in bulk) will cause migration and concentration of moisture in areas of the grain mass which will favor insect and mold development. In many instances the differences in temperature are a result of mold and/or insect activity.

Because it is so important in determining whether grain will store safely, moisture content should be determined prior to placing grain in storage and should be checked periodically while the grain is in storage. Wherever large quantities of grain are stored, equipment for determining moisture content should be used. In this category I would include government storage sites, mills and large grain dealers. Knowledge of proper management of grain has not been developed in Jordan, probably as a result of most local grain being harvested relatively dry. Also grain, being generally in short supply, is consumed in relatively short periods of time. That grain which is imported, however, does not have as low a moisture content as that grown and harvested locally. Since all of the grain imported is purchased by the government and sold to mills for processing, these two groups must be aware of the problems in storing grain of higher moisture content.

As early as 1957, Mr. Harvey Bross, Regional Grain Advisor for NESA, recommended the installation of temperature monitoring equipment for use in the 10 500-metric ton capacity concrete bins at the Government storage site at Ruseifa. No action was taken on this recommendation. Since it is sometimes impractical to obtain representative samples from large quantities of grain (either sacked or bulk) temperature can be used as an indicator of potential problems. Localized increases in temperature ("hot spots") in a grain mass are evidence of increased respiration. This indicates that insects or molds are present and that moisture in that area of the grain mass has reached a level which is unsafe for continued storage.

The manner in which sacked grain is stored in a warehouse or store can contribute greatly to the hazards of loss in storage. Some recommended practices are:

(1) Sacked grain should be stored in orderly stacks by lot and type of wheat.

(2) Stacks should be stored off the floor on wooden pallets or slotted platforms to allow air circulation and prevent absorption of moisture from concrete or ground surfaces.

(3) At least ½ to 1 meter (20-40 inches) should be left between walls and stacks of grain to allow for air circulation, insect control and rodent control.

(4) Stacks of grain should not exceed 6 meters (20 feet) in width and 6 meters (20 feet) in height with length of the stack determined by size of the warehouse or store. This provides spacing for air circulation and fumigation of stacks of grain. Fumigation of stacks of grain is much easier and less expensive than fumigation of entire warehouse or stores.

(5) Temperature monitoring equipment can be used with stacks of grain as well as with bulk grain to check the condition of the grain.

The above listed storage practices are not properly used in any of the grain storage observed in Jordan. Only UNRWA commodity storage approaches good storage practices.

Insect control is virtually non-existent in farm, dealer and mill grain storage. DDT and lindane are used as residual sprays in government storage warehouses. These two materials can provide a health hazard from residues of the insecticides. Malathion and methoxychlor are considered much safer insecticides. They should be used for spraying on walls and floors in warehouses and in bins and silos. Proper concentrations of Malathion can be applied directly to grain and/or sacks of grain.

Fumigants used in government storage are methyl bromide and Phostoxin. Both materials are good fumigants if properly used, however, under conditions of storage in Jordan Phostoxin is preferred. From discussion with GOJ personnel at the Ruseifa storage site, I would estimate they are using about 1/3 the manufacturer's recommended dosage of Phostoxin in their fumigations. Under ideal conditions a fumigation at 1/2 the recommended dosage can be effective, but it is doubtful whether the conditions in Jordan approach the ideal. Forty-five Phostoxin tablets per metric tons should be used when fumigating grain beneath gas-tight tarps and 20 tablets

per 1000 cubic feet used when fumigating well sealed warehouses.

Rodent control at farm, dealer, and mill storage was virtually non-existant. In government storage rats and mice are controlled by poisoning with a thallium preparation. Thallium compounds are extremely toxic to humans as well as rodents. Baiting of rodents with Thallium occurs only when visible evidence of their presence is noted. By the time rodents are easily detected, they have done considerable damage by consuming quantities of grain, damaging sacks by chewing and by contaminating much larger quantities of grain with urine and droppings. The contamination of grain with urine and droppings can be responsible for disease transmission. Storage structures should be made rodent and bird proof by eliminating openings which allow their entry. Windows should be screened, doors kept closed and tight fitting, and other openings in structures. Anticoagulant baits should be used for rodent control.

General housekeeping in and around grain storage warehouses, bins, and silos is as important in grain management as any of the other aspects. Accumulations of grain, spillage or grain cleanings which are left in or near grain storage structures become sources of infestation and attract rats and mice as well as insects to otherwise clean grain in storage.

There is a definite need to inform those persons responsible for grain storage in Jordan of the proper management of grain in storage to prevent losses.

C. Grain Marketing

1. Marketing Organization. In the past, the marketing of grain has been under the direction of various departments of the Jordanian government. According to Mr. Ilhami Masar in his report of November 16, 1955 entitled "Jordan's Wheat Problems and the Jordanian Grain Office" the Grain Office Act Number 2 of 1954 (issued according to Art. 4-A(6) of the Defense Law of 1935) provides for a financially independent public organization attached to the Ministry of Economy and called the "Grain Office." The Grain Office had the following major responsibilities:

1. Purchase of grain from local markets for local supply at prices decided by the Council of Ministers.

2. Purchase of grains for export in accord with foreign contracts.

3. Import grain for consumption or seed when local production is deficient.

4. Storage of purchased grain and its preservation.

5. Construction of modern grain stores.

6. Provision of necessary equipment for grain grading and cleaning.

7. Organization of grain transport operations from production to storage to consumption points.

8. Sale of grains held by municipalities, Mill or Administrative Authorities in case of shortage of grain for local supply or unnecessary rise in its prices.

Other responsibilities included establishing prices, seed improvement, loans to farmers, storage for interested parties, seed improvement and compilation of statistics. The "Grain Office" functions now appear to be in the Supply Import-Export Department.

"The Seven Year Program for Economic Development of Jordan 1964-1970" prepared by the Jordanian Development Board indicated that major problems in agricultural marketing were:

1. Producer lack of "know-how" in harvesting and handling resulting in damage and lack of uniformity.

2. No grades and standard regulations

3. No clear export and import policies

4. Complaints about margin between producer and consumer prices.

5. No price information service in internal and external markets.

It was also indicated that an Agricultural Marketing Department of the Ministry of Economy had been created as a bureau in 1962 and established as a department in 1964. An agricultural Marketing Center was created and staffed with a United Nations Special Fund. It did not indicate whether the grain marketing functions were included.

The Agricultural Products Marketing Corporation Law, Law Number 42 for 1966 published July 2, 1966 in the Official Gazatte, Issue Number 1933 established the Agricultural Products Marketing Corporation. The Corporation was to be private and broad ranging with multiple interests represented. The Government of Jordan, farm producers, merchants and others were included. This Corporation did not include any price or production stabilization functions. Again, it is not known whether grain marketing would have been included. The Corporation, to the best of my knowledge, is still on paper and not active.

At present, grain marketing functions of the Government of Jordan are centered in the Supply, Import-Export Department (SIED) of the Ministry of National Economy.

There are no fixed or support prices for grain in Jordan except in certain years when domestically produced wheat is purchased at fixed prices by the government of Jordan. Previous Agricultural Situation Reports have indicated, that prices paid to producers during these years are not used as an incentive for increased production but rather to control urban cost of living.

Indirectly, prices of wheat may be affected by price ceilings maintained by the Government of Jordan on wheat flour and bread.

Decision Number 37 taken by the Minister of National Economy in May, 1965, set the price of flour for three grades of flour and specified extraction, moisture, ash and protein of the three grades. No other grades of flour could be milled. Prices per metric ton for the three grades delivered to the local customer were:

Grade		Price/M.T.
Zero	-----	JD 43 ($120.40)
Grade one	-----	JD 37 ($103.60)
Standard	-----	JD 38 ($106.40)

Decision Number 38 taken by the Minister of National Economy in May 1965, set the price of white bread (sandwich, kimaj, mashrouh, tannouri, and armanieh) at 50 fils/kilogram and local bread (kimaj, manqoush, mashrouh, tannouri and mukabtal) at 45 fils/kilogram. Prices for flour and bread were effective June 1, 1965 and remain in effect at present.

Imports of PL 480 wheat are controlled by the SIED and Ministry of National Economy. Wheat that arrive at Port of Aqaba on July 16, (7,000 M.T. of a 30,000 M.T. purchased from the United States) had been allocated to 6 mills in the Amman area. Each mill was to receive 1000 M.T. with the

remaining 1000 M.T. to be stored at the government storage site at Ruseifa.

From discussion with SIED personnel, I got the impression that they would prefer not to store grain but would rather have the grain stored by mills. This may stem, in part, from the fact that the government has had bad experiences in the form of losses with grain they have stored in the past.

2. Grain Standards. Certain standards of grain quality have been established for wheat and barley according to Mr. Dabbas and Mr. Kakish, Director and Deputy Director of SIED, respectively. Although copies of the standards were requested several times, I was able to get only partial information on the grain standards. Foreign material, broken kernels and smutted kernels appear to be the only factors used in quality determination. Moisture and test weight are not considered in the "standards."

I question whether the following information given by the SIED as standards for wheat are used in the purchase and sale of wheat in the market:

	Maximum of:
I Degree Wheat	1% foreign material (by wt.)
	1% broken (by count)
	0% smutted kernels (by count)
II Degree Wheat	2% foreign material
	3% broken
	1% smutted kernels

The "standards" indicated by the SIED are not published and are not readily available. In discussion with grain dealers and millers, they indicated wheat is bought merely on judgement of the buyer. It would be misleading to say that any type of active formal gram grading system exists.

The general classifications given to wheat in the trade are Domestic and Commercial. Domestic refers to that wheat which has been machine or hand cleaned to remove most of the foreign material (impurities). Domestic wheat is used for seed wheat or high quality milling wheat. Commercial wheat contains larger amounts of foreign material than Domestic. Various brackets of impurity levels are sited in reports for Domestic and Commercial categories of wheat. In general Domestic wheat is classed as having less than 3% impurities and Commercial wheat with 3 to 6% impurities. In some instances Commercial wheat may be divided into Grades 1 and 2 Commercial. Although these classifications are given they do not appear to be measured other than by estimate on the part of the buyers.

3. Methods of Marketing Grain. According to available information there are no cooperatives active in marketing. "The East Jordan Valley, A Social and Economic Survey, Amman 1961," a report prepared by the Jordan Department of Statistics stated that the percentage of wheat and barley production sold on the market in 1961 was 16 percent. Percentage of yellow maize and white corn marketed were 72.9 and 34.2 percent, respectively. The implication is that most producers largely consume their own production.

The figure of 16 percent of wheat production marketed does not seem realistic for Jordan as a whole. According to data supplied to Dr. Clinton Brooke by Mr. Naim Aiveida, Principal Assistant, Program Office, USAID Mission Amman, major flour mills in Jordan produced approximately 150,000 tons of flour per year. At 80 percent extraction the wheat equivalent is 187,500 tons or about half the annual consumption. Maximum wheat imports over the past several years have been 20,000 M.T. The balance of 167,500 M.T. of wheat milled represents more than half of the wheat consumed per year. At least an equivalent amount of wheat must have been marketed (sold to mills).

In the East Jordan Valley Survey, two major ways of selling grain accounted for 99 percent of grain sales. The two were (1) sale through a commission agent in a market and (2) sale to a wholesale merchant (grain dealer). Probably most grain is sold through wholesale merchants.

Sales are consumated by farmers bringing samples to grain dealers. If the dealer is interested he will state a price. If price is agreeable to both parties the dealer will usually examine the lot of grain for sale and varify its quality in relation to the sample. If satisfied, the transaction is completed.

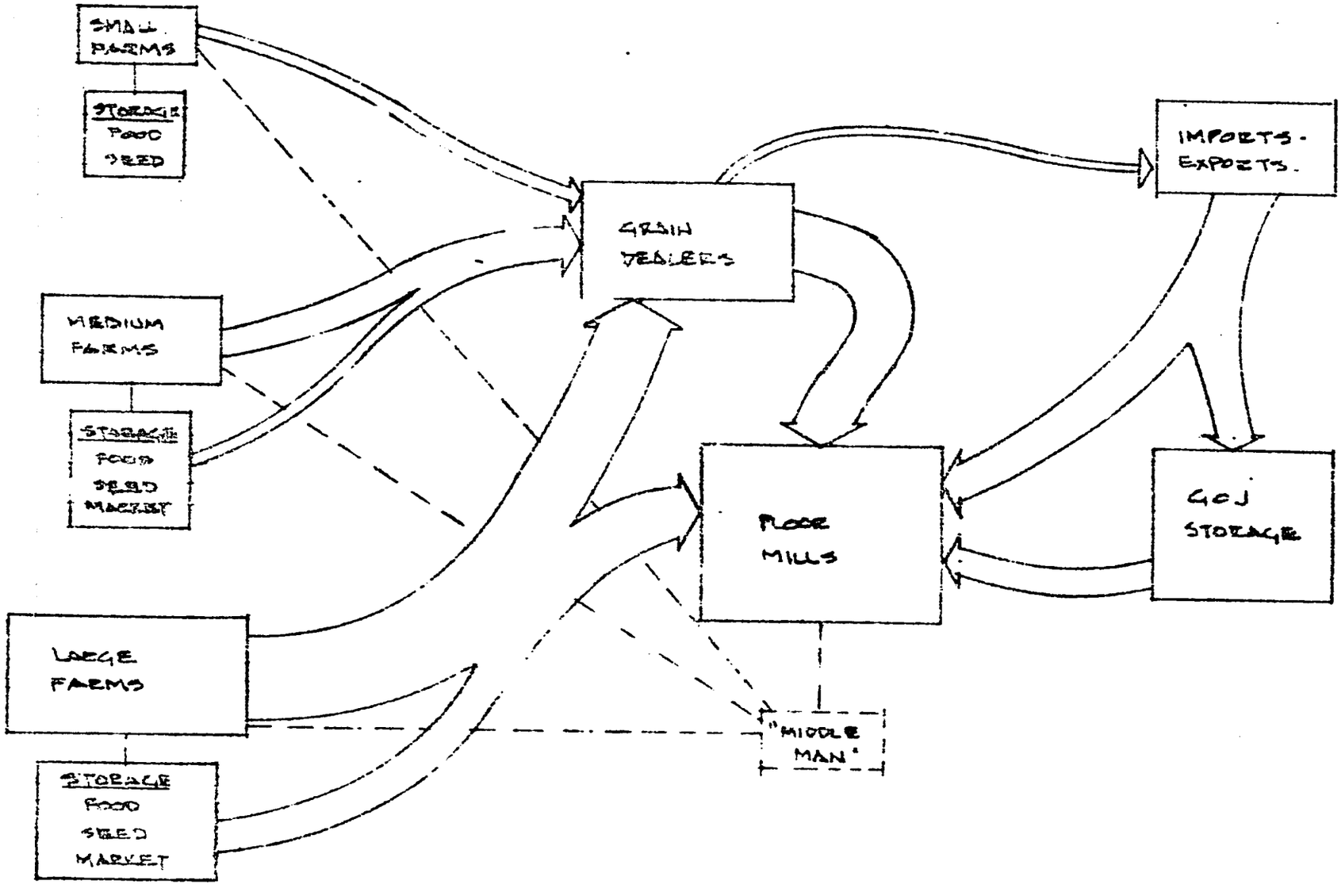
Flour mills may buy locally produced grain from farmers through commission agents or they may buy from grain dealers. All foreign grain is imported by the SIED and sold directly to processors (flour mills). Figure 6 shows a diagramatic market flow of wheat. Government purchases of wheat from farmers is not shown on the diagram.

4. Grain Prices. As indicated previously, there are no fixed or support prices for agricultural products except in certain years when the Government of Jordan buys domestically produced wheat at a fixed price.

Price of wheat very nearly reflects the level of production with production being dependent on rainfall.

Figure 5

MARKET FLOW OF WHEAT



It appears that wheat production may, in addition to rainfall, be responsive to cash prices of wheat. This is reflected in reduced acreages and reduced quantities of seed utilized following recent periods of good production.

Any substantial increases in production may have to be supported by a government support program. This aspect should be considered when undertaking a program to increase production of locally grown durum wheat. The demand for hard wheat and hard wheat flour should also be considered together with the effect of relief flour which by various means may enter non refugee consumption channels.

From available data (See Figure 7) it does not appear that wheat prices respond to seasonal storage cost fluctuations. Prices do, however, fluctuate considerably in response to annual production and rainfall.

D. Bulk Handling of Grain.

Under present conditions in Jordan an immediate complete change to bulk handling of grain should not be considered.

Bulk handling, however, evolves through gradual change in many aspects of grain storage, handling, transportation and marketing over a period of time.

It seems, the most logical place to start the evolution to a bulk handling system would be with government imported grains. This would involve, on the average, 20,000 to 30,000 metric tons of grain a year at present with possible increases in the future. This suggestion is based on the following:

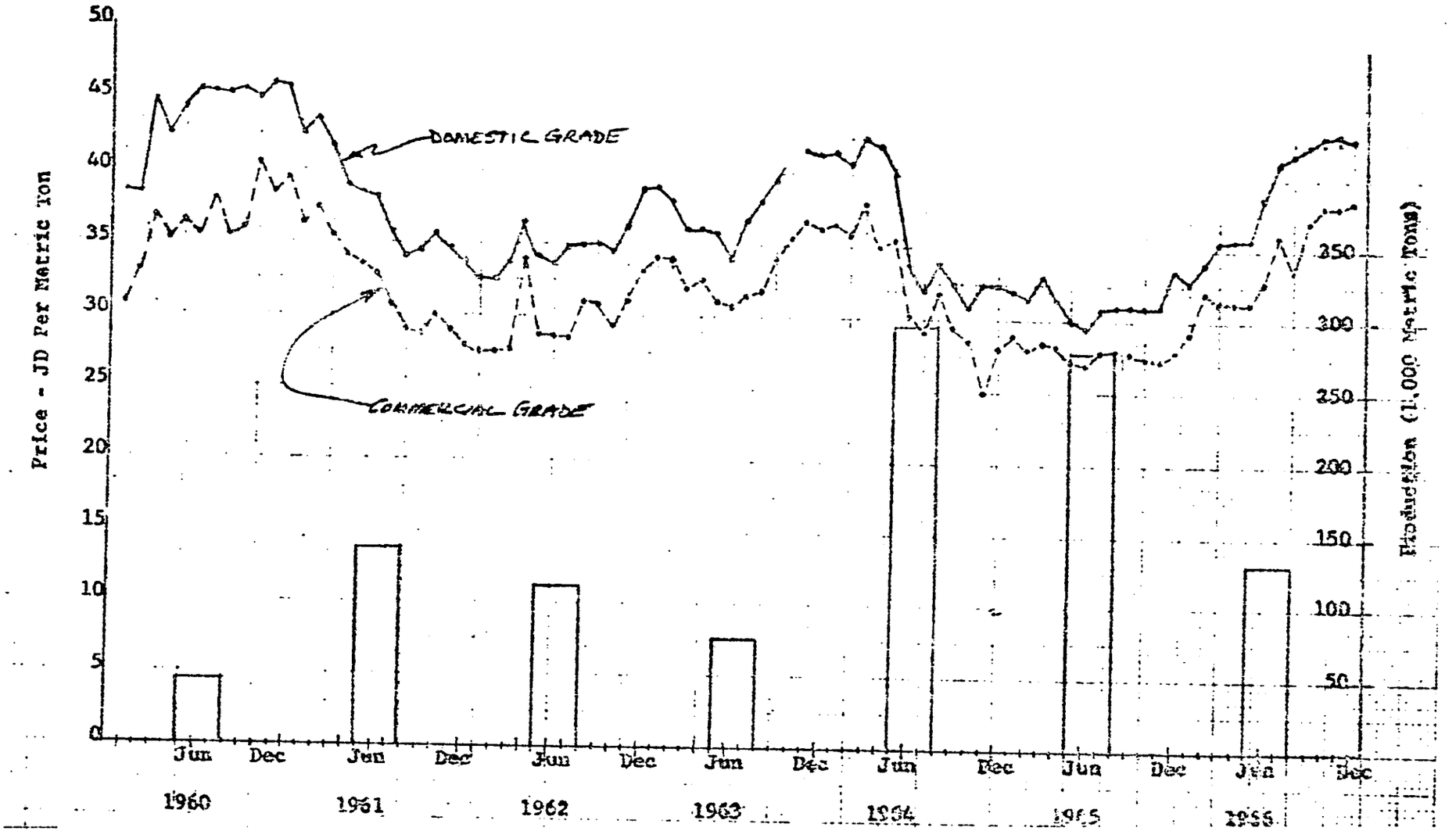
1. Grain arrives at Port of Aqaba in bulk

2. Government owned bulk storage is presently available at Ruseifa for 7,500 metric tons with disassembled silos for 4,000 to 5,000 metric tons additional.

3. Modification of trucks to transport grain from Aqaba to Ruseifa would cost only slightly more than the cost of sacks to transport an equivalent amount of grain.

4. Mills in the Amman area which use imported grain could be encouraged to start development of bulk storage. It is possible that some of the existing bag storage could be converted to bulk.

Figure 7 AVERAGE MONTHLY PRICES PAID FOR "DOMESTIC" AND "COMMERCIAL" GRADE WHEAT VERSUS PRODUCTION - 1960-1966



5. Bulk unloading time at Port of Aqaba would be reduced by 50 percent or more resulting in reduced demurrage. It would require bulk unloading equipment at Aqaba.

At least some of the locally produced grain is stored in bulk on farms. Grain stored in bulk on farms is used for farm consumption as food or seed and does not enter distribution channels.

The initial handling of imported grain in bulk could stimulate the evolution of bulk handling of local grains in other areas of the distribution system. The most important factor that would stimulate bulk handling is the development of a marketing and grading system.

Although the metal silos at Ruseifa and Irbid are not now equipped for mechanical unloading this is one refinement which could easily be incorporated. At Ruseifa loading of metal silos could be incorporated into the system now used in the concrete bin complex. This could be accomplished by extending screw conveyors from the concrete bins to the metal silos and running screw conveyors the length of the rows of silos. The same end could also be accomplished by placing a pit and elevator system in the metal silo area.

E. Port of Aqaba Grain Handling Facilities.

At present, all grain received at the Port of Aqaba is sacked by hand on board the ship and then transported by truck to Amman or other use or storage points. In the unloading process, grain may be transferred from ships to lighters (barge-type vessels) and then to the dock area and to trucks; or ships may be docked and grain unloaded directly to trucks.

Grain is sacked by numerous men (20 - 30) entering the ship's hold (PS-56) and hand filling 120-140 kilo jute sacks. Four or five men work in a team to sack grain. One or two men ladle grain into sacks using square five gallon cans. Two men hold the sack and another man sews the sack shut (PS-57).

During the unloading observed at the Port of Aqaba on July 17, 1968, used jute sacks were used. As slings containing six sacks each were lifted from the ship to trucks considerable spillage was noted (PS-58). Some spillage was the result of poor sewing and some a result of poor condition of the sacks.

According to Mr. Jiryes Kakish, Deputy Director of SIED, over a ten hour period 500 M.T. of grain were hauled from the Port. This gave an average unloading rate of 50 M.T. per hour. The unloading employed anywhere from 12-36 men working. At this rate it will take roughly 14 days to unload the ship.

As a demonstration of bulk handling of grain a proposal had been made to the SIED to have two to four truck loads of bulk wheat hauled from Aqaba to the Ruseifa storage site. (See Appendix C). To accomplish the bulk hauling would have required lining the truck box with a material to prevent grain spillage through the slotted sides of the boxes. Wood panels could be used but because of cost, jute sacks were proposed. Due to lack of anyone wanting to assume the responsibility for any loss that might have occurred, the proposal was not carried out. It is hoped that by the scheduled arrival of additional wheat on August 23, 1968 the difficulties will have been resolved and a test of bulk hauling will be attempted.

In preparation for the proposal to haul wheat in bulk from Aqaba to Ruseifa costs for materials to line truck boxes were determined. (See Appendix D.) It is interesting to see that the cost for material to line the truck box with wood panels is about the same as the cost of used jute sacks to haul an equivalent quantity of grain.

The firm of Rendel, Palmer and Tritton, West-Minister, London S.W. 1 prepared a report entitled, "The Hashemite Kingdom of Jordan, Port of Aqaba Recommended Eight Year Development Plans 1964-1971, February 1964." In the report, a section was devoted to "Bulk Grain Imports." (See Appendix B.) Recommendations were made for two four year periods.

Briefly, the first four year proposal was for the construction of a warehouse at the Port for bulk storage of 10,000 M.T. of grain with facilities for sacking the grain prior to further shipment. Unloading was to be done by ships grabs discharging grain into 10 to 12 ton capacity trucks for short hauls to the warehouse. Unloading rate was estimated at 150 M.T. per hour. Cost of this proposal was estimated at JD 125,000 ($350,000).

The second four year proposal was for a 30,000 M.T. elevator (concrete silos) and a pneumatic grain unloading system at an estimated cost of JD 600,000. The second four year proposal was recommended if grain traffic exceeded 200,000 M.T. per year.

Mr. Fahed A'wamleh, Director General of the Port of Aqaba indicated there were no plans for building any grain handling facilities at the Port.

At present there does not appear to be a need for the 30,000 M.T. silo storage. Wheat imports for the past four years has been as follows:

1963-64	16,400 M.T.
1964-65	2,015 M.T.
1965-66	20,499 M.T.
1966-67	19,519 M.T.

A multi purpose warehouse in which bulk grain could be stored temporarily could, however, be utilized. In addition to grain, the warehouse could also be used for intransit storage of flour and other commodities which at present are stored in the open. Bulk unloading equipment which is portable should also be considered. The unloading equipment could be truck mounted and used at GOJ storage sites as well as the Port.

F. Transportation.

All grain transported in the Hashemite Kingdom of Jordan is handled in jute sacks of roughly 120 kilo (250 Pound) capacity. Sacks are loaded and unloaded by hand labor.

1. Truck Transportation. At present nearly all transport of bagged grains within Jordan is accomplished with trucks and/or trailers.

Small quantities of grain may be moved limited distances by tractor or animal drawn cart. This would include field-to-farm and farm-to-market transport of small quantities of grain.

There appears to be an adequate supply of trucks, tandem trailers and semi-trailers to accommodate present movement of grain within Jordan.

An official of the Garage Union, the organization which appears to control the trucking industry, Mr. Mustafa Hasham Okkaileh, indicated trucks and trailers used to transport grain were of the following capacities:

Trucks	15 metric tons
Tandem Trailers	12 metric tons
Semi-trailers	28 metric tons

Trucks and trailers (PS-59, 60, and 61) have a solid box which extends upward about one meter in most cases. Above the solid box is a rail-type box which extends upward about another half meter. The solid box portion of trucks and trailers are generally lined with sheet metal. Tandem and semi-trailers have trap door hatches of about one square

foot mid-way along one side of the trailer (PS-62). Trucks do not have the trap door. The trucks and trailers have been designed with a dual purpose in mind. The solid box, trap door design is for bulk transport of phosphates from processing plants near Amman to Aqaba for export. The rail type upper protion allows transport of bulkier containerized items.

The trucks now in general use in Jordan could be modified at minor cost for use in bulk transport of grain. As indicated in Appendix D of this report, cost of materials to modity a truck is about the same as cost of used jute bags for one load of grain. Tandem and semi-trailers equipped with trap door hatches would lend themselves to easy unloading of bulk grain.

Truck charges for transporting bagged grain are 10 fils/ metric ton/ kilometer (about $0.028/M.T./ Km.). The quantity of bulk grain per load would be about the same as that hauled in sacks. This is the case since sacked grain can be loaded above the top of truck sides. There are supposed to be legal load limits but in some instances they are violated.

It was obvious during examination of the trucks used to transport grain from Aqaba to Amman that they were not adequately cleaned prior to hauling the grain. In some instances phosphate residues were up to 2 inches deep in truck beds.

2. Roads. Roads in Jordan are in generally good shape. They are of asphalt type construction and appear to be well maintained.

Major roads are shown in Figure 8. They provide access from the major production areas to major consumption areas.

Grain imports through Port of Aqaba are transported to Amman via roads through Ras en Naqb and Ma'an and the desert highway. The road from Aqaba to Ras en Naqb is the most difficult for truck transport. Although the road is rugged and there is a steep hair pin climb out of the valley to Rae en Naqb it is passable.

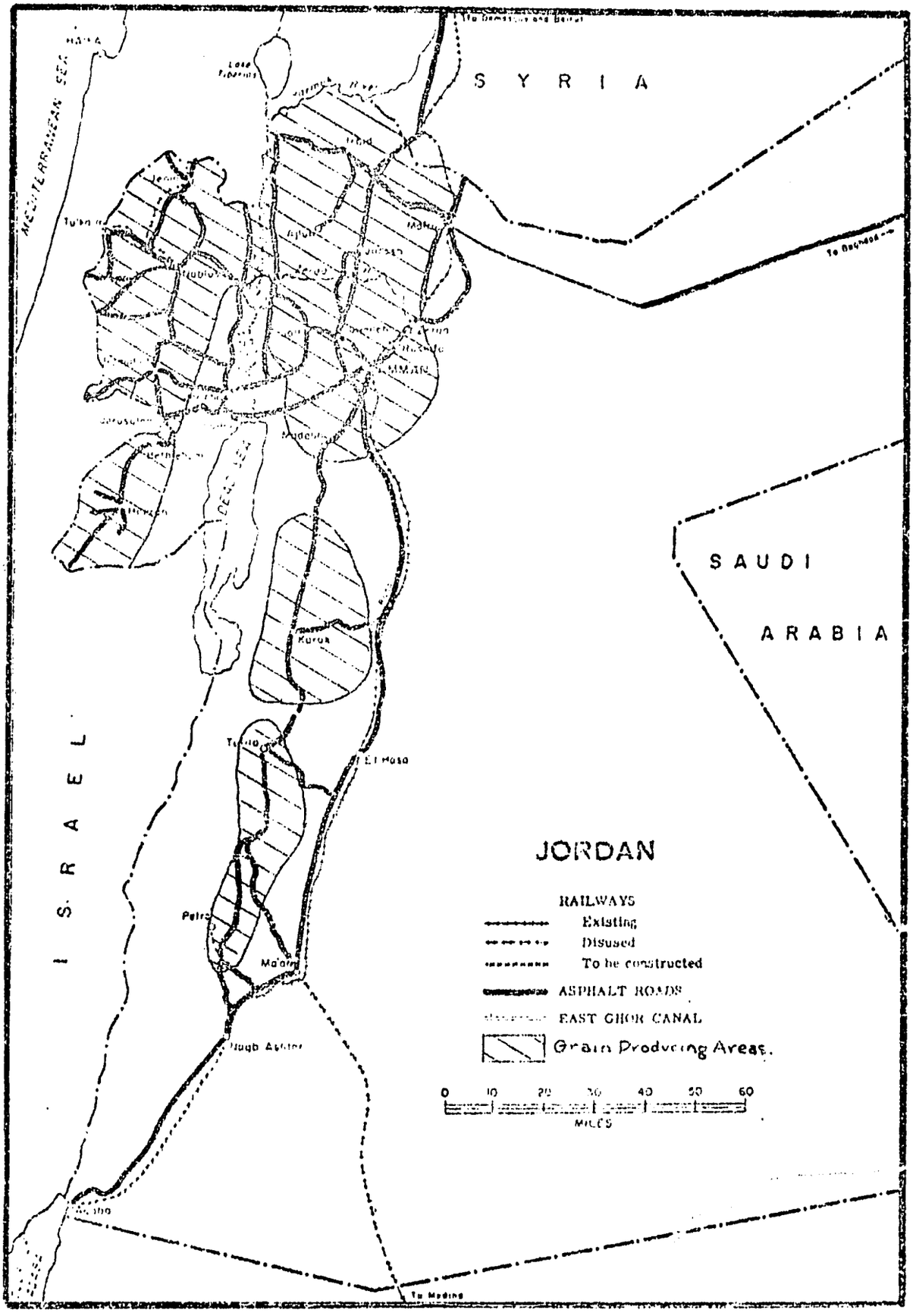
Roads from aqaba to Amman have been maintained to handle the phosphate export traffic.

There are also roads to Syria and Iraq for import from these countries.

3. Railroads. To the best of my knowledge no grain is now transported by railroad.

The present rail system extends from the Syrian border north of Mafraq to Amman, Ma'an and Ras en Naqb. According

Figure 8. MAJOR ROADS AND RAILROAD IN RELATION TO GRAIN PRODUCING AREAS



to the FAO Mediterranean Development Project - Jordan Country Report, 1967 tender specifications were completed in 1967 to extend the railroad to Aqaba. Whether or when this extension will be completed is not known.

At present, phosphate is shipped by rail to Ras en Naqb and transferred to trucks for remainder of the trip to Aqaba. Various type rail cars are used (PS-63, 65, 66, and 67). There are approximately 140 30-metric ton capacity metal cars (PS-63) which have been designed for bulk hauling of phosphate. They have two top loading hatch and two trap door type unloading hatches on the under side of the car (PS-64). The 30 metric ton capacity metal cars used for phosphate could be used for bulk grain transport on a backhaul from Port of Aqaba if and when the railroad is extended.

Other rail rolling stock includes smaller, 10 metric ton capacity, metal box cars (PS-66), two sizes of hopper cars with side opening discharge (PS-65) and wooden boxcars with capacities under 10 metric tons (PS-67).

U.N.R.W.A. flour at present is trucked from Port of Aqaba to Ras en Naqb and then transferred to boxcars for transport to Amman.

The route of the only railroad in Jordan (Figure 8) is so located that rail transport of grain in any form could be benefical for imports through Port of Aqaba (providing the railroad is extended from Ras en Naqb to Aqaba) or from Syria or other northern countries.

G. Flour Mills.

According to the Jordanian Department of Statistics there were 337 active flour mills in Jordan in 1966 (See Table 7). The east Bank had 175 of the total mills. These figures include all sizes of mills. According to reports by Dr. Clinton Brooke, 9 or 10 large mills operating year round 5 - 6 days per week produce 75 - 80% of the total white flour milled in Jordan. At least five of the larger mills are located in Amman.

Two-thirds of the imported wheat is processed in the mills in the Amman area, presumably in the larger mills. In 1966 a total of 34,300 metric tons of imported wheat were milled in the Amman area as compared with 15,400 metric tons of local wheat. Approximately half of the local wheat milled was milled in the West Bank in 1966. There was also 11,300 metric tons of imported wheat milled in the West Bank in 1966.

Table 7 ACTIVE FLOUR MILLS IN JORDAN DURING 1966 BY GOVERNORATE

Governorate (Muhafadha)	No of Employees	Fuel Consumed (Solar)	Kind and Quantity of Grain Milled					No. of Mills
			Others	Lentils	Barley	Foreign Wheat	Local Wheat	
	No.	Tons	000 Metric Tons					No.
Total	687	2908.1	5.3	0.4	2.0	44.6	60.7	337
Amman	206	1281.1	3.5	0.1	0.1	34.3	15.4	41
Balqa	36	126.0	0.1	---	1.0	---	3.1	28
Irbid	96	279.0	0.4	0.1	0.1	---	8.7	73
Karak	32	60.0	---	---	---	---	2.1	22
Ma'an	14	30.0	---	---	0.1	---	1.1	11
East Bank Total	384	1776.1	4.0	0.2	1.3	34.3	30.4	175
Jerusalem	114	426.3	0.6	0.1	0.3	2.9	12.7	63
Nablus	150	598.7	0.3	0.1	0.2	7.4	14.7	79
Hebron	39	105.0	0.4	---	0.2	---	2.9	20
West Bank Total	303	1132.0	1.3	0.2	0.7	11.3	30.3	162

Source: Owners of Mills

From: Hashemite Kingdom of Jordan
Department of Statistics
Statistical Yearbook 1966
No. 17.

The conflict of June 1967 has had an effect on mill production and grain utilization. According to a survey conducted by Mr. Abdul Awad (See Table 8) at four large flour mills in Amman, the following has occurred. Prior to the conflict, mills operated 24 hours a day, 7 days a week with capacities from 45 to 75 metric tons of grain per 24 hours and sold from 30 to 65% of their production to the West Bank. After the conflict, running time has been reduced to 8 hours a day for 6 day week with no sales to the West Bank.

According to Mr. Awad's survey, all of the mills contacted, feel that the relief agencies such as UNRWA, etc. should import wheat rather than flour and let Jordanian mills provide the processing. Such a program would offset the mills' loss of business but would necessitate improved mill grain storage facilities and improved handling and transportation facilities at the Port of Aqaba.

Table 8 RESULTS OF SURVEY BY ABDUL AMAD - 4 MILLS IN AMMAN AREA

Mill	Amman Milling Co.	Al-Urdon Mills	Hashemite Mill	Modern Mill	Remarks
Capacity (M.T./24 hr.) * (Prior to 6-67)	75 M.T. 7 days 24 hrs.	45 M.T. 7 days 16 hrs.	45-50 M.T. 7 days 24 hrs.	48-50 M.T. 7 days 24 hrs.	All Mills feel voluntary agencies (UNRWA, ect.) should import wheat and let local mills process instead of importing flour for distribution.
Quant. Sold to W. Bank (Prior to 6-67)	CA 65%	CA 50%	CA 50%	CA 30%	
Prod. In M.T. (After 6-67)	15 M.T. 6 days 8 hrs.	10 M.T. 6 days 8 hrs.	5-8 M.T. 5 days 8 hrs.	16 M.T. 5 days 8 hrs.	
Quant. Sold to W. Bank (After 6-67)	None	None	None	None	
Quant. Sold to Local Mkt.	300 M.T./Mo. (Part to Army)	240 M.T./Mo (Part to Army)	100 M.T./Mo (Part to Army)	300 M.T./Mo. (Part to Army)	
Quant. Export to Saudi Arabia	10 M.T. Mo.	8 M.T. Mo.	10 M.T. Mo.	10 M.T. Mo.	
Type of Wheat Used	1. Local '67 2. U.S. '67	Local '67 French '67	Local '67 U.S. '67	Local '67 Canada '67	
Flour Prices					
Zero	JD 41	JD 43	JD 45	JD 45	
Grade 1	JD 37.5-38.5	JD 39	JD 40	JD 40	
Laborers	24	24	28	62	
Daily Expenses	JD 70	JD 70	JD 70	JD 100	

* Capacity is metric tons of wheat milled.

APPENDIX

APPENDIX A

TABLE OF JORDANIAN, METRIC AND U.S. EQUIVALENTS

VOLUME

1 cubic meter = 35.314 cubic feet
1 cubic meter = 28.376 U.S. bushels
1 cubic foot = 0.028 cubic meters
1 cubic foot = 0.8036 U.S. bushel
1 U.S. bushel = 0.0348 cubic meters
1 U.S. (Winchester) bushel = 1.2445 cubic feet

AREA

1 dunum	=	0.1 hectares
1 dunum	=	1000 square meters
1 dunum	=	0.247 acres
1 hectare	=	10 dunums
1 hectare	=	10,000 square meters
1 hectare	=	2.471 acres
1 acre	=	4.047 dunums
1 acre	=	0.405 hectares
1 acre	=	4046.9 square meters

WEIGHT

1 metric ton	=	1000 kilograms
1 metric ton	=	2204.6 pounds
1 metric ton	=	36.7 bushels (60 pound) wheat
1 metric ton	=	45.9 bushels (48 pound) barley

CURRENCY

1 J.D. (Jordanian Dinar) = $2.80 U.S.
1 J.D. = 1000 fils
1 U.S. dollar = 357 fils

APPENDIX B

FROM: THE HASHEMITE KINGDOM OF JORDAN, PORT OF AQABA
RECOMMENDED EIGHT YEAR DEVELOPMENT PLANS, 1964-1971
RENDEL, PALMER & TRITTON, WEST-MINISTER, LONDON S.W. 1
February, 1964

V. BULK GRAIN IMPORTS

27. Present Day Unloading Methods

It is understood that of all grain imports into Jordan through Aqaba, only wheat actually arrives in bulk. Other grains, flour and sugar are shipped in bags and will probably continue to be handled in this way.

Wheat, nearly all of which is Foreign Aid, arrives usually in 10,000 ton shipments. The ships are normally discharged at anchorage in the Bay, and the lighterage company, Abu Zeid and Nazzal, send gangs out to bag the grain in the ship's holds before unloading overside into their lighters. It takes on average about ten days to discharge 10,000 tons. The bagged wheat is usually brought ashore at the Lighter Berth in the Middle Port and stacked in huge piles ready for subsequent loading into lorries. The present day costs per ton for handling wheat from its bulk state in a ship's hold to loading onto lorries for dispatch from Aqaba is understood to be about JD 1.20 per ton which is paid by the Jordan Government. Some reduction in this figure must be sought.

Rendel, Palmer and Tritton have been unable to obtain figures of bulk grain imports through Aqaba for past years, but have been given to understand that between November 1962, and October 1963, some 78,000 tons of wheat was discharged, 47,000 tons of it in one four-week period.

28. Proposed Short-Term Scheme for Bulk Grain

The present annual tonnages, which appear to be comparatively small, can hardly justify a heavy capital expenditure, and Rendel, Palmer and

Tritton have therefore proposed a low cost Short-Term Scheme, which is illustrated on Drawing No. 5 at the end of this Report, for reducing the unloading costs of bulk grain.

A grain ship will berth at Cargo Berth No. 2, or at Cargo Berth No. 1 according to availability, and discharge the grain cargo direct into ordinary 10 to 12 ton lorries using grabs handled by the ship's own derricks. Grabs designed for handling wheat would be used and the ship's derricks would be worked with a "Union Purchase" rig. With all holds of a 10,000 d.w.t. ship being worked at the same time an unloading rate of 250 tons per hour could be achieved, but the average rate over the whole discharging operation would probably be of the order of 150 tons per hour. A photograph of a ship discharging a bulk cargo by the method described above is reproduced on the facing page.

The loaded lorries would be driven to the Grain Store sited behind future Cargo Berth No. 3 and unloaded by end-tipping on a platform of similar type to those at the existing Phosphate stores; the grain would be transferred into the Store by overhead conveyor belt. Rendel, Palmer and Tritton understand that grain imports tend to be concentrated into a few weeks of the year, so the Store, which is of sufficient capacity to hold a 10,000 ton shipment, has been designed for use either as a Bulk Grain Store or as a General Cargo Store in the grain off-season.

Rendel, Palmer and Tritton assume that grain will continue to be dispatched from Aqaba in bags, so the scheme includes for mobile bagging plants which will work into the stack of grain in the Store; each bagging plant would consist of feed hopper (to be kept filled with grain by a conveyor elevator or grab), weigher, feed spout, sack stitcher and conveyor, all mounted on a wheeled trailer. The rated capacity of each plant would be 25 tons per hour.

With this Short-Term Scheme, bulk grain ships will be unloaded in about half the time now taken, which will result in a lower shipping cost, and bagging will be carried out more economically and in better working conditions in the Store.

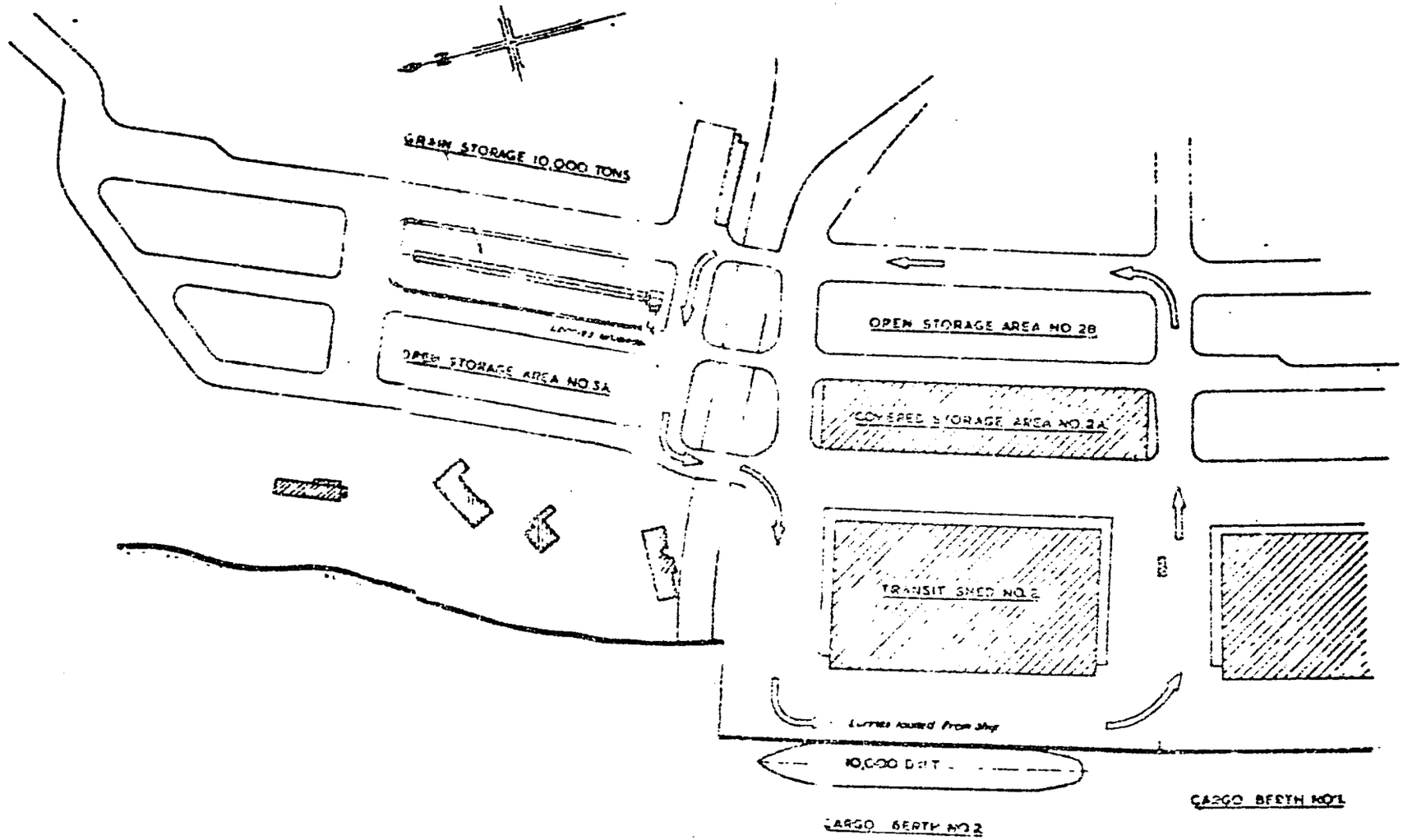
29. Long-Term Scheme for Bulk Grain

If the population of Jordan increases over the next few years to such an extent that annual grain imports have to be greatly increased, then the cost of a more extensive Bulk Handling Plant would be justified. The Long-Term Scheme for Bulk Grain would consist of a mobile pneumatic grain unloader, travelling on Cargo Berth No. 3, and stationed when not in use at the northern end, sucking the grain out of the holds of the ship and delivering on to a grain conveyor, carried past the northern gable of Transit Shed No. 2, and delivering to a 30,000 ton grain Silo to be built behind future Cargo Berth No. 3 and adjacent to the Grain Store described in Section 28, which will then revert to use solely as a General Store, or possibly be used to store grain after bagging.

This Long-Term Scheme has been included in Rendel, Palmer and Tritton's recommendation for the Second Four-Year Plan, 1968-1971, but implementation would only be justified if the annual bulk grain traffic has risen to about 200,000 tons a year.

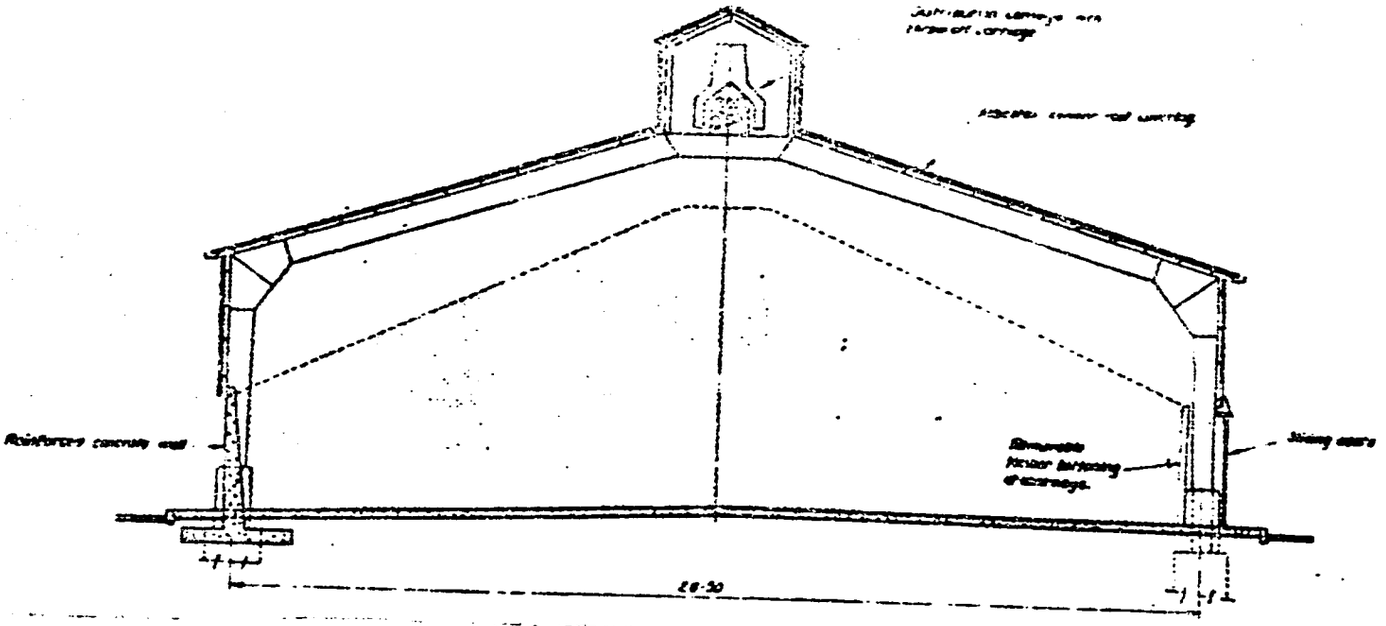
30. Summary of Costs for Bulk Grain

The Short-Term Bulk Grain Scheme, included as a recommendation in the First Four-Year Plan, is estimated to cost JD. 125,000 and the Long-Term Scheme, with pneumatic unloader, conveyors and 30,000 ton silo which may be needed in the Second Four-Year Plan is estimated at JD. 600,000. The figures are preliminary only, and the proper percentages must be added.



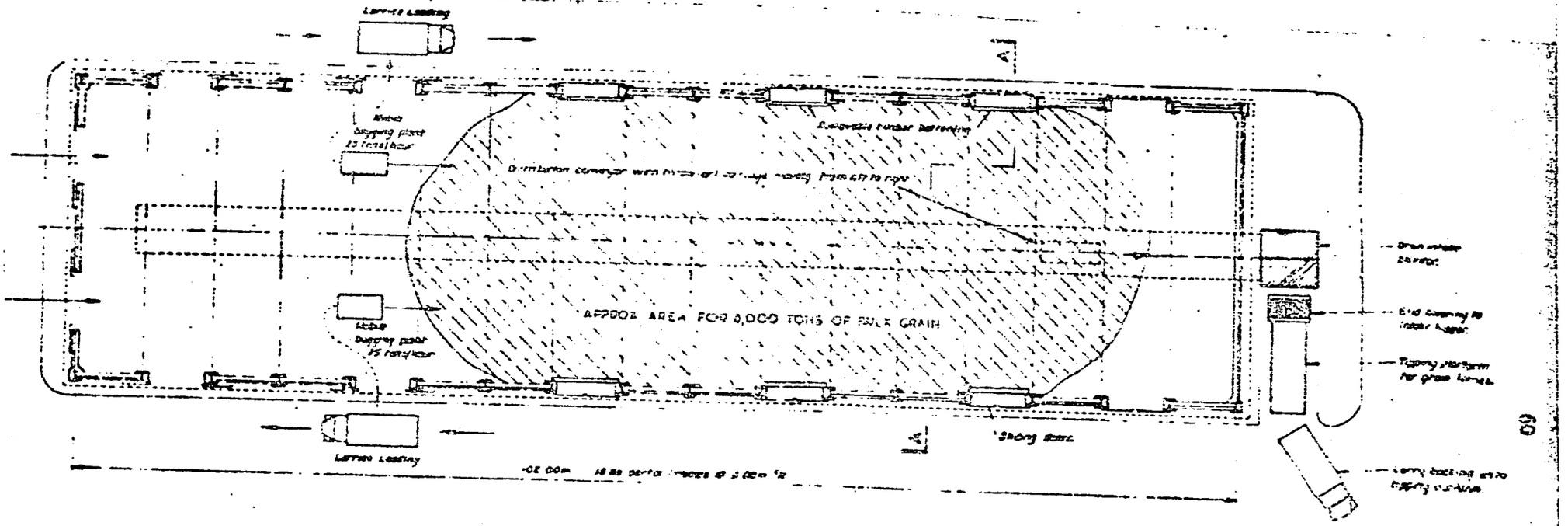
KEY PLAN TO SHOW MOVEMENT OF GRAIN LORRIES

SCALE- 1/2500

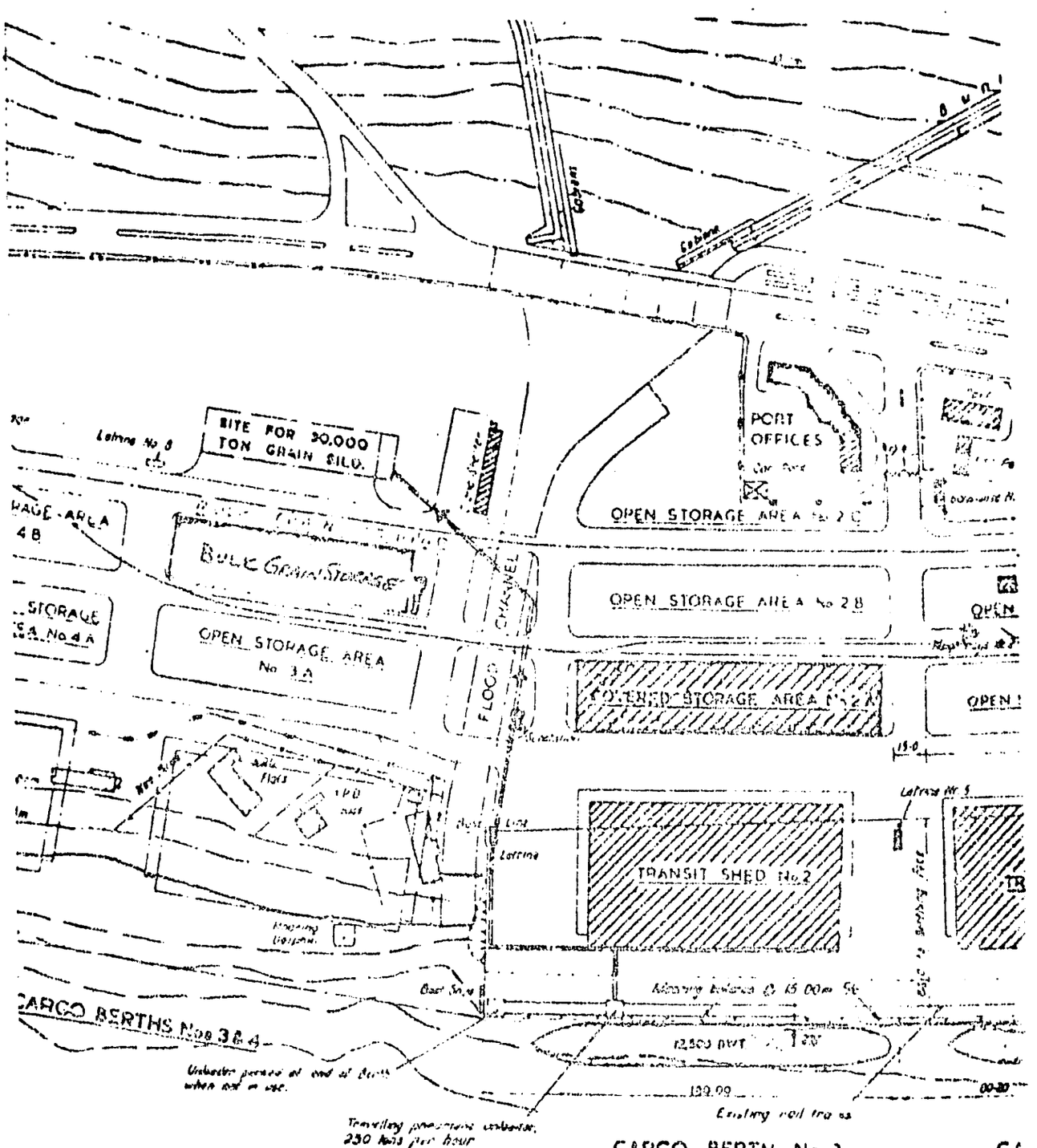


SECTION A-A

SCALE:- 1/200



GROUND PLAN OF 10,000 TON GRAIN STORE


SITE FOR 30,000 TON GRAIN SILO.
PORT OFFICES
OPEN STORAGE AREA No 2 C
OPEN STORAGE AREA No 2 B
OPEN STORAGE AREA No 3 A
COVERED STORAGE AREA No 2 A
FLOOD CHANNEL
TRANSIT SHED No 2
CARGO BERTHS Nos 3 & 4
CARGO BERTH No. 2

APPENDIX C

July 11, 1968

Mr. Jiryes Kekish
Assistant Director
Supply, Import/Export Department
Amman, Jordan

Dear Mr. Kekish:

This morning in your office Mr. Horton, Mr. Awad and I, discussed a three step proposal for improvement of grain handling, transportation and storage. The three steps were as follows:

1. Test feasibility of bulk transportation and handling of wheat from Aqaba Port to S.I.E.D. Storage Site at Ruseifa.

2. Test wheat storage in metal silos equipped with temperature reading and aeration systems at Ruseifa.

3. Install temperature reading and aeration systems in all metal silos at Ruseifa and add bulk handling equipment. (This step will follow if Step 2 is successful).

Specifications for equipment required to perform Steps 2 and 3 will be the subject of another letter.

The remainder of this letter is directed to Step 1 of the above proposal.

It is proposed that:

1. Four truck and/or trailer loads of bulk wheat be transferred from Aqaba Port to S.I.E.D. Storage Site at Ruseifa on or about 16 July.

2. Above truck and/or trailer loads of wheat be unloaded at Ruseifa into the elevator servicing the concrete bins (Cap. 500 M.T. each).

It is understood, and you have very generously agreed, that the Supply, Import and Export Department will assist by doing the following:

1. Supply labor and materials to form linings of canvas and jute bags, and install the linings in the trucks and/or trailers.

2. Supply rope to strengthen tops of truck and/or trailer boxes against lateral pressures of the wheat.

3. Provide labor at Aqaba Port to empty bags of wheat into trucks and/or trailers on or about 16 July. (This may not be necessary if the ship has bulk unloading equipment).

4. Provide proper operation and cleaning of the elevator and its equipment for unloading four trucks and/or trailers at Ruseifa before 16 July.

5. Remove the roof over the unloading pit at the elevator at Ruseifa before 16 July.

6. Provide temporary hopper and chute at elevator unloading pit.

7. Provide labor at Ruseifa to assist in unloading four trucks and/or trailers at Ruseifa elevator on or about 16 July.

The assistance of the Supply, Import and Export Department in performing Step 1 of the proposal is greatly appreciated. It is hoped that this test will lead to safer and more economical transportation and storage of grain in Jordan.

Sincerely,

John R. Pedersen
Grain Storage Consultant
U.S. AID/Jordan

cc. Dr. Sami Sunna' - JDB
C&R (3)

AG,JRPedersen:ghk

APPENDIX D

COMPARISON OF COST OF USED JUTE BAGS
AND PLYWOOD TRUCK LINING

Approximate Cost of Lining Truck (12-14 M.T. Capacity)
With Plywood (or Pressed Wood)

Sides		
2 Sheets	8mm Pressed Wood 180 cm x 361 cm @ 2.400	4.800
2 Sheets	8mm Plywood 122 cm x 244 cm @ 1,250	2.500
Ends		
2 Sheets	8mm Plywood 122 cm x 244 cm @ 1.250	2.500
	COST OF WOOD LINING	JD 9.800
	COST OF BOLTS TO INSTALL LINING	1.300
	TOTAL COST	JD 11.100

Approximate Cost of Used Jute Sacks
For Load of 12 M. T.

Each Sack (120 KG Cap) Cost	JD 0.100
100 Sacks Needed for 12 M.T. (12,000 KG) @ JD 0.100	10.000
TOTAL COST OF USED SACKS	JD 10.000

APPENDIX E

PERSONNEL CONTACTS IN GOVERNMENT OF JORDAN, USAID/JORDAN AND USAID/WASHINGTON

GOVERNMENT OF JORDAN

His Excellency Sami Ayoub, Minister of Agriculture
Mr. Hashem Dabbas, Director of Supply Import-Export Department (SIED)
Mr. Jiryes Kakish, Deputy Director (SIED)
Dr. Sami Sunna', Jordan Development Board
Mr. Yusef Atiyeh, Jordan Development Board
Mr. Abdul-Raouf Nabulsi, Manager of Wheat Production Project, Ministry of Agriculture
Mr. Ahmad Khasawneh, Director of the Plant Protection Institute
Mr. Fahed A'wamleh, Director General Port of Aqaba Authority
Mr. Zeid Nabulsi, Manager of Sied Storage at Ruseifa
Mr. Mustafa Hashem Okkaileh, Garage Union

USAID/JORDAN

Mr. John Funari, Mission Director, AID/JORDAN
Mr. Arthur M. Handly, Deputy Director, AID/JORDAN
Mr. Dallas Ostergaard, AID executive Officer
Mr. E. B. Bowen, Chief Agricultural Officer
Mr. C. R. Horton, Deputy Chief Agriculture
Mr. Fuad Qushair, Administrative Assistant Agriculture
Mr. Fred Thomas, Regional Food for Peace Officer, Jordan
Mr. Abdul Awad, AID/JORDAN

USAID/WASHINGTON

Mr. O. L. Minns NESA/ID
Mr. Anderson Renshaw NESA/ID
Mr. Jacob Crane NESA/NE

APPENDIX F

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