ANNEX - E

FACILITIES DEVELOPMENT PLAN

ANNEX-E FACILITIES DEVELOPMENT PLANNING

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. EXISTING SOIL AND WATER CONSERVATION MEASURES

1.1 General

Jordan has been promoting soil and water conservation projects since 1960s such as Soil Conservation and Fruit Tree Planting Project, Highlands Development Project and Zarqa River Basin Project and has accumulated substantial experiences in the soil and water conservation measures. The Highland Development Project renamed "Development of Highland Agricultural Regions" has been implemented since 1965 by the Ministry of Agriculture with technical and financial support from FAO through the World Food Programme (WFP). This project is the most informative for its long experiences on the soil and water conservation measures. The objectives were:

(a) To control soil erosion;
(b) To ensure better utilization of the limited water resources;
(c) To stabilize agricultural output at higher levels; and
(d) To bring about a shift in production from cereals to olive and other fruit trees in hilly areas with shallow soils.

The following practices were used by several of the soil conservation projects carried out in Jordan.

(a) Earth Banks
(b) Gradoni Terraces
(c) Bench Terraces
(d) Contour Stone Terraces
(e) Stone and Reinforced Concrete Structures
(f) Micro-Catchments
(g) Check Dams

Much information on the existing measures were referred to a soil and Water Conservation by A.A,. Jaradat and J.A. Mushrofa in the bank titled An Assessment of Research Needs and Priorities for Rainfed Agriculture in Jordan.

1.2 Earth Banks

Two types of earthen banks are constructed as soil and water conservation measures:

(i) Diversion banks: These were designed to intercept run-off, either from broad areas or depressions, and carry it to areas where it can be safely drained. In Karak area, diversion banks were principally used to protect cropped land from foreign water.

(ii) contour or absorption banks: These are constructed along contour lines and were designed to intercept and retain surface runoff before attains a high velocity.

1.3 Gradoni Terraces

A gradoni terrace is an excavated ditch constructed along the contour. Trees are planted directly into the terrace. These structures intercept water which runs from the interterrace area, and hold it in the terrace while it infiltrates into the soil.

The gradoni terraces are adapted in areas where soil is deep with a slope of 5-15%.

1.4 Bench Terraces

These structures should not be used except in situations where other soil and moisture conservation practices are not applicable. This is due to the relatively high construction cost of bench terraces. Contour stone walls were preferable where sufficient stones were available to build them. Bench terraces were built on slopes of 15-35% where stones were not sufficiently available.

1.5 Contour Stone Terraces

This soil conservation measure proved to be the most useful method of controlling soil erosion on the steep and stony land in Jordan. Contour stone terraces have the following advantages:

(i) Intercepting and reducing the velocity of surface runoff, thus reducing the erosive power of water and allowing suspended soil sediment to be dropped.

(ii) Encourage farmers to cultivate on the contour, ensuring maximum conservation of soil and soil moisture.

(iii) Clearing surface stones from agricultural lands.

Stone terrace construction was not recommended if suitable surface stone was not available adjacent to the terrace site. Other soil conservation measures, such as earthen banks or gradoni terraces, were recommended where no surface stones are available.

1.6 Stone and Reinforced Concrete Structures

There structures were designed to deliver flows from natural surfaces to the floor of a gully without causing erosion. Some types were used to slow down runoff from banks and dissipate its energy. Building materials used were;

(i) Dry structure; stones of different sizes and shapes are stacked as densely as possible without a mortar bond.

(ii) Concrete-capped layer of stones at the top of a dry structure as in (i).

(iii) All stones in the structure were bonded together with mortar or concrete.

The above mentioned structures can be built entirely of reinforced concrete.

1.7 Micro-Catchments for Water Harvesting Measures

Micro-catchments are small, almost rectangular or diamond-shaped, partly embanked plots, of which the diagonal is along the direction of the slope. In the downslope corner of the plot, embankment increased in both height and width. All the runoff of the plot is collected in the downslope corner where a tree is planted. Micro-catchments is recommended for subsistence horticulture on slopes between 0-25% in the rainfall of less than 300mm per annum.

1.8 Check Dams

In a wadi with catchment of 25-500ha and with a gentle river bed gradient, a check dam has been built in the study area to reduce the water velocity, to retain sediment or to grow crops in the reservoir areas.

There are several types of check dam in Jordan. In a small catchment area of 25 to 50 ha a check dam without an apron or with an apron but without a sill was observed. In a wadi with a catchment of more than 50ha, a check dam with a apron and stilling basin was built. The safe criterion for the spacing of stone check dams in the Zarqa river basin says that the top of the lower dam should be at the bottom level of the upper dam.

2. WATER HARVESTING

2.1 General

There are the following 5 measures have been adopted for the soil conservation and water harvesting measures in the Project area.

(i) Stone contour terraces (stone walls)
(ii) Absorption earth banks (earth banks)
(iii) Bench terraces
(iv) Gradoni terraces (excavated ditch)
(v) Check dams

The gradoni terraces have difficulties in their construction by farmers for their sophisticated design criteria and in control of weeds. The Study team visited several bench terraces and found there are bare rocks or gravel exposed resulting in elimination of soils, by the construction of bench terraces. Farmers have little supports for the terraces.

According to the farm survey by the present study team on farmer's intention on the soil conservation and water harvesting measures, the terraces covered only 3% of choices of fruit farmers among several alternatives i.e. pond, contour furrows check dams, water tanks (like cistern), terraces, and stone walls, as shown in the following table.

Farmers' choices of Soil/Water Conservation Measures

Measures		Farmers		
		Livestock	Cereal	Fruit Trees
No. of farmers answered		20	13	25
a. pond	(%)	50	40	14
b. contour furrows	(%)	0	0	6
c. check-dams	(%)	18	5	14
d. water tanks	(%)	29	30	47
e. terrace	(%)	0	5	3
f. stone walls	(%)	3	15	17
g. others	(%)	0	5	0

Source: Survey by the present study team.

In conclusion the following measures is recommended to be adopted in the project.

- Stone walls
- Earth banks
- Tied contour furrows
- Microcatchments
- Check dams

The following application criteria was made primarily based on the existing criteria applied in the Highland Development Project.

Application Criteria

Slopes (%)	Soil Depth (cm)	Annual Rainfall (mm) 300-200	200-100
0-8	50-100	-	microcatchments (fodder shrub)
	100<	-	microcatchments (fruit trees)
8-12	50-100	stone wall/ contour furrows (field crops)	stone wall/ contour furrows (fodder shrub)
	100<	stone wall/ earth banks (fruit trees)	stone wall/ contour furrows (fodder shrub)
12-30	50-100	stone wall/ contour furrows (barley, forage legume, shrub)	
	100<	stone wall/ earth bank (fruit trees)	

The guidelines for construction of the proposal facilities are as follows.

2.2 Contour Stone Walls (CSW)

Contour stone walls are planed on slopes between 8-30% with moderately deep to deep soils where surface stones are available for materials. The spacing between walls are about 100m with 8-12% slope coverage and 25 to 30m with 12-30% slope under annual rainfall of 200-300mm.

construction method depends on the availability and size of stones. The bigger stones should fill the space in the center. The size decreases in the higher position to provide the optimum filter function. The wall surface should be covered by relatively big and flat stones. The fill in the upper side of the wall should be compacted when completed (see Fig. E.1.1)

2.3 Absorption Earth Banks

Absorption earth banks are applied on slope 8-18% under annual rainfall of more than 200mm. The spacing between earth banks are about 100m for 8-12% slopes and 25 to 30m for 12-18% slopes.

The banks are chisel plowed (ripping) 2m wide on either side of the established contour line. The banks are then formed by hand labor. The height of the bank should be more than 50cm and not less than 30cm wide at the top and more than 90cm wide at the base (Fig. E.1.2)

2.4 Micro-Catchments

Micro-catchment (MC) is small, almost rectangular or diamond-shaped, partly embanked plots, of which the diagonal is along the direction of the slope. In the lowest corner of the plot, embankment will increase in both height and width. All the run-off in the plot will be collected in the lowest corner where a tree will be planted.

MC will be constructed roughly by tractor plow and then shaped by hand. Before construction, the contours will be surveyed and locations of trees will be marked. The embankment can be low (about 10cm) at the ends but increases height up to 30 to 40cm near tress. The sizes of a micro-catchment will be as follows depending on the crops and rainfall (see Fig. E.1.3)

Size of a Micro-catchment

(Unit: m)

Annual Rainfall (mm)	Olives	Grapes	Apricots	Shrub
100-150	45 x 45	15 x 15	58 x 58	5.7 x 5.7
150-200	41 x 41	13 x 13	45 x 45	5.7 x 5.7
200-250	35 x 35	11 x 11	41 x 41	5.7 x 5.7

2.5 Check Dams

Check dams will be built in wadis with a catchment of 100-500 ha and with gentle gradients. A tipical check dam site should be 30 m wide and have a reservor of about 0.3ha at least. Check dams will be built with gabions with a dimention of 0.5-1.0 m thick, 1.0 m wide and 2-4 m long. Rock for gabions should be graded. As a general rule, 25% of rock should have diameters of 10-15cm. The maximum depth of cut at the upstream side of a dam should be 1.5-1.0m for the bottom gabions and 0.5m in the apron gabions. A key into the sides of a wadis should be at least 1.0m long. Cutting for an apron should be more than 3.0m long. The total length of cut for a apron and a sill should be 4m. An apron will be made of gabion of 4 m long and 0.5m thick. The sill at the end of an apron will be made of 1.0mx1.0mx2.0m gabion(see Fig.E.1.4).

3. WINTER IRRIGATION SCHEME

3.1 Selection of Weir Sites

The JICA preliminary mission for the feasibility study of the Karak-Tafila Agricultural Development confirmed the following facts with the government of Jordan:

1) Construction of any facilities for water resource development will not be permitted in the catchment area of Wadi Wala.

2) Planning of Sin Sara on Wadi Karak will be excluded from the study even if surplus water for irrigation is available, because of the water utilization programme has already been established.

3) Apart from cases mentioned above, other dams/weirs with a storage capacity of less than 100,000 m^3 will be possible but need acceptance of the Water Authority of Jordan.

4) Any utilization of ground water for irrigation will not be permitted in the study area.

Taking the above conditions into consideration, the winter irrigation schemes were formulated mainly in the catchment area of Wadi Hasa.

According to the inception report, the reconnaissance surveys of the following seven (7) sites were carried out to confirm the location and the existing condition of the sites from late October to early November 1989.

No.	Place	Name of Wadi	Structure	Catchment area km^2	Judgement	Reason or type
1)	D-1 Tafila	W. Laban	Dam	18.3	omitted	A
2)	D-3 Tafila	W. Laban	Dam	45.1	omitted	A
3)	E-1 Tafila	W. Zabda	Dam	9.0	accepted	Weir
4)	D-2 Tafila	W. Laban	Weir	26.9	accepted	Weir
5)	I-1 Tafila	W. Sidd	Weir	10.2	omitted	T
6)	J-1 Tafila	W. Khaur	Weir	19.8	accepted	Weir
7)	L-1 Tafila	W. Buries	Weir	15.9	omitted	A

Note: A: means the site is not suitable to the development from agricultural point of view i.e. too small cultivable area.
T: means the site is not suitable to be development from topographical point of view.

As is shown in the above table, three (3) weir sites were selected out of the seven (7) taking agricultural and topographical points into account.

The selected three (3) weir sites are summarized as follows:

1) E-1, selected weir site

E-1 weir site is located about 1km downstream of E-1 Dam site on the Wadi Zabda. The catchment area of the site is about $9.6km^2$. Farmland of about 5ha exist downstream from the site and can be irrigated by gravity flow (see Fig. E.2.1)

2) D-2, selected weir site

D-2 weir site in this study was selected between D-2 weir site and D-3 Dam site, both the sites proposed Master Plan Study, on the Wadi Laban. New D-2 weir site is situated about 2 km downstream of D-2 weir site proposed in the Master Plan Study. Because the construction costs of the site might increase by crossing the trunk road between Tafila and Qasr al Bint. The catchment area is about $34.8km^2$. Potential irrigable land of about 5ha exists downstream from this weir site and can be irrigated by gravity flow. Winter irrigation by a diversion weir scheme is conceivable (see Fig. E.2.2)

3) J-1, selected weir site

J-1 weir site in this study was selected on the Wadi Khaur is the same as the proposed Master Plan Study. The catchment area is about $18.7km^2$. Farm land of about 10ha exist both upstream and downstream from the site and cna be irrigated by gravity flow (see Fig. E.2.3).

4) Abyad weir site

On the other hand, the Abyad weir site was newly identified as favorable site through the investigation. The weir site is located on the Wadi Abyad, a tributary of the Wadi Sultan in Wadi Mujib basin, and is situated about 4km east of the Muhai village, about 25km south-east of Karak.

The catchment area of the weir site is about 117km^2, and has been developed for the cultivated land except hill areas. About sixty (60) percents of the catchment area in upstream side is agricultural land, and the rest around the proposed weir site has not yet been developed.

The proposed weir site will be expected to collect comparatively much water discharge corresponding to the higher percentage of cultivating land in the basin (see Fig. E.2.4).

3.2 Topo Survey of Proposed Sites for Detailed Surveys

The purposes of the topo survey for the Winter irrigation scheme in the Study are to prepare 1/500 topographic map, up to 10m high from the bottom of river bed for the above mentioned proposed weir sites, and to produce relevant topo data.

The following survey and mapping work were entrusted to RUQN AL HANDASA (local contractor) by the Karak-Tafila Agricultural Development Study Team and the contract signing is made on December 11, 1989.

1) Topo survey

	Description	Unit	Plan Qt'y	Actual Q'ty
a.	Plane table survey			
	- W. Laban (D-2)	ha	12	13
	- Khashabeh (E-1)	ha	6	8
	- Korbat Shade (J-1)	ha	13	13
	- Abyad	ha	29	44
b.	Profile survey at storage area			
	- W. Laban (D-2)	ha	700	700
	- Khashabeh (E-1)	ha	700	500
	- Korbat Shade (J-1)	ha	600	700
	- Abyad	ha	900	1,200
c.	Cross section at storage area			
	- W. Laban (D-2)	ha	2,250	1,795
	- Khashabeh (E-1)	ha	1,050	397
	- Korbat Shade (J-1)	ha	1,950	2,671
	- Abyad	ha	5,300	11,696

The topo survey is started by the local contractor on December 14, 1989. All topo survey and mapping work are finished by February 7, 1990.

All results of topo survey is prepared as the data book by the other volume.

a) Plan table survey

The area of plan table survey for each weir sites are indicated the above table, and the mapping scale of each weir site are 1/500 with one (1) meter of the principle contour, five (5) meters of the index contour and 0.5 meters of the supplimsutary contour in flat areas.

The elevation of each weir sites are determined the elevation of local datums used by the altimeter on the established bench marks respectively.

b) Profile survey at storage area

The beginning point of the profile survey is started from the center line point on the selected weir site. The line of profile survey is carried out from the weir site to the upstream in the storage area. The measuring intervals of profile are 25m and plus pages.

c) Cross section at storage area

The cross section survey are carried out at every 50m intermediate pag which have previously been set out at every 25m intervals along the profile survey line. The width of the cross section is up to 10m height from the elevation of the river bed at the weir site, and are from the line of profile survey to both sides in the storage area.

2) Plotting

The profile survey data acquired int he field are plotted at the scale of 1/1,000 in horizontal and 1/100 in vertical. The cross section survey data acquired in the field are plotted at the scale of 1/1,000 in horizontal and 1/100 in vertical.

The skeleton maps to indicate the location of the profile and the cross section survey lines are prepared at the scale of 1/1,000.

3.3 Design of Facilities

3.3.1 Design Criteria

In the proceeding chapter 3.1 of "Selection of Weir Sites", it is found that the four (4) weir sites of D-2, E-1, J-1 and Abyad have the possibility to be developed with the suitable for the maximum use of the estimated annual runoff at the weir sites.

The design of the facilities for the winter irrigation scheme are divided into the following 3 components:

a. Diversion weir
b. Intake
c. Irrigation canal

The study is based on the topo surveyed maps with 1/500 scale, profile and cross section survey at the storage area in the proposed weir sites.

The maximum flood discharge to the proposed weir sites is estimated by using the rainfall intensity, collected from Water Authority of Jordan (WAJ), and the rational formula for the each weir sites.

1) Diversion weir

As for the type of weir, the following weirs are considered.

- Homogeneous earthfill
- Wet masonry
- Concrete gravity

Typical section for the above 3 types of weir are in Fig. E.3.1.

The spillway with a non-gated overflow weir is adopted due to the safety and easiness of flood control, the normal water level (NWL El.) corresponds to the crest elevation of a spillway overflow weir.

The spillway design is made so that the maximum flood discharge is flowed within the maximum water level (MWL), as 1m or 1.5m above NWL.

In order to design the spillway of the weir. The maximum flood discharge of 10-year return flood is adopted.

The weir crest elevation of wet masonry and concrete gravity type is designed as 1m or 1.5m above NWL. On the other hand, the weir crest elevation of fill type is designed as 0.5m above MWL.

2) Intake

The intake facility is designed in a way to make the intake water depth at least 1m below the NWL in order to make use of meager runoff to the full extent.

The sand flash gate of intake is adopted to prevent the sedimentation in the reservoir.

3) Irrigation canal

The capacity of the canal is supposed to take the mean daily rainfall into account.

The supposed maximum discharge of water intake for the capacity of canal are as follows:

Weir site	Water intake
D-2	1.2 m^3/s
E-1	0.3
J-1	0.6
Abyad	4.1

3.3.2 Comparative Study

The comparative study is carried out the following procedure on the each proposed weir site.

- To determine the intake water level corresponds to the normal water level (NWL El.) based on the topo surveyed map and the relevant topo data.

- To select the three weir sites including the center line of topo survey using the topo survey map based on the NWL as above mentioned.

- To adopt the weir type such as earthfill, wet masonry and concrete gravity type

- To estimate the construction cost include the irrigation canal by the preliminary design.

- To determine the weir site and type at the each weir site by the compared construction costs.

a) D-2 weir site

This weir site was adopted the intake water level elevation El. 1194m to take the topographic condition into consideration. The weir sites were selected 150m and 250m upstream from the center line of the topo survey (See Fig. E.3.2). The comparative studies were designed the wet masonry and earthfill type, and estimated the construction cost included the irrigation canal's cost. This weir site is determined at 250m upstream from the center line of the topo survey with the wet masonry type.

b) E-1 weir site

The intake water level of E-1 weir site was determined El. 1020.5m. The weir sites were compared the center line of the topo survey and its downstream 25m sites, and designed only the wet masonry type due to the comparatively narrow both banks (see Fig. E.3.3). The finally weir site is determined at the center line of the topo survey by the compared construction cost.

c) J-1 weir site

The intake water level of J-1 weir site was adopted El. 1394m. The weir sites were compared 200m and 300m upstream

from the center line of the topo survey (see Fig. E.3.4). The comparative studies were designed. The wet masonry and earthfill type, and estimated the construction cost included the irrigation canal's cost. The finally weir site is determined at 300m upstream from the center line of the topo survey with the earthfill type.

d) Abyad weir site

The intake water level of Abyad weir site was adopted El. 884m. The weir sites were selected 300m and 500m upstream from the center line of the topo survey (see Fig. E.3.5). The comparative studies were designed the wet masonry and earthfill type, and estimated the construction cost with the irrigation canal. The finally weir site is determined at 500m upstream from the center line of the topo survey by the wet masonry type.

e) Construction costs of comparative study

The results of the study for the each weir sites are as follows:

Site	Construction cost(JD)		
	Weir	Irrigation canal	Total
a) D-2 site (Intake water level El. 1,194m)			
(150m upstream site)			
1) earthfill type	52,120	8,800 (1,100m)	60,920
2) wet masonry type	47,880	8,800 (1,100m)	56,680
250m upstream site of;			
3) earth fill type	40,100	9,600 (1,200m)	49,700
4) wet masonry type	32,040	9,600 (1,200m)	41,640
b) E-1 site (Intake water level El. 1,020.5m)			
1) Center line of topo survey	25,150	3,300 (500m)	28,450
2) 25m downstream site	31,330	3,080 (475m)	34,410
c) J-1 site (Intake water level El. 1,394m)			
(200m upstream site)			
1) earthfill type	48,660	4,500 (600m)	53,160
2) wet masonry type	63,650	4,500 (600m)	68,150
(300m upstream site)			
3) earth fill type	40,040	5,250 (700m)	45,290
4) wet masonry type	48,340	5,250 (700m)	53,590
d) Abyad site (Intake water level El. 884m)			
(300m upstream site)			
1) earthfill type	66,790	13,800 (1,200m)	80,590
2) wet masonry type	85,260	13,800 (1,200m)	99,060
(500m upstream site)			
3) earth fill type	60,870	16,700 (1,450m)	77,570
4) wet masonry type	60,280	16,700 (1,450m)	76,980

3.3.3 Facilities

As a result of the comparative studies, the principal features of the four weir sites, D-2, E-1, J-1 and Abyad, for the winter irrigation scheme are as follows:

1) D-2 weir (see Fig. E.3.6 and E.3.7)

- Catchment area;	34.8 km^2
- Frequent annual runoff (2-year return);	0.34 MCM
- Weir type;	wet masonry
- Crest level;	El. 1,195.5 m
- Weir height;	4.5 m
- Weir length in total;	45.0 m
- Weir volume;	220 m^3
- Spillway type	non-gated type
- Design flood;	42.8 m^3/s
- Overflow crest level (NWL)	El. 1,194.0 m
- Overflow crest length	12.0 m
- Discharge of water intake	1.2 m^3/s

2) E-1 weir (See Fig. E.3.8 and E.3.9)

- Catchment area;	9.6 km^2
- Frequent annual runoff (2-year return);	0.10 MCM
- Weir type;	wet masonry
- Crest level;	El. 1,021.5 m
- Weir height;	4.0 m
- Weir length in total;	23.0 m
- Weir volume;	194 m^3
- Spillway type	non-gated type
- Design flood;	18.4 m^3/s
- Overflow crest level (NWL)	El. 1,010.5 m
- Overflow crest length	10.0 m
- Discharge of water intake	0.3 m^3/s

3) J-1 weir (see Fig. E.3.10 and E.3.11)

- Catchment area;	16.7 km^2
- Frequent annual runoff (2-year return);	0.15 MCM
- Weir type;	Homogeneous earthfill type
- Crest level;	El. 1,395.5 m
- Weir height;	2.5 m
- Weir length in total;	70.0 m
- Weir volume;	830 m^3
- Spillway type	non-gated and U-shaped type
- Design flood;	28.6 m^3/s
- Overflow crest level (NWL)	El. 1,394.0 m
- Overflow crest length	19.0 m

- Discharge of water intake 0.6 m^3/s

4) Abyad weir (see Figs. E.3.12 and E.3.13)

- Catchment area;	116.5 km^2
- Frequent annual runoff (2-year return);	0.9 MCM
- Weir type;	wet masonry
- Crest level;	El. 885.5 m
- Weir height;	4.3 m
- Weir length in total;	65.0 m
- Weir volume;	480 m^3
- Spillway type	non-gated type
- Design flood;	112.6 m^3/s
- Overflow crest level (NWL)	El. 884.0 m
- Overflow crest length	25.0 m
- Discharge of water intake	4.1 m^3/s

4. CONSTRUCTION PLAN AND SCHEDULE

4.1 Construction Material and Equipment

As for the construction materials, the cement, ordinary portland cement, is to be purchased from the local market.

Raw materials such as earth for the weir embankment, stone for the wet masonry and the gabion and concrete aggregates easily be scraped at each weir site.

Selection and arrangement of the construction equipment for type, capacity and numeral number will depend upon construction method and economical interpretation which will taken by the Government or the contractor. However, the major construction equipment to be required in a practical manner for the construction work of the weir sites summarily be set forth on following table.

Equipment	Description
Bulldozer	18-19 ton
Power Shovel	1.2 m^3
Wheel Loader	0.6 m^3
Tire Roller	10 - ton
Dump Truck	6 - ton
Truck Crane	3 - ton
Tank Lorry	5,000 ltrs.
Ordinary Truck	6 - ton
Vibrating Roller	0.6 - ton
concrete-mixer	1.0 m^3

4.2 Implementation Schedule

The time required for the implementation of the each weir site will be enough within 12 months for all the work items respectively.

The detailed survey and design are proposed to complete before the construction works are commenced. The detailed survey

mainly conduct the topographical and geological investigation on the each weir site which were selected in the previous feasibility survey and study. These surveys furnish the detailed design with further technical information and interpretation than the facts obtained from the feasibility survey. The detailed survey and design is worked out for 3 months.

The construction schedule of the main structure such as weir. Spillway, intake and irrigation canal are enough within 6 month after all the necessary work such as mobilization of personnel and materials, equipment to be ready at the site within a month are made (see Fig. F.5.2).

5. COST ESTIMATE

5.1 Construction Costs

5.1.1 Winter Irrigation Scheme

The costs of the construction works were estimated by work items. The estimated costs of each work item are the accumulated amount of all the necessary costs to perform each work at the each weir site. The work volumes of each work item were estimated basing on the design drawings.

In estimating the unit price of each work item, unit prices collected from the WAJ were adjusted updated to 1989 price level. The breakdown of the each weir site cost is shown in Table E.5.1.

The direct costs of the each weirs are summarized below,

Proposed site		Amount
D-2		JD 39,700
Wet masonry type		30,100
Irrigation canal	L=1,200m	9,600
E-1		JD 28,450
Wet masonry type		25,200
Irrigation canal	L=500m	3,250
J-1		JD 45,810
Wet masonry type		40,560
Irrigation canal	L=700m	5,250
Abyad		JD 72,665
Wet masonry type		55,990
Irrigation canal	L=1,450m	16,675

5.1.2 Water Harvesting

The details of the cost estimate are presented in Table E.5.3. The followings are the summary of the cost estimate for the water harvesting scheme.

1) Contour stone wall(spacing 100m)	JD 131.6/ha
2) Contour stone wall(spacing 25m)	JD 506.3/ha
3) Absorption earth bank(spacing 100m)	JD 107.4/ha
4) Absorption earth bank(spacing 25m)	JD 384.9/ha
5) Microcatchments	JD 55.9/ha

6) Check dam JD 3,120/site

5.2 Operation and Maintenance costs

The annual operation and maintenance of the facilities of a weir site was calculated at about JD 20 (4 man-days x JD 5.0) covering cancel cleaning cost on the basis of 1989 prices.

Table E.5.1 CONSTRUCTION COST

(Unit:JD)

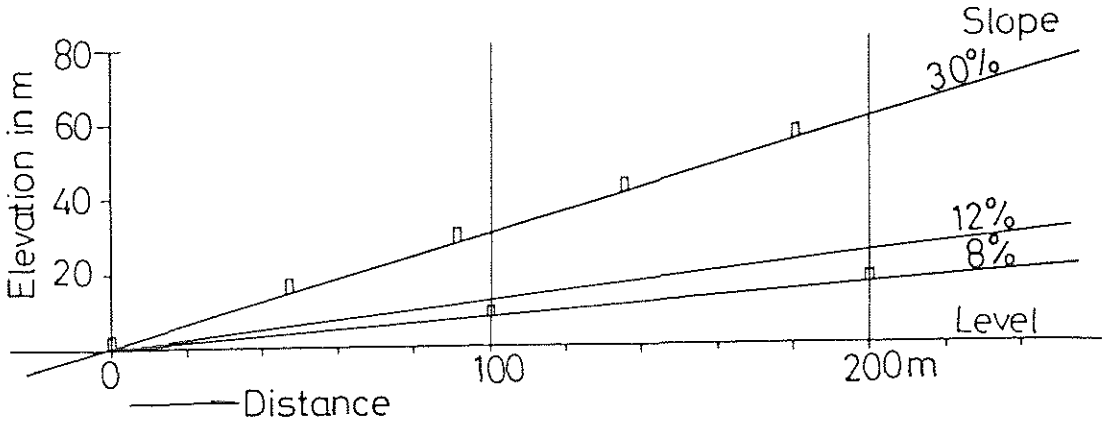
NO.	Work	Unit	Q'ty	Price	Amount
(1)	D-2 weir				
I	Weir				
	1. Excavation	m3	220	3	660
	2. Wet masonry	m3	219	60	13,140
	3. Embankment	m3	18	5	90
II	Apron				
	1. Excavation	m3	65	3	195
	2. Gavion	m3	140	30	4,200
III	Intake				
	1. Excavation	m3	125	3	375
	2. Concrete	m3	92	70	6,440
IV	Miscellaneous	L.S.			5,000
	sub-total	(I-IV)			30,100
V	Irrigation canal	m	1,200	8	9,600
	Total				39,700
(2)	E-2 weir				
I	Weir				
	1. Excavation	m3	150	3	450
	2. Wet masonry	m3	194	60	11,640
II	Apron				
	1. Excavation	m3	90	3	270
	2. Gavion	m3	112	30	3,360
III	Intake				
	1. Excavation	m3	103	3	309
	2. Concrete	m3	71	70	4,970
IV	Miscellaneous	L.S.			4,201
	sub-total	(I-IV)			25,200
V	Irrigation canal	m	500	6.5	3,250
	Total				28,450
(3)	J-1 weir				
I	Weir				
	1. Excavation	m3	160	3	480
	2. Wet masonry	m3	832	5	4,160
II	Apron				
	1. Excavation	m3	254	3	762
	2. Gavion	m3	293	7	20,510
III	Intake				
	1. Excavation	m3	132	3	396
	2. Concrete	m3	107	70	7,490
IV	Miscellaneous	L.S.			6,762
	sub-total	(I-IV)			40,560
V	Irrigation canal	m	700	7.5	5,250
	Total				45,810
(4)	Abyad weir				
I	Weir				
	1. Excavation	m3	460	3	1,380
	2. Wet masonry	m3	478	60	28,680
	3. Embankment	m3	30	5	150
II	Apron				
	1. Excavation	m3	232	3	696
	2. Gavion	m3	232	30	6,960
III	Intake				
	1. Excavation	m3	200	3	600
	2. Concrete	m3	117	70	8,190
IV	Miscellaneous	L.S.			9,334
	sub-total	(I-IV)			55,990
V	Irrigation canal	m	1,450	11.5	16,675
	Total				72,665

Table E.5.2 UNIT PRICE OF MANPOWER AND MATERIALS

Item	Unit	Unit Price JD
Manpower		
Technician	Man-day	7
Operator	"	5
Labourer	"	4
Materials		
Cement	t	40
Gravel	m3	4
Sand	m3	5
Steel bar	t	350

Table E.5.3 COST OF WATER HARVESTING SCHEME

Items	Executor	Unit	Unit/h	JD	JD/ha
1. Contour Stone Wall (distance 100m)					
Contour survey	Surv. + 2 lab.	day	0.20	17.00	3.40
Preparing trench	D3	hour	0.50	4.50	2.25
Site ripping	D3	hour	1.00	4.50	4.50
Stone picking	Stonepicker + tractor	hour	2.50	2.60	6.50
Wall construction	Manpower	day	23.00	5.00	115.00
Total					131.65
2. Contour Stone Wall (distance 25m)					
Contour survey	Surv. + 2 lab.	day	0.50	17.00	8.50
Preparing trench	D3	hour	3.00	4.50	9.00
Site ripping	D3	hour	5.00	4.50	18.00
Stone picking	Stonepicker + tractor	hour	8.00	2.60	20.80
Wall construction	Manpower	day	90.00	5.00	450.00
Total					506.30
3. Absorption Earth Bank (distance 100m)					
Contour Survey	Surv. + 2 lab.	day	0.20	17.00	3.40
Ripping	D3	hour	1.00	4.50	4.50
Cutt & fill	D3	hour	11.00	4.50	49.50
final shaping	Manpower	day	10.00	5.00	50.00
Total					107.40
4. Absorption Earth Bank (distance 25m)					
Contour Survey	Surv. + 2 lab.	day	0.50	17.00	8.50
Ripping	D3	hour	4.00	4.50	18.00
Cutt & fill	D3	hour	35.20	4.50	158.40
final shaping	Manpower	day	40.00	5.00	200.00
Total					384.90
5. Micro- catchment					
Survey	Surv. + 2 lab.	day	0.20	17.00	3.40
Building catchment	Manpower	day	10.00	5.00	50.00
Leveling surface	Manpower	day	0.50	5.00	2.50
Total					55.90
6. Check Dam(1 site)					
Cut		cubic meter	40.00	5.00	200.00
Gabion		cubic meter	80.00	30.00	2400.00
Miscellaneous		lump sum			520.00
Total					3120.00



Spacing of Contour Stone Walls

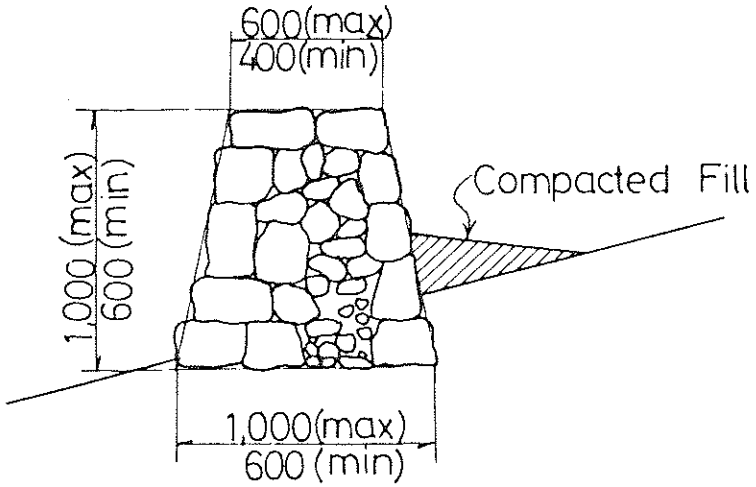
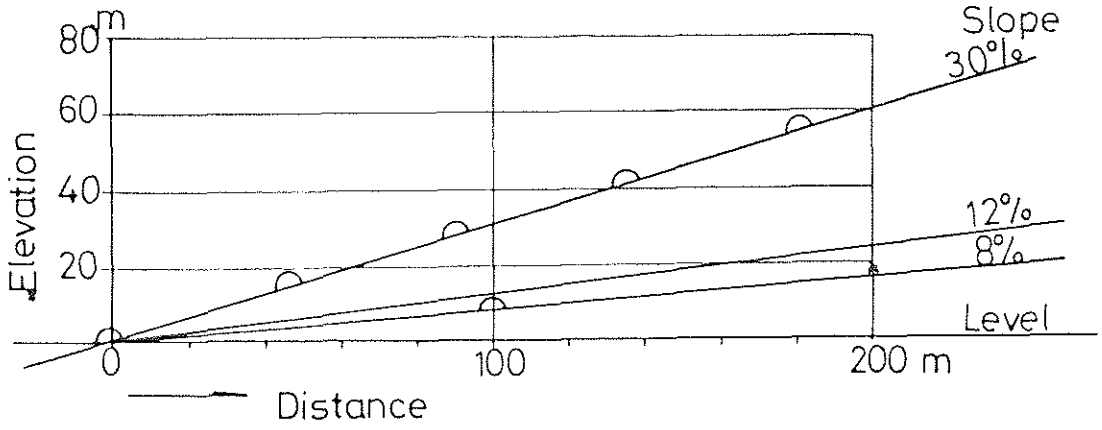


Fig. E.1.1 Typical Section of Contour Stone Wall

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK-TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY



Spacing Of Absoption Earth Banks

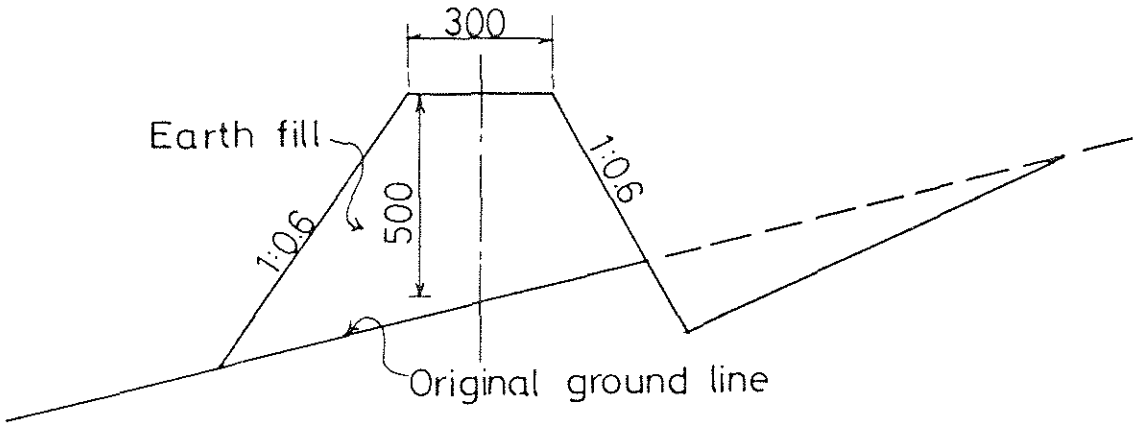
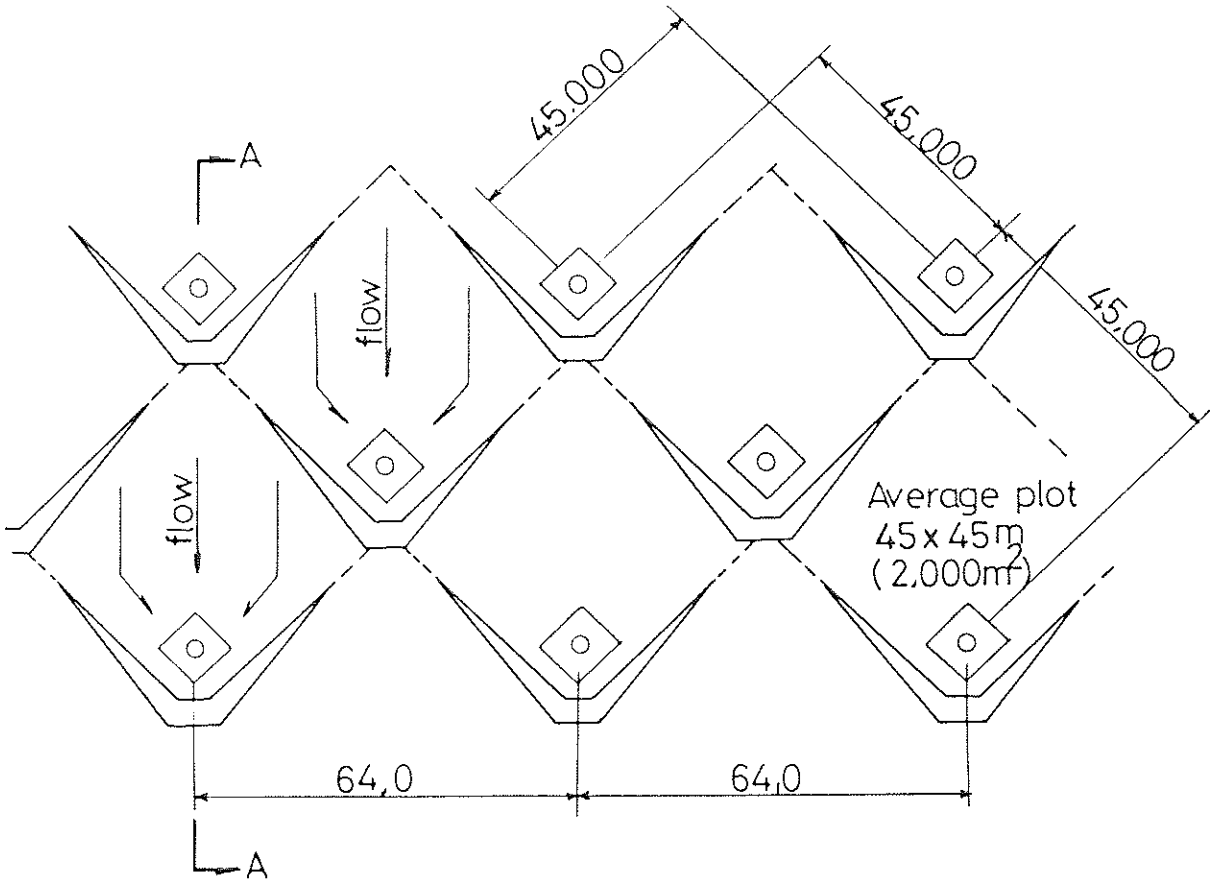
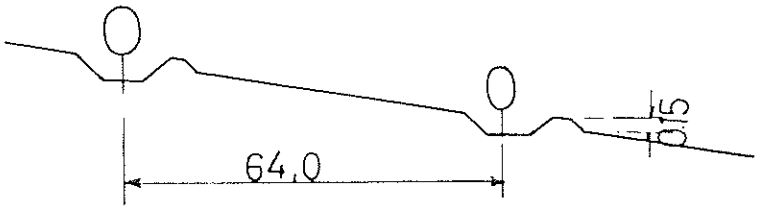


Fig. E.1.2 Typical Section of Absorption Earth Bank

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

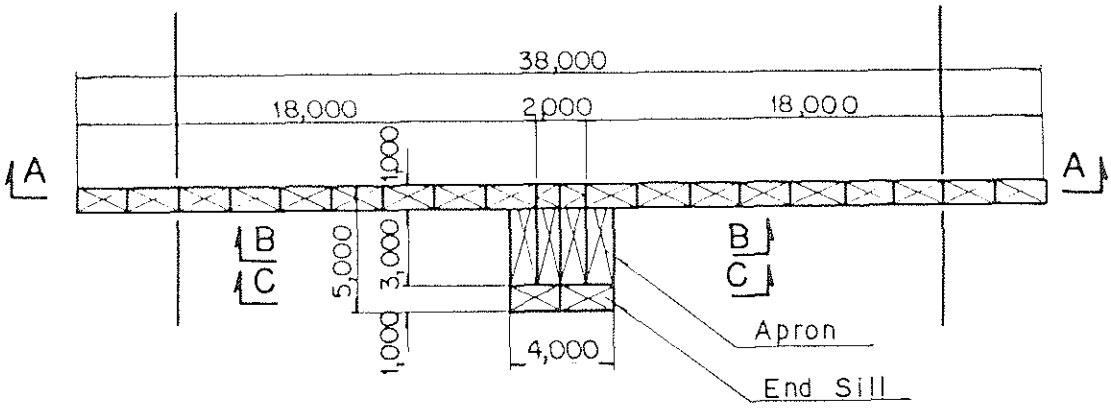




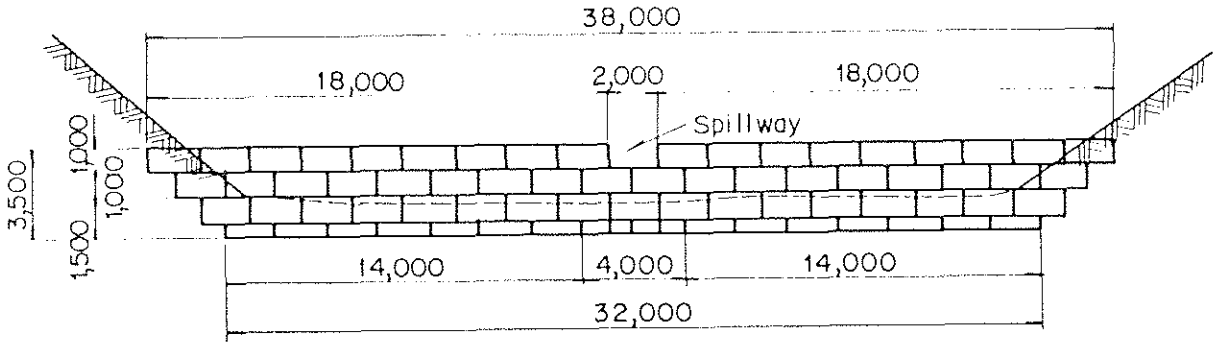
SECTION A-A

Fig. E.1.3 Micro-Catchment

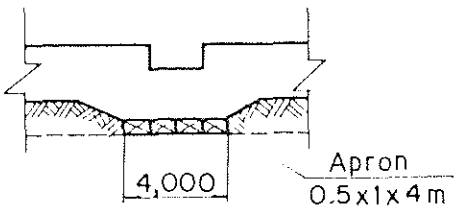
THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK-TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY



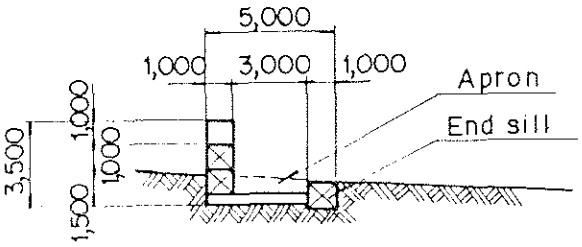
PLAN



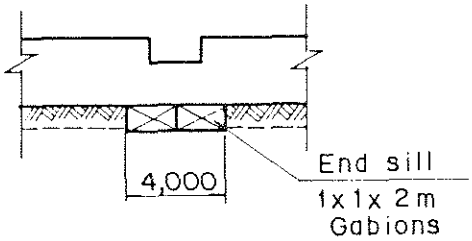
SEC. A-A



SEC. B-B



PROFILE



SEC. C-C

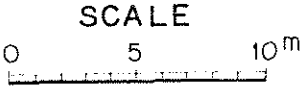


Fig. E.1.4 Check Dam

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK-TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

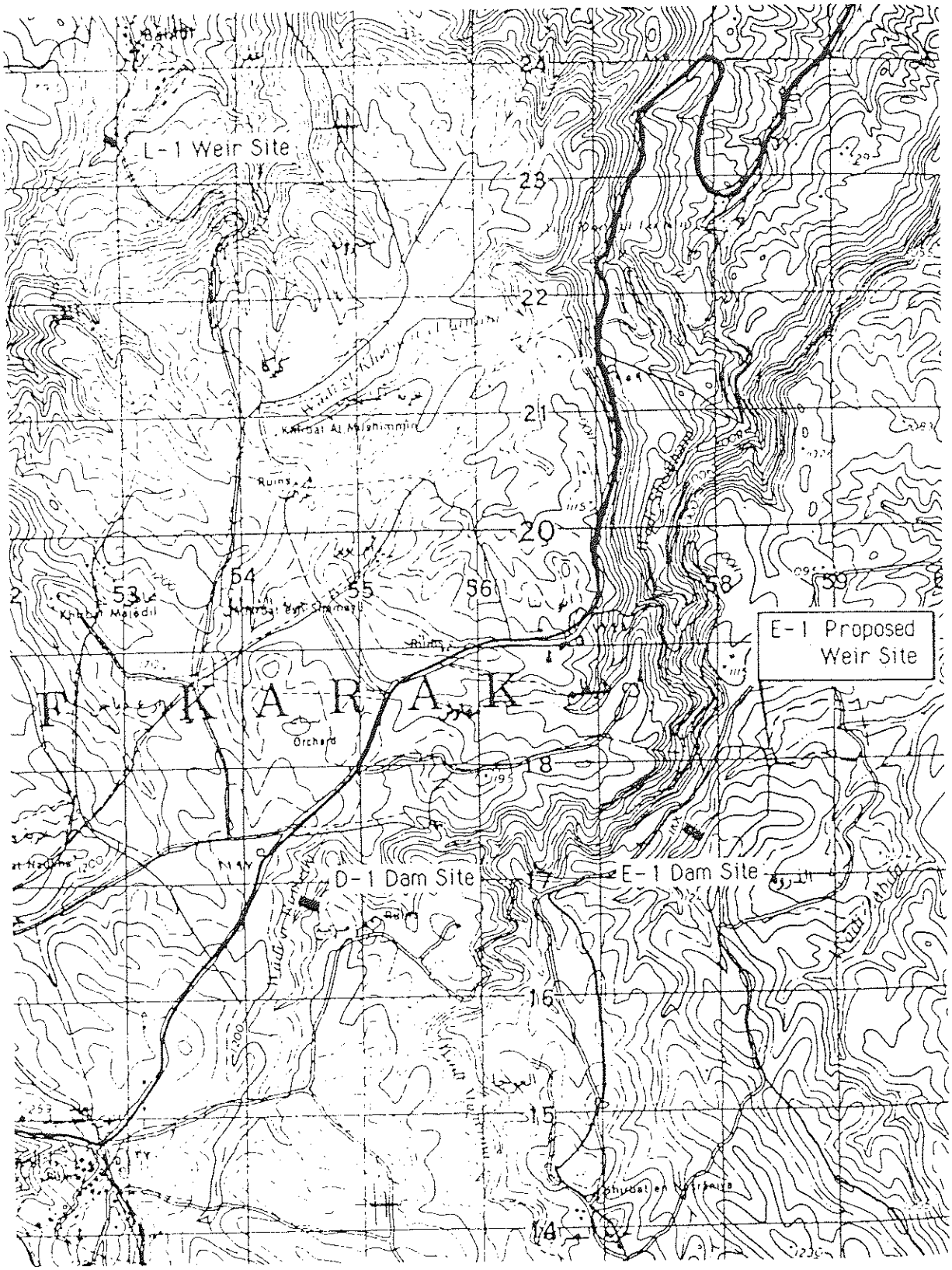


Fig. E.2.1 E-1 Weir Site

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK-TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY

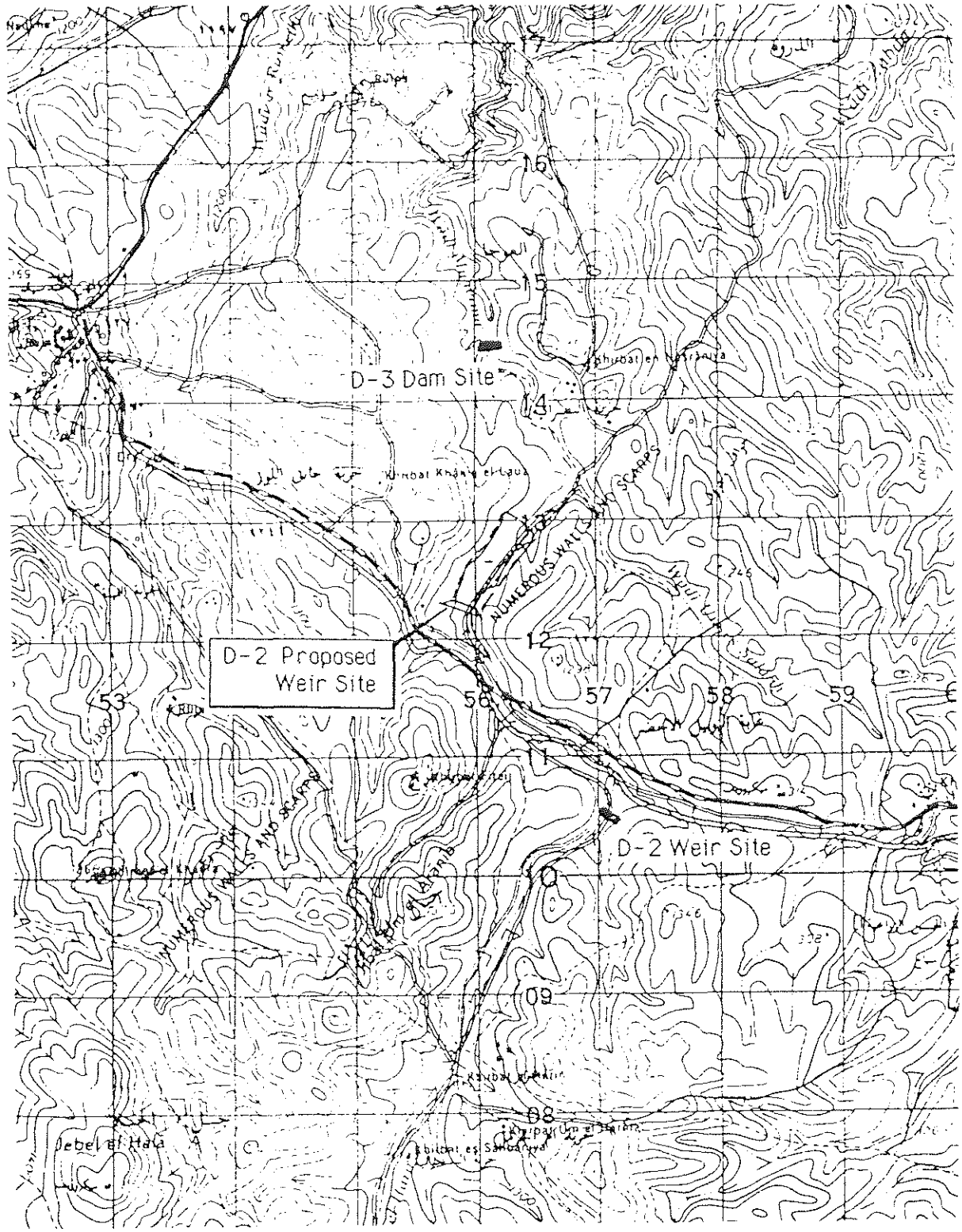


Fig. E.2.2 D-2 Weir Site

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

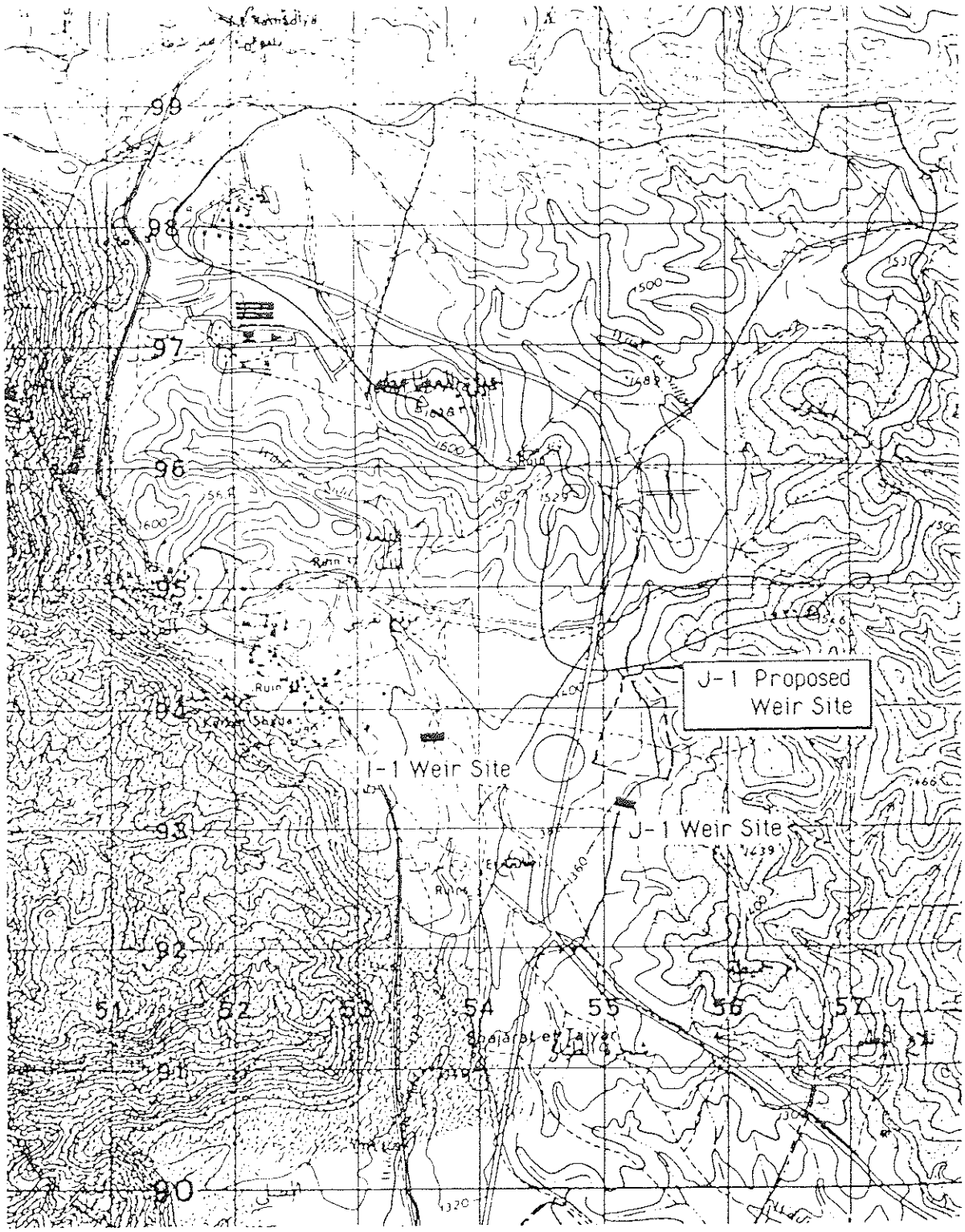


Fig. E.2.3 J-1 Weir Site

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY

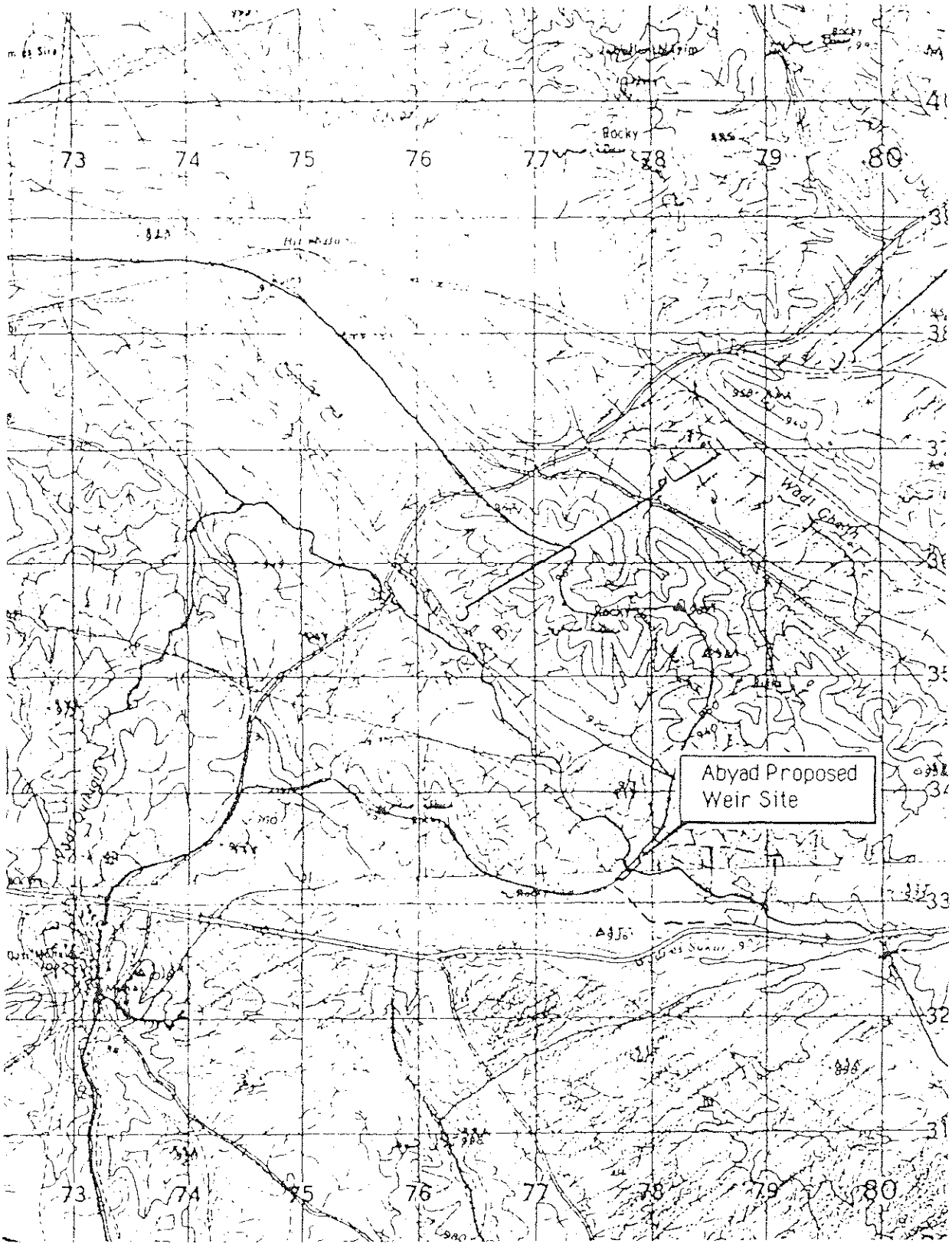
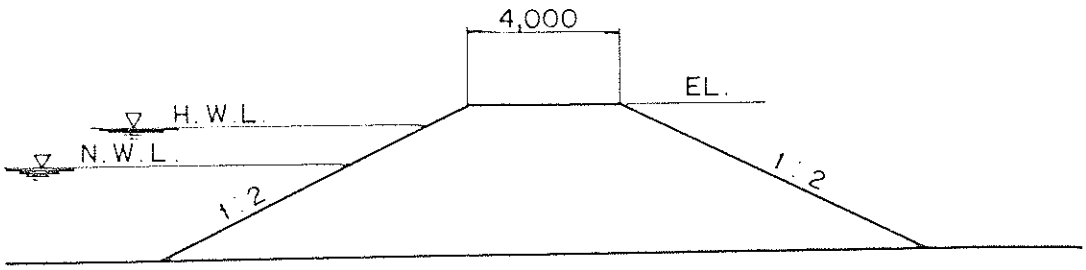


Fig. E.2.4 Abyad Weir Site

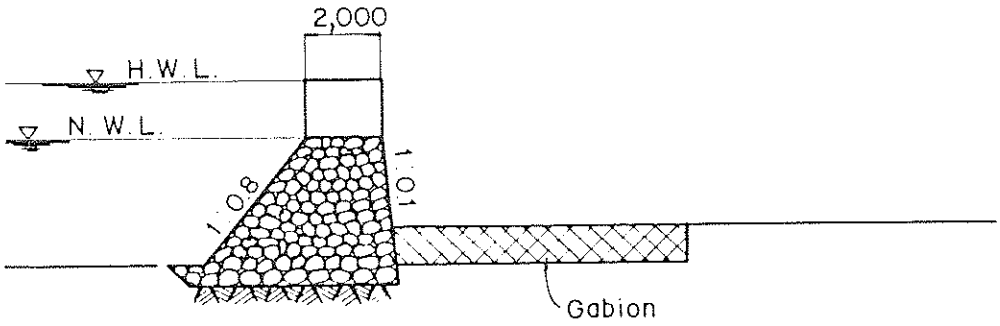
THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

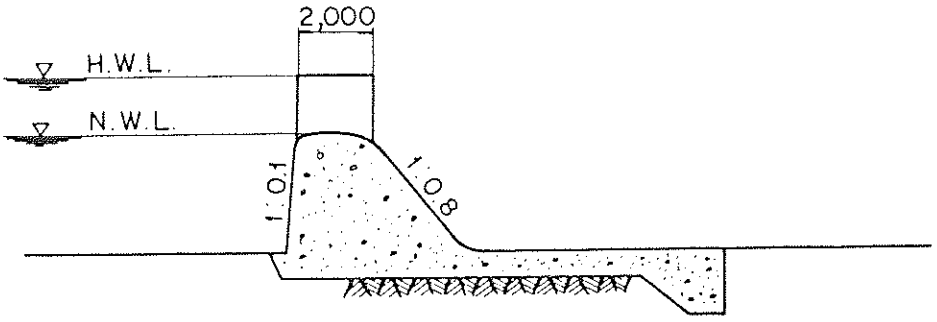
JAPAN INTERNATIONAL COOPERATION AGENCY



HOMOGENEOUS EARTH FILL



WET MASONRY



CONCRETE GRAVITY

Fig. E.3.1 Practical Type of Weirs

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK-TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

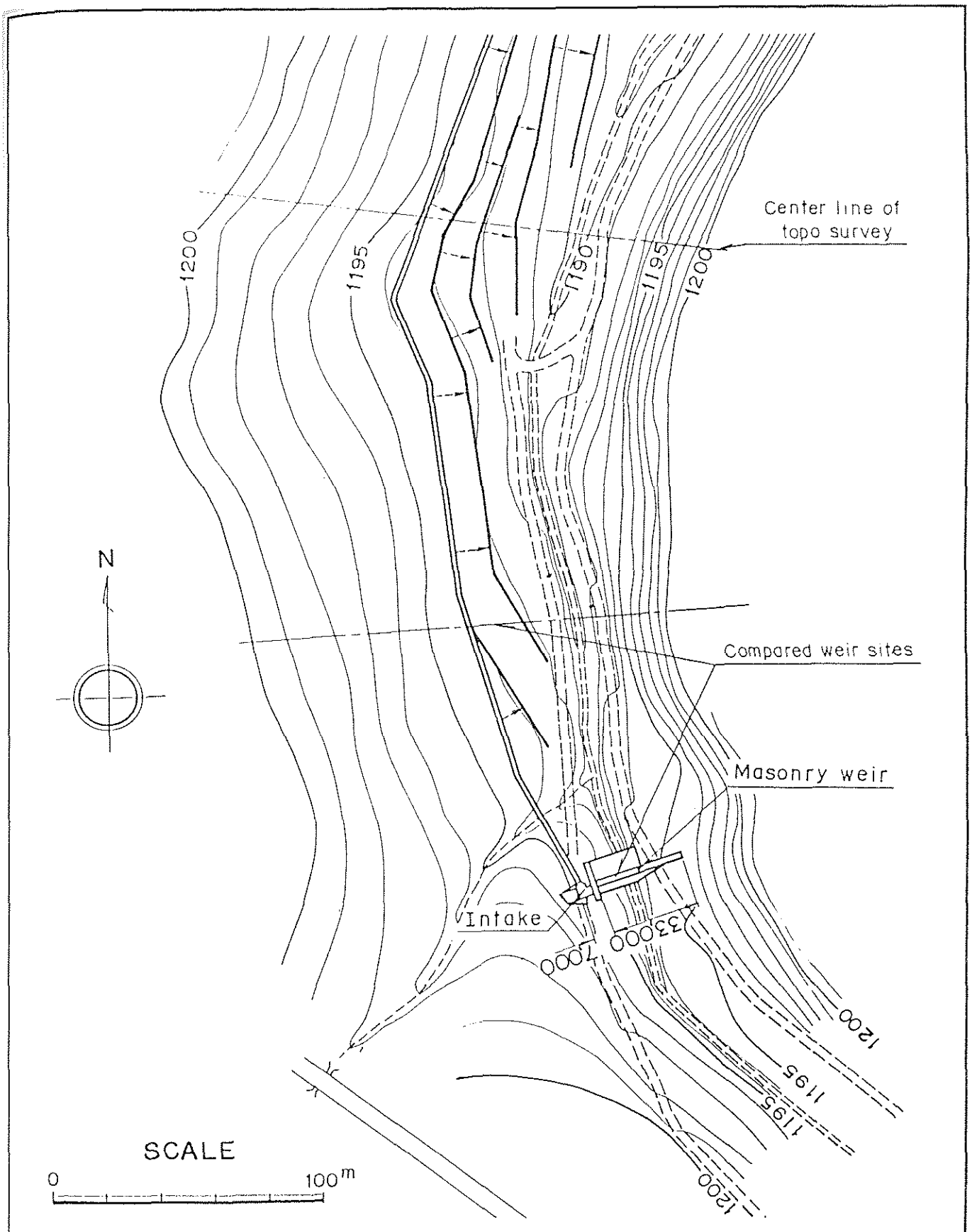


Fig. E.3.2 D-2 Compared Weir Sites

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY

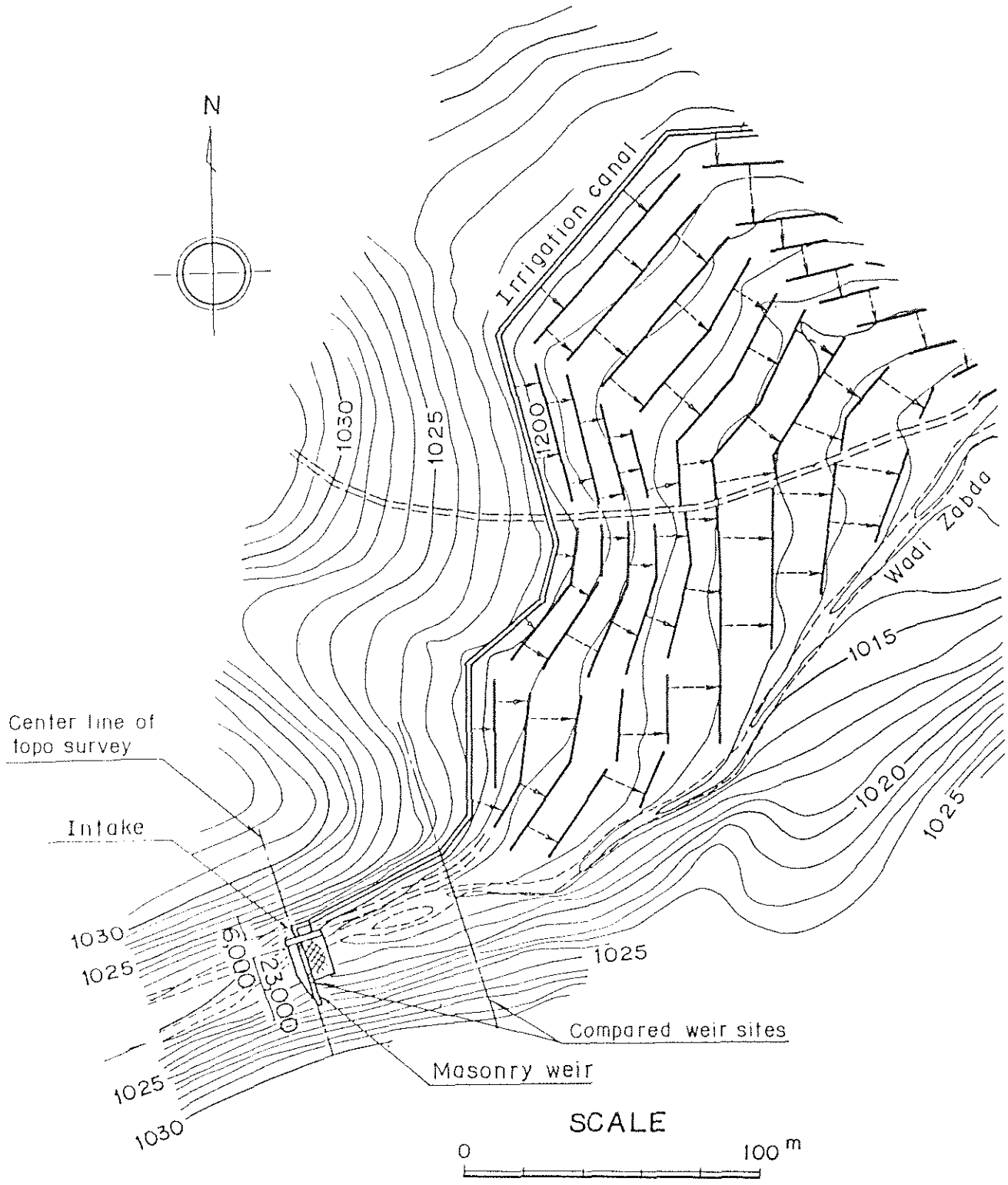


Fig. E.3.3 E-1 Compared Weir Sites

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY

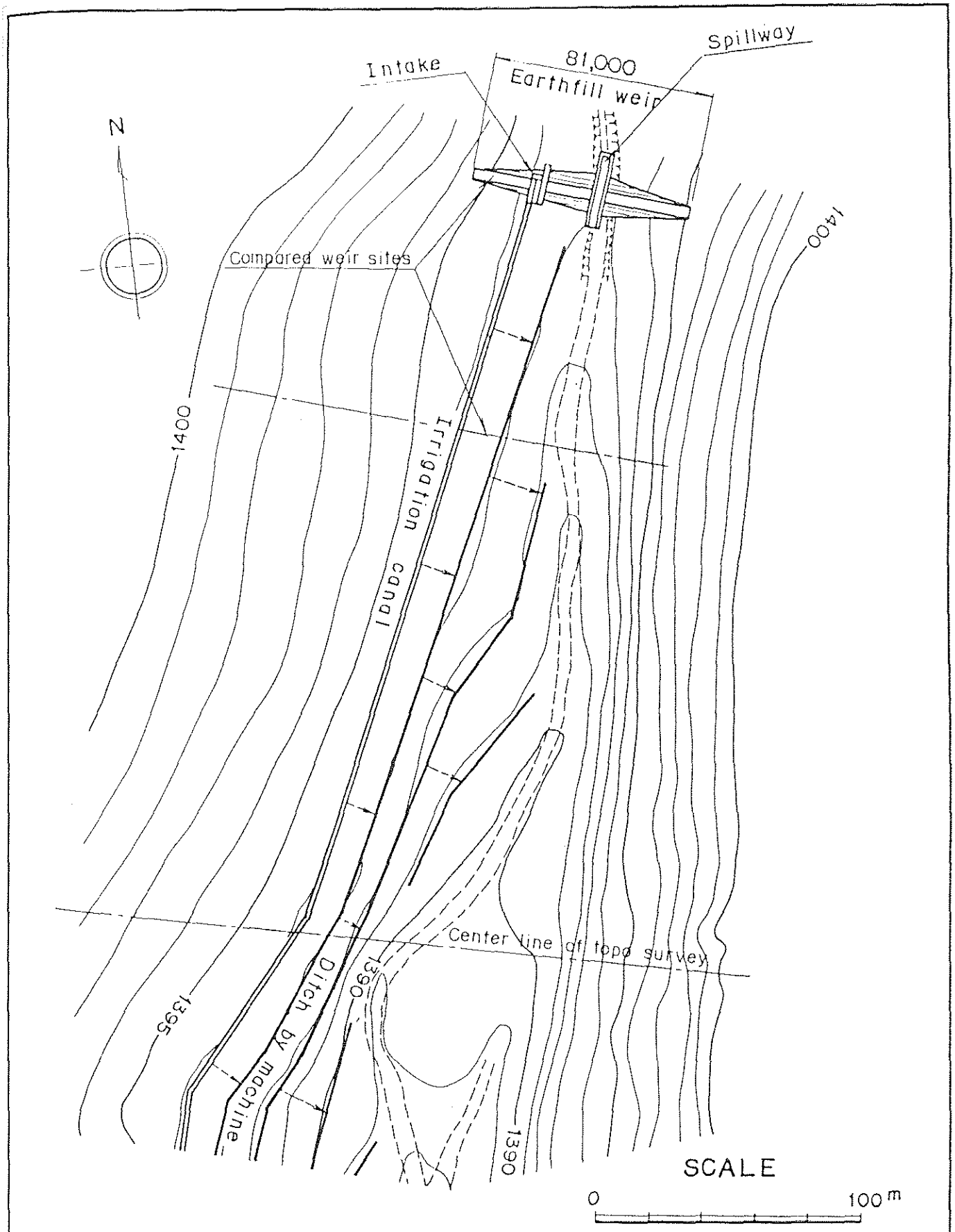


Fig. E.3.4 J-1 compared Weir Sites

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY

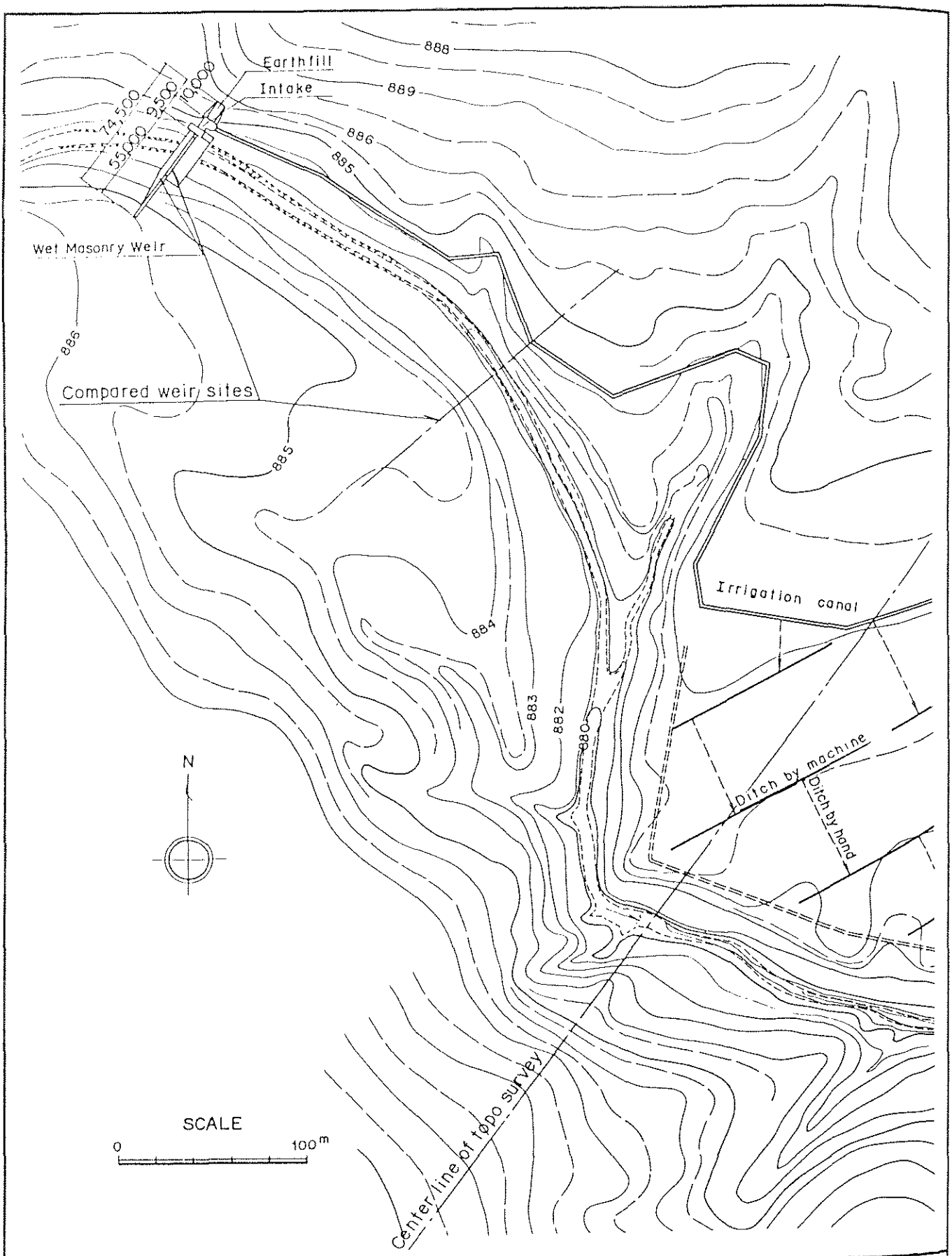
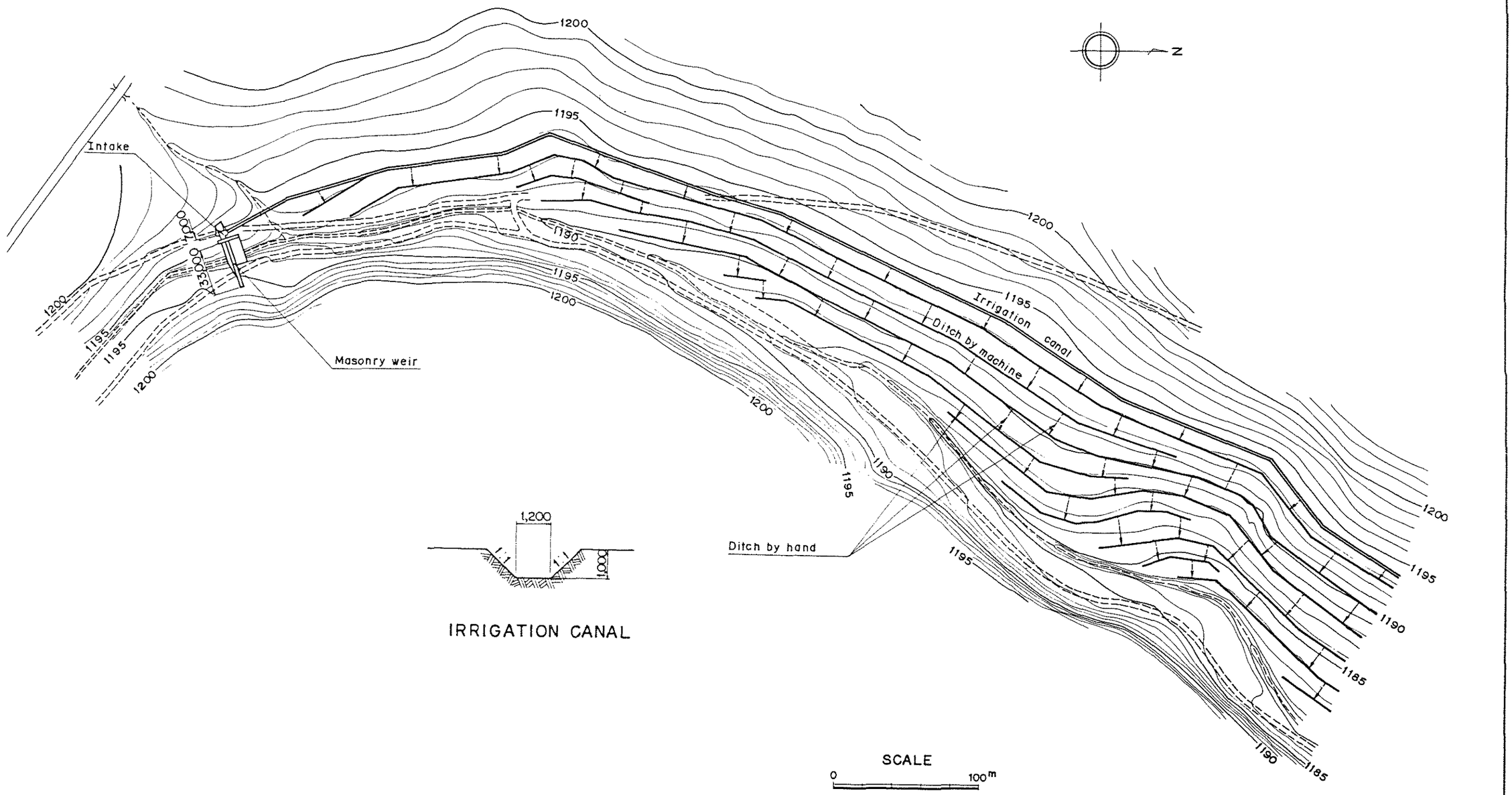


Fig. E.3.5 Abyad Compared Weir Sites

THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

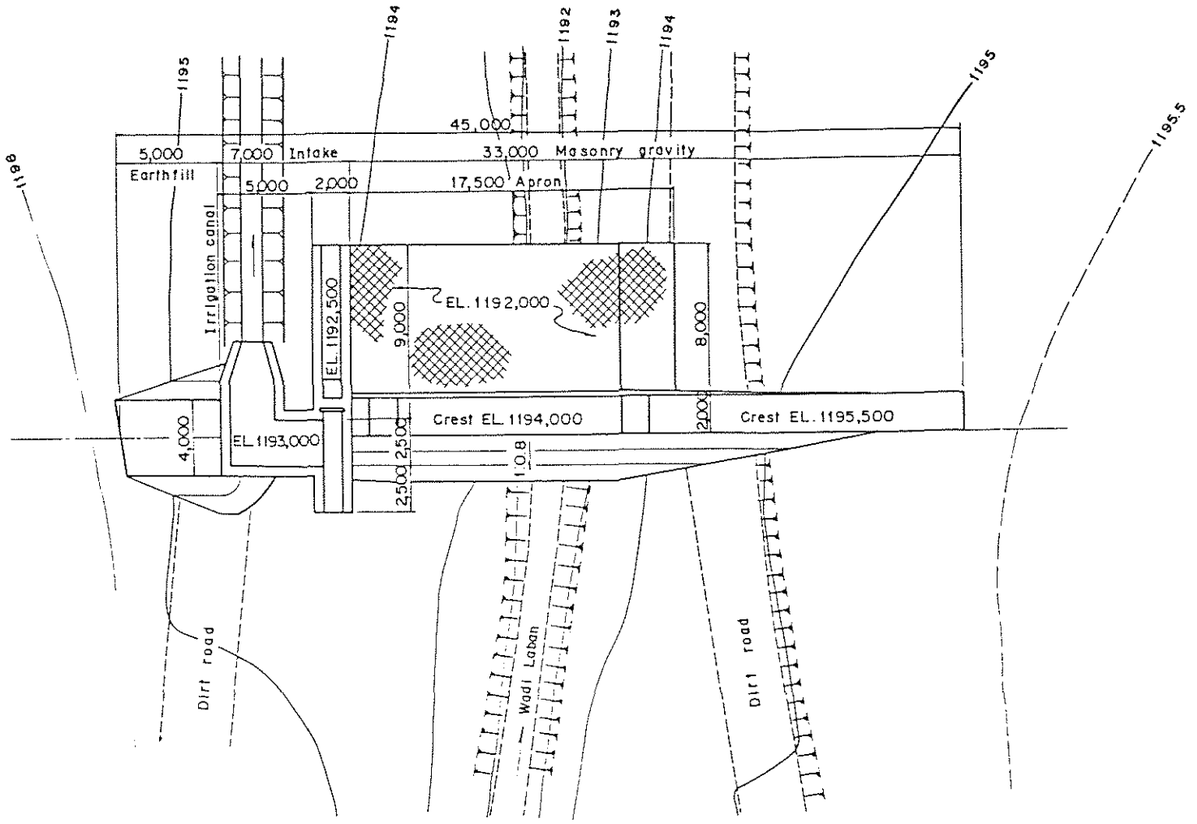
JAPAN INTERNATIONAL COOPERATION AGENCY



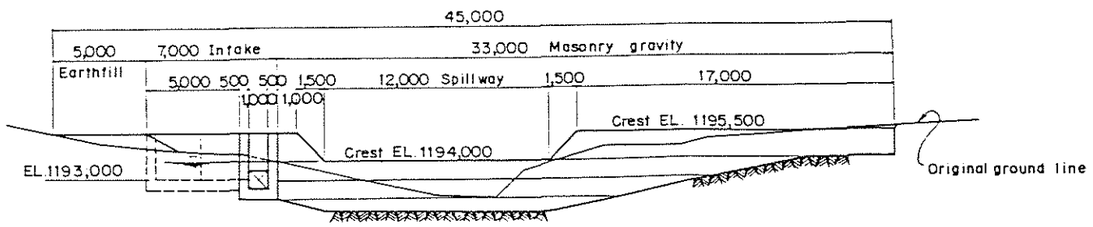
IRRIGATION CANAL

Fig. E.3.6 Plan of D-2 Site

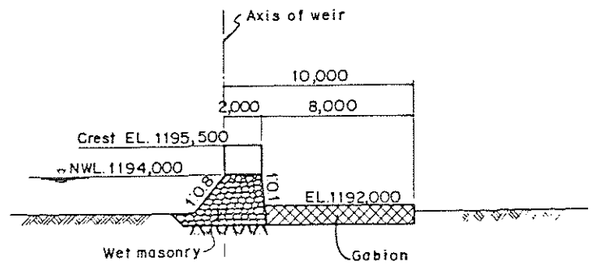
THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY



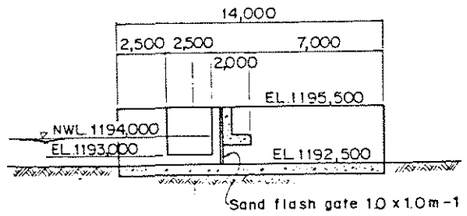
PLAN



PROFILE



SECTION OF MASONRY GRAVITY WEIR



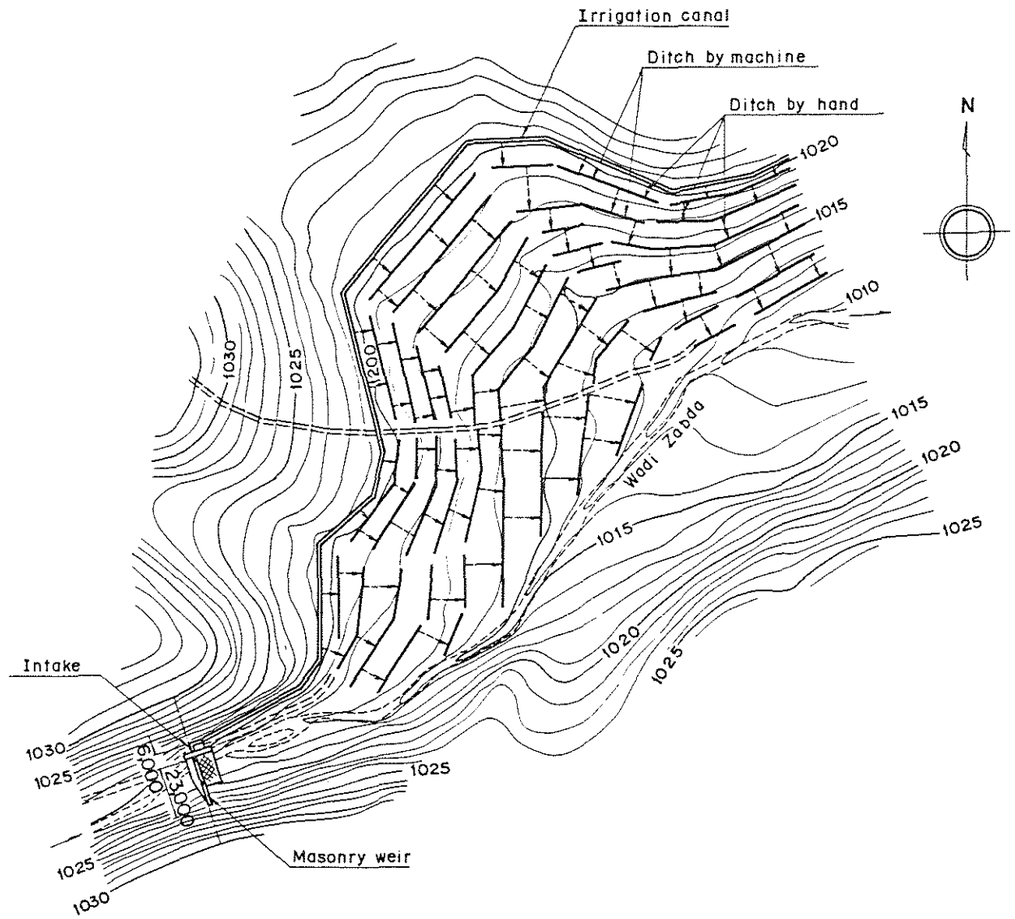
PROFILE OF INTAKE

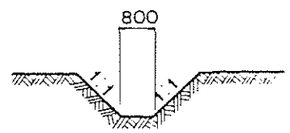
SCALE

0 10m

Fig. E.3.7 Wet Masonry Weir of D-2

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY





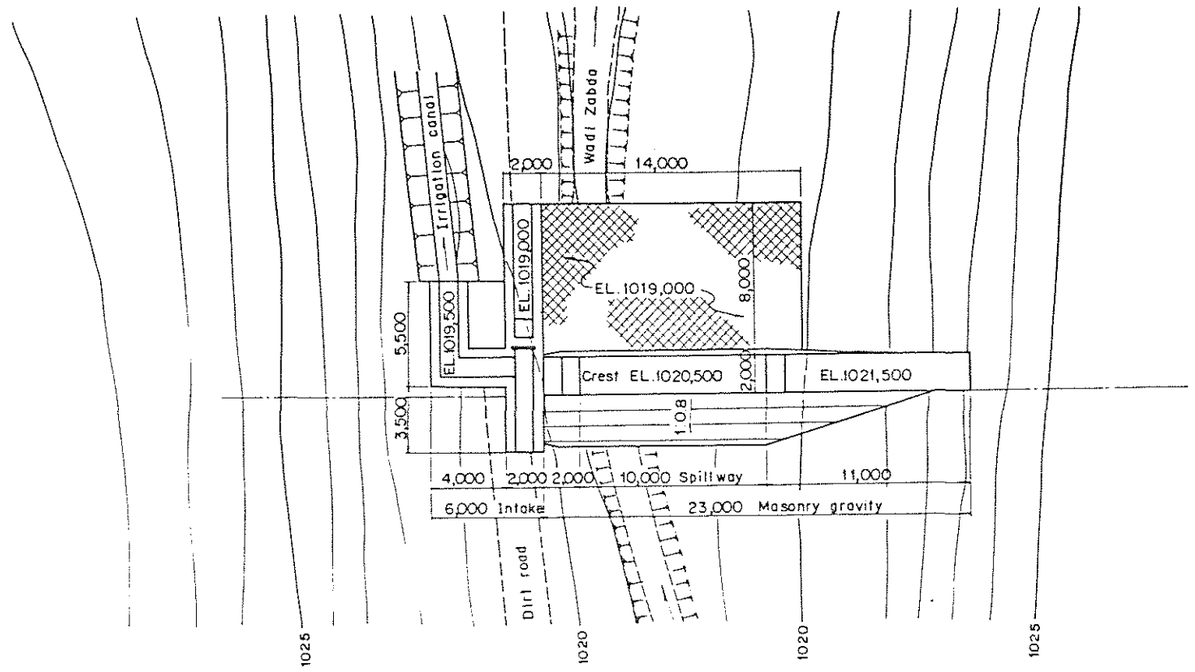
IRRIGATION CANAL

SCALE

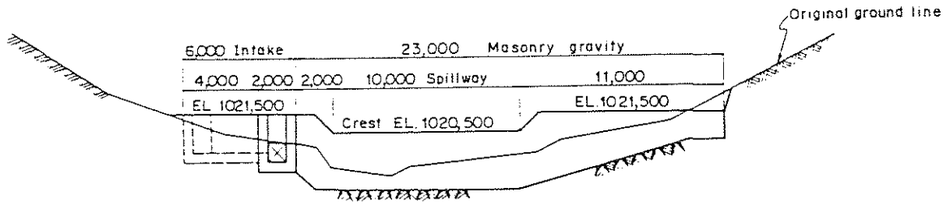
0 100 m

Fig. E.3.8 Plan of E-1 site

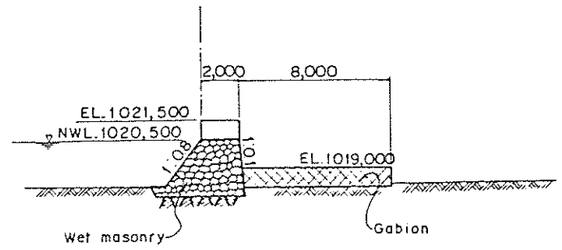
THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY



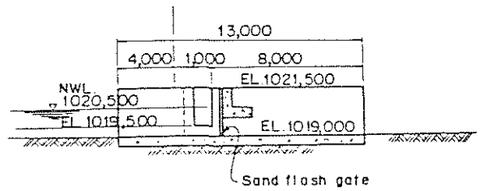
PLAN



PROFILE



SECTION OF MASONRY GRAVITY WEIR



PROFILE OF INTAKE

SCALE
0 10m

Fig. E.3.9 Wet Masonry Weir of E-1

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

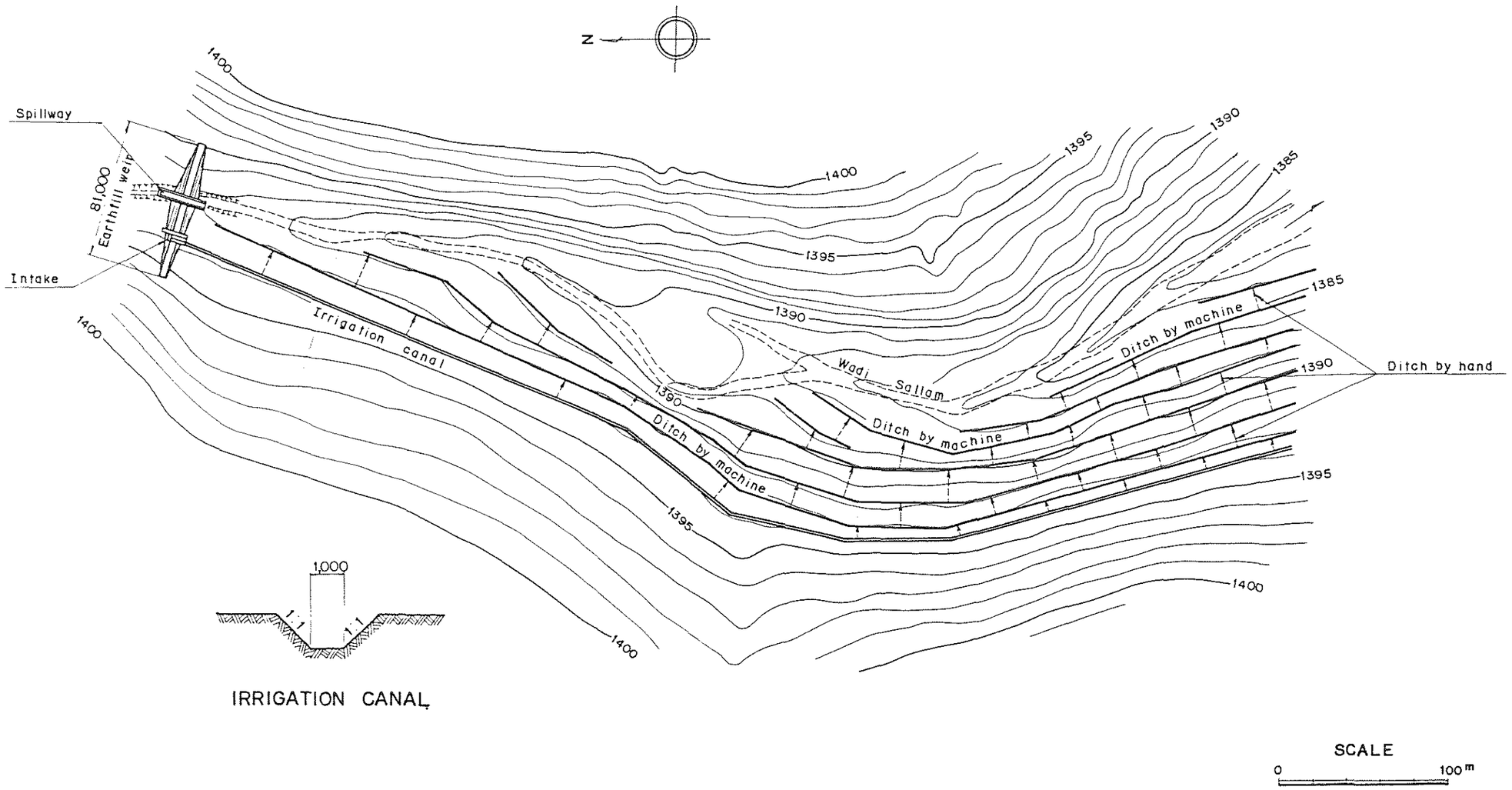
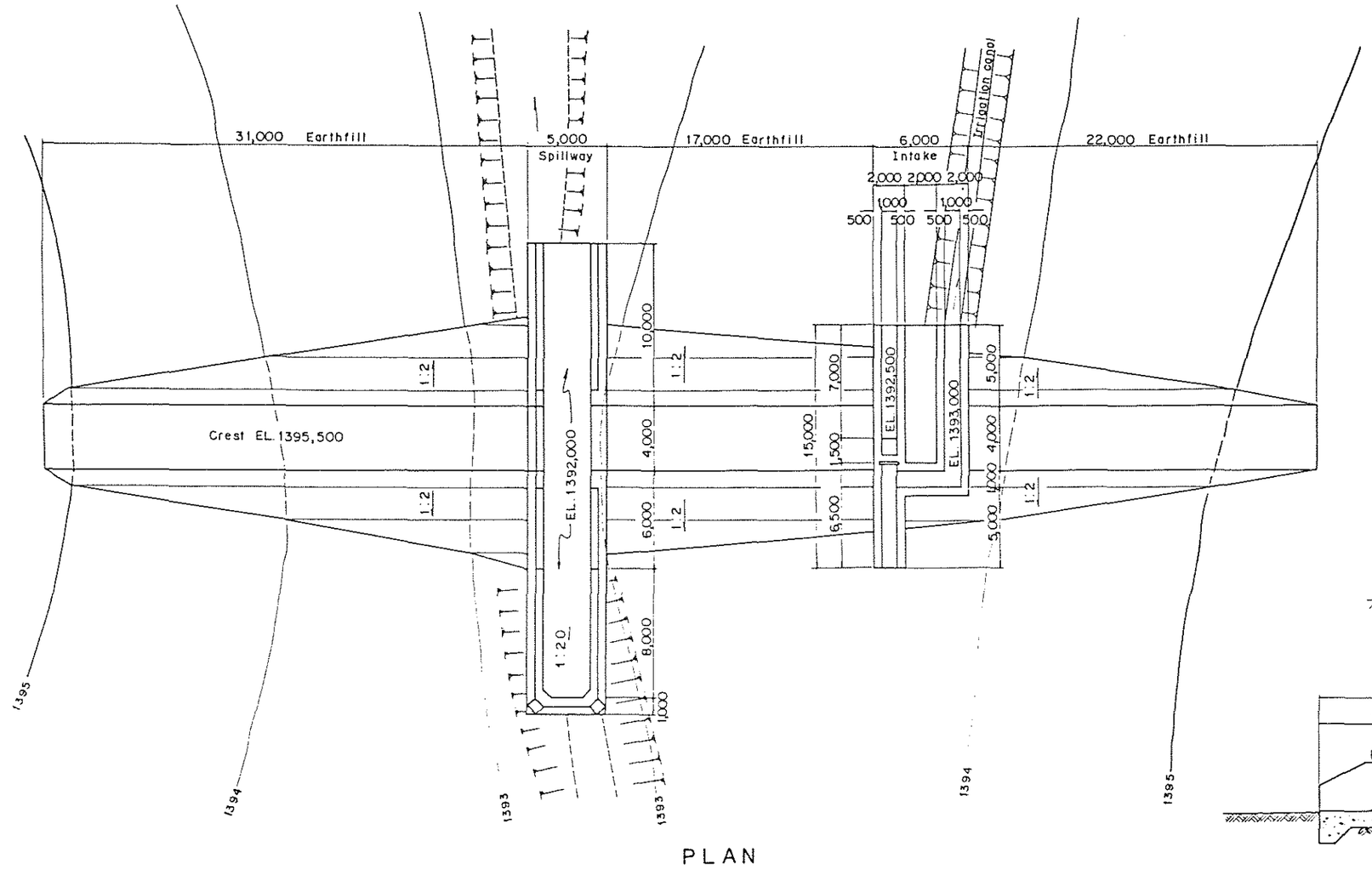
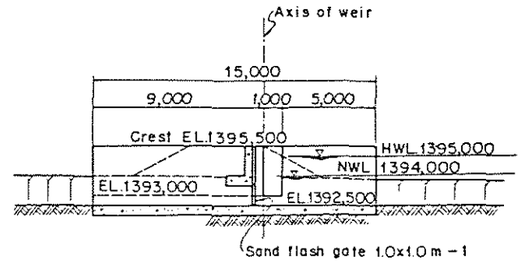


Fig. E.3.10 Plan of J-1 site

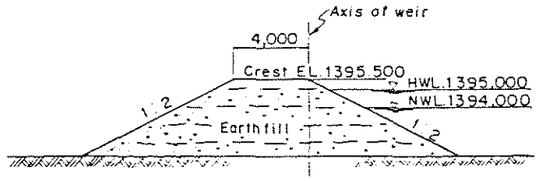
THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY



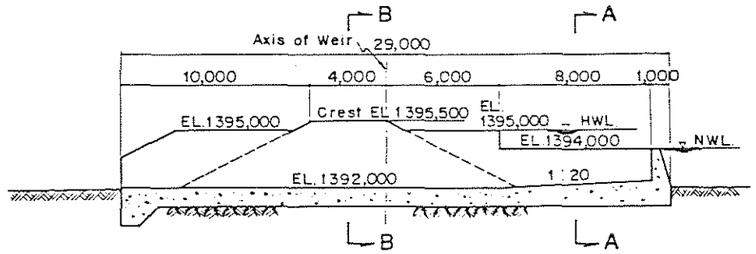
PLAN



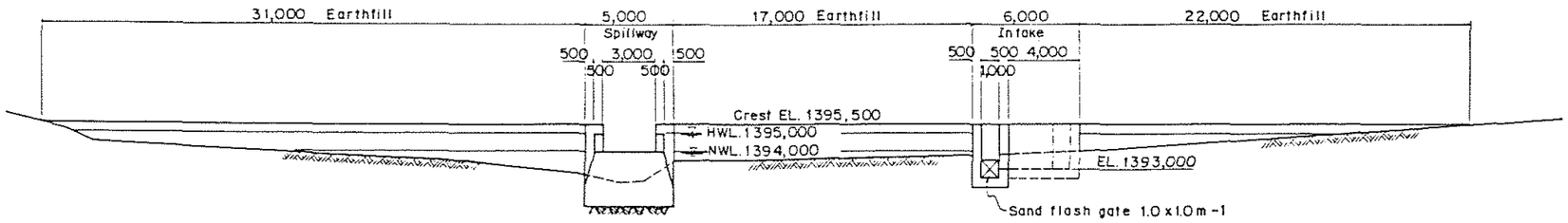
PROFILE OF INTAKE



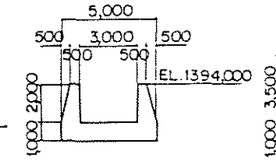
SECTION OF EARTHFILL



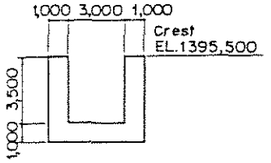
PROFILE OF SPILLWAY



PROFILE



SEC. A-A



SEC. B-B

SCALE
0 10m

Fig. E.3.11 Earthfill Weir of J-1

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

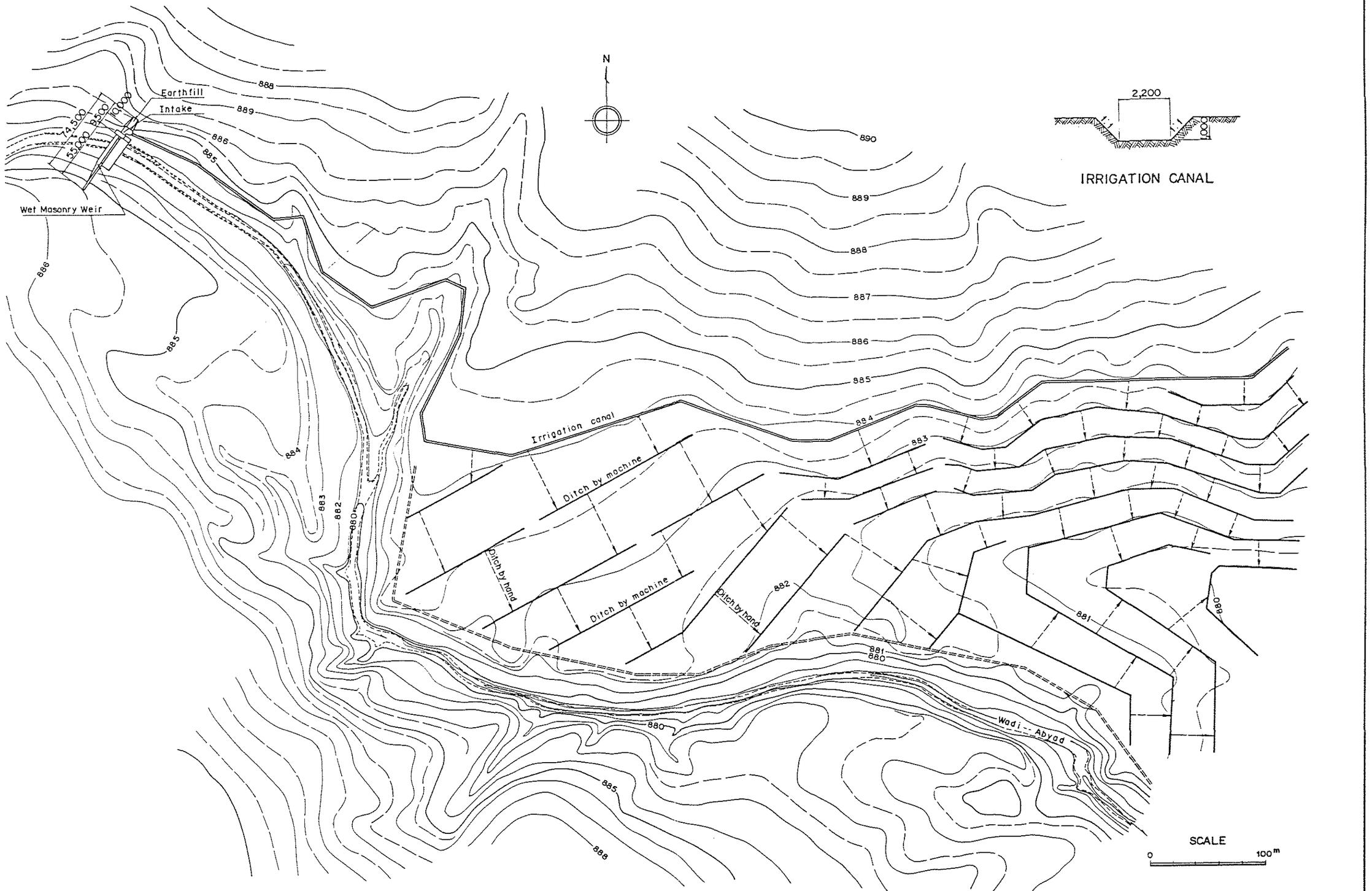
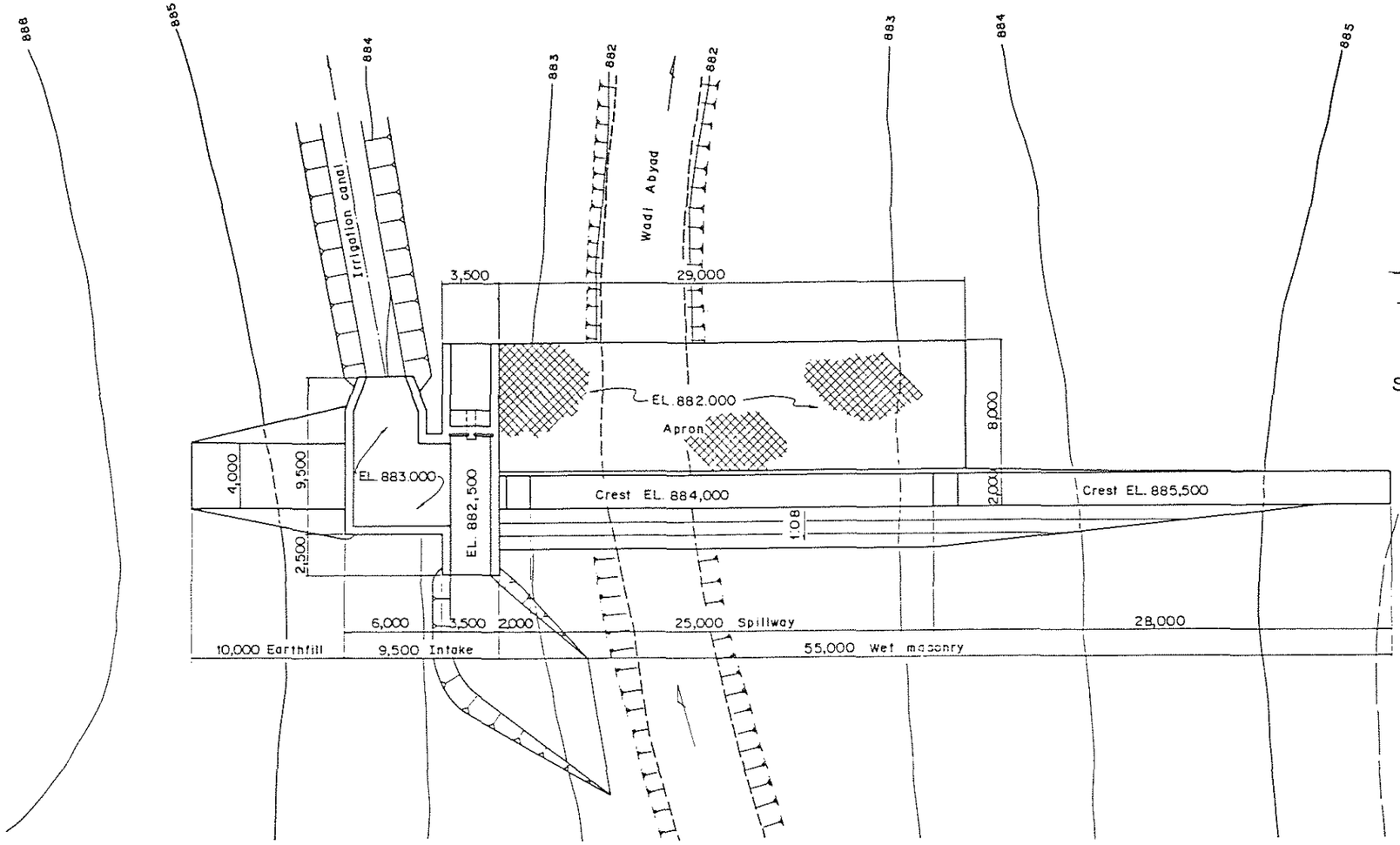


Fig. E.3.12 Plan of Abyad Site

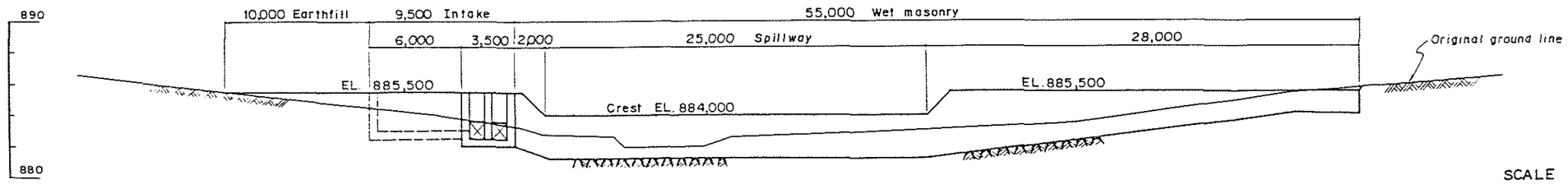
THE HASHEMITE KINGDOM OF JORDAN

FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION

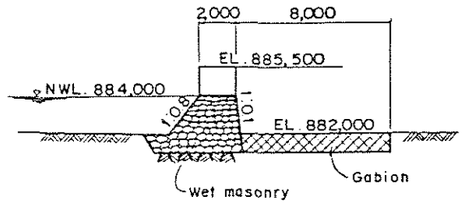
JAPAN INTERNATIONAL COOPERATION AGENCY



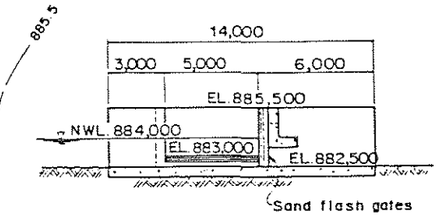
PLAN



PROFILE



SECTION OF WET MASONRY WEIR



PROFILE OF INTAKE

SCALE
0 10m

Fig. E.3.13 Wet Masonry Weir of Abyad

THE HASHEMITE KINGDOM OF JORDAN
FEASIBILITY STUDY ON AGRICULTURAL DEVELOPMENT FOR THE KARAK - TAFILA DEVELOPMENT REGION
JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX - F

ORGANIZATION AND MANAGEMENT

ANNEX-F ORGANIZATION AND MANAGEMENT PLAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. GENERAL

The Agricultural Development Project for the Karak-Tafila Development Region consists of two schemes; one is the crop production by introducing water harvesting measures and the other is the fodder shrub production. It would be proposed to be implemented by the private sector for the crop production and by the Government for fodder shrub production, taking the following points into consideration.

1) Crop production scheme (field crops and tree crops)

- Most of proposed area for the crop production is located in the private land.
- The Government has encouraged the development by means of private sector.

2) Fodder shrub production scheme

- The fodder shrub production area is located mainly in the government land.
- The scheme will has less profitability, which cannot be recommended to the private sector.
- The main purpose of this scheme is to improve the living standard of the nomads, and the scheme will be implemented as one of the social projects under the condition of non profit.

The Project consists of the following components and development areas. The details of development area are presented in Table F.1.1 to F.1.4.

(Unit: ha)

	Crop Production (Development by Individual Farmers)	Fodder Shrub Production (Development by Government)	Total
1) Water Harvesting Measures	8,510	4,480	12,990
- Micro-catchment	(5,600)	(2,380)	(7,980)
- Stone Walls/Earth Bank	(210)	-	(210)
- Stone Walls/Contour Furrow	(2,700)	(2,100)	(4,800)
2) Mechanized Farming	270	-	270
3) Check Dam	93	-	72
4) Winter Irrigation	33.9	-	33.9
Total	8,906.9	4,480	13,386.9

2. EXECUTING AGENCY

The Ministry of Agriculture (MOA) would be the executing agency of the Agricultural Development Project for the Karak-Tafila Development Region. In MOP, there is the Department of Projects under the Steering Committee. The Project belongs in this department, and would be executed under the supervise of

the Steering Committee. It is proposed that MOP and WAJ related to the execution of the Project are included in this Steering Committee. In addition, it is recommended that the system of government subsidy for the development of water harvesting measures and check dam is established in MOA, because the farm management of such development schemes in the dry land is financially marginal.

The crop production scheme would be executed through the agricultural extension system of MOA. Accordingly construction and management would be done directly by the private sector with technical assistance and guidance from MOA. As for the fodder shrub production scheme, there are several on-going projects which have been executed by MOA. This scheme would be executed in parallel with these on-going projects.

The MOA coordinates all activities of the relevant Government agencies and regional administrative organizations in connection with the project implementation. The agricultural offices in Amman, Karak and Tafila governorate under MOA have direct responsibility for the project implementation. The main tasks of the agricultural offices would be as listed below.

a) Extension of the water harvesting project to the farmers.
b) Technical assistance and guidance for the water harvesting to be implemented by the farmers.
c) Coordination between the Government authorities concerned with implementation of the project; JCO and ACC.
d) Construction and management of fodder shrub production scheme.

At present, the fodder shrub project has been executing also by the Karak Branch Office of JCO. If this agency will request its implementation of the scheme, it is possible. But in such case, the technical assistance and guidance of MOA are required for its successful implementation. If it will be cleared in feature that the management of this scheme is financially feasible, it is proposed to turn over the management to a cooperative which will be established newly in the area.

3. IMPLEMENTING PROCEDURES

The overall implementing procedures of both schemes are presented in Figs. F.3.1 and F.3.2. The details are described hereinafter.

3.1 Crop Production Scheme

(1) Preparation of Design Criteria

The researches and experiments for the water harvesting

measures such as micro-catchments, contour farrows, earth banks, etc. will be continued during the implementation period of the Project, which have been done by MOA and the University of Jordan. In addition, the trial farming and tentative water harvesting measures will be implemented by MOA in the initial stage (see 5.1). Based on these results which will be obtained in the initial stage and the design criteria prepared in this feasibility study, MOA prepares more detailed design criteria for the detailed design and construction.

After establishment of technical matters, MOA make the operation schedules including the short, middle and long term targets for project implementation.

(2) Extension and Construction

a) Advertisement and Recommendation

According to the operation schedule, the extension offices in Amman, Karak and Tafila governorate advertise the water harvesting scheme and recommend to the farmers through their extension activity. The farmers who have interest for the scheme consult and request to the extension offices directly.

b) Screening, Field Reconnaissance and Technical Evaluation

The farmers who requested the scheme are screened by the extension offices. The fields located in the proposed area are selected for inclusion in the scheme, and in case of land hold by a group (family), their approval is checked.

The extension agents carry out the reconnaissance survey to the fields requested from the farmers. The main investigating points are to i) area of field, ii) slope, iii) soil depth, iv) soil texture and v) availability of materials (stone). The agro-climatological factors such as temperature, rainfall and wind velocity are also reviewed by the agents. On the basis of these results, the extension agents evaluate the technical possibility of water harvesting, and propose its optimum measure to the farmers.

c) Design and Farming Plan

With reference to the design criteria, the extension offices design the structures of water harvesting and make a proposed farming plan including the following items. The construction and management costs are also estimated by the offices.

- Proposed crops
- Proposed farming practices including varieties, planting density, pests and diseases control, etc.

- Implementation schedule
- Cost estimate

d) Economic Evaluation

Economic evaluation is done by the extension offices in order to clear the financial feasibility of the proposed scheme. The evaluation includes the following items:

- Requirement of capital investment
- Provisional cash flow statement
- Provisional profit and loss statement
- Repayment capability

If this scheme is financially marginal, the government subsidy to the farmers is arranged by the extension office.

e) Farmers' Review and Construction

The extension offices submit the results of design, farming plan and economic evaluation to the farmers. The farmers review these results and make final decision for the implementation of water harvesting.

The construction cost is arranged by the farmers themselves. It is expected that the best credit of ACC and JCO are offered fully to these farmers. The construction is done directly by the farmers or contractor under the technical assistance from the extension offices.

(3) Farm Management

After completion of the construction, the farm management are immediately conducted by the farmers. In order to improve the farming practices and solve the technical problems which will occur during the management stage, the extension office make monitoring survey to the water harvesting farmers. The survey results are analyzed by the extension offices or submit to NCARTT which make researches for improving water harvesting, and new technology and/or counter measures for problems are fed back to the farmers. The supporting services such as machinery service, supply of farm inputs and marketing service of farm products are done by JCO.

3.2 Fodder Shrub Production Scheme

The construction and management of the fodder shrub production scheme are done directly by the Government, and the agricultural offices in Amman, Karak and Tafila Governorates have its direct responsibility under the technical and administrative assistance from the Head Office. The overall implementing procedures are presented in Fig. F.3.2.

The agricultural offices advertise the scheme and select the farmers who have the following conditions.

a) The farmers having difficulty in obtaining grazing land.
b) The farmers who have a specialty in animal husbandry, or make mainly a living by the animal husbandry.
c) The farmers who are unable to make a living.

The operation plan is prepared by the agricultural office, which includes the annual grazing head, grazing area per one farmer, grazing period, grazing rotation, etc., and the Office make a contract with the farmers under the condition of the plan. The contract is renewed at about five-year intervals. Then the operation plan is revised and all contract farmers are re-screened at this time.

4. AGRICULTURAL SUPPORTING SERVICES

The implementing and cooperating agencies of the schemes are the agricultural offices at Amman, Karak and Tafila Governorates, NCARTT, JCO and ACC, as mentioned earlier. For successful implementation of the schemes, especially of the crop production scheme by the introduction of water harvesting measures, it would be necessary to improve and strengthen their organizational structures and functions. The main improving and strengthening points are described hereinafter.

4.1 Research and Extension Work

Prior to the implementation of the project, the following improvement would be required to the agencies concerned.

1) Strengthening of research and experimental works which have been carried out by MOA and Jordan University.
2) Increase of the extension agents.
3) Training of staff related to the project implementation.

The training of extension agents is done by the method of "on the job training" through the implementation of trial farming and tentative water harvesting measures (see 5.1).

4.2 Agricultural Cooperatives

(1) Marketing and transportation services for products

At present, the crops produced by farmers have been transported to the middlemen at Amman Central Market or in other areas by farmers themselves. This transportation cost including plastic boxes occupies a large portion in the production cost. In order to curtail the production cost, it is proposed that JCO has transportation services with a good charge.

(2) Farm Machinery Services

According to the farm interview survey, the farmers desire to have the farm machinery services from JCO, because the service fee of private sector is higher than that of JCO and its services are not available at a convenient time of farming. On the other hand, the JCO Raba station has only three units including tractor, chisel plow and sprayer and one combine harvester, and the station cannot meet the farmers' demand. After the implementation of the project, the mechanical power requirement will increase along the expansion of crop area. It is therefore proposed to strengthen the farm machinery services of JCO.

4.3 Agricultural Credits

A considerable amount of initial investment cost will be necessary for implementation of the scheme. This cost will be covered by the credits, because the farmers have no investment capacity. As mentioned earlier, various types of loans have been offering by ACC and JCO (see Tables F.4.1 and F.4.2). But in case of water harvesting, it is expected that the agencies offer some soft loans which consist of less interest with long repayment and grace periods, because the repayment capability of water harvesting project is lower than the other projects.

At present, the credit institutions have a big problem for the agricultural credit, which is the low repayment of loans. To solve this problem, the following improvement and strengthening activities are proposed to the credit institutions.

a) to establish mobile bank services for collecting repayment money,

b) to supervise the defaulters for improving their repayment condition, and

c) to make promoting campaign for loan repayment.

5. IMPLEMENTING SCHEDULE

5.1 Crop Production Scheme

The agricultural development in semi-arid zone is one of the crucial policies of Jordan, in order to stabilize the living standard of rural people and activate the national economy. As one of the development measures, the introduction of water harvesting was proposed in the priority areas.

For the implementation of the water harvesting project which is invested by the private sector, careful consideration must be paid not only to technical viability but also to financial feasibility. In general, the farmers in the priority areas have a small capacity to pay for loans, while a

considerable amount of loan will be required to the farmers who implement the scheme. According to the financial analysis, it seems that the development by check dam and water harvesting measures such as micro-catchment and stone walls (fruits cultivation) will inevitably be financially marginal. It means that the farmers will face some financial risk in its implementation.

Under such situations, the phased implementation is recommended to the Project. The project implementation is divided into the following three stages:

Phase-I (5 Years):

1) Trial farming in the actual field, and continuation of the research and experimental works for water harvesting measures.
2) Extension of the tentative water harvesting measures to the existing fields.
3) Training of extension agents related to the scheme.
4) Improvement and strengthening of agricultural supporting services.
5) Preparation of design criteria for detailed design and construction
6) Implementation of winter irrigation
7) Preparation of extension schedule.

Phase-II (5 Years):

1) Development in the potential areas with over 200mm of annual rainfall.
2) Continuation of research programme for improvement of water harvesting measures.

Phase-III (5 Years):

1) Development in the area with below 200mm of annual rainfall.

In the Phase-I stage, MOA makes researches and trial farming on the water harvesting measures. In parallel with this research programme, it is proposed that the tentative water harvesting measures, which construct the small stone walls or ditches for collecting rainfall water around the tree crops or fodder shrubs, are implemented to the existing fields. The effects of water harvesting and more practical information will be confirmed and collected through these tentative measures. In addition, the water harvesting measures will have received technical and financial confirmation.

The development in the Phase-II stage is promoted according to the proposed implementing procedures as shown in Fig. F.3.1. The development priority would be given to the development areas with over 200mm of annual rainfall.

After confirmation of the development effects which are implemented in the Phase-II stage, the Phase-III stage is conducted in the areas with below 200mm of annual rainfall. If it is cleared that the water harvesting is an effectual measure for developing the areas with below 200mm, the water harvesting scheme will be adopted in the whole study area.

Total development period was assumed at 15 years including 5 years of pre-implementation stage. The annual development area was estimated at 670 ha/year for the Phase-II stage and 1,090 ha/year for the Phase-III stage, as shown in Table F.5.1. The overall implementation schedule is presented in Fig. F.5.1.

All of facilities for the winter irrigation scheme which consists of 4 sites can be constructed with in one year (Fig F.5.2) it is assumed that this scheme is done in the 4th year in the Phase-I stage. As for the check dams, the construction period of one site is estimated within one month. The check dam development would be implemented during the period of 5 years in the Phase-II stage.

5.2 Fodder Shrub Production Scheme

The fodder shrub development scheme would be implemented carefully as well as the crop production scheme, though this is one of the crucial schemes for developing the semi-arid zone. At present, MOA and JCO have been implementing the fodder shrub projects in and around the study area, however these are still in the trail stage. Considering such situations, it is proposed to implement the scheme in stage.

Phase-I Stage (5 Years):

- Researches and experiments including trial grazing in the existing project areas
- Detailed design

Phase-II Stage (10 Years):

- Construction and management.

In the Phase-I stage, all preparatory works required for implementation of the project would be done by MOA. The farming practices such as optimum grazing period, maximum grazing density, planting density of fodder shrub, grazing interval and grazing season will be confirmed through the researches and experiments in the existing projects.

The total development period was assumed at 15 years as well as the crop production scheme. The annual development area during the construction stage was estimated at about 450 ha (see Table F.5.1).

Table F.1.1 DEVELOPMENT AREA OF THE WHOLE PROJECT AREA

(Unit: ha)

	Development by Individual Farmers											Development by Government Fodder Shrubs				Grand Total
	Field Crops				Fruit Crops				Mixture*		Total					
	0-8%	8-12%	12-30%	Total	0-8%	8-12%	12-30%	Total	12-30%	Total		0-8%	8-12%	12-30%	Total	
First Phase	270	510	-	780	-	170	190	466	2,190	2,190	3,435.9	1,190	1,050	-	2,240	5,675.9
1) Water Harvesting Measures																
- Micro-catchment	-	-	-	-	-	150	-	150	-	-	150	1,190	-	-	1,190	1,340
- Stone Walls/Earth Bank	-	-	-	-	-	20	190	210	-	-	210	-	-	-	-	210
- Stone Walls/C. Furrow	-	510	-	510	-	-	-	-	2,190	2,190	2,700	-	1,050	-	1,050	3,750
2) Mechanized Farming	270	-	-	270	-	-	-	-	-	-	270	-	-	-	-	270
3) Check Dam				-				72		-	72				-	72
4) Winter Irrigation				(33.9)*				33.9		-	33.9				-	33.9
Second Phase	-	-	-	-	5,450	-	-	5,450	-	-	5,450	1,190	1,050	-	2,240	7,690
1) Water Harvesting Measures																
- Micro-catchment	-	-	-	-	5,450	-	-	5,450	-	-	5,450	1,190	-	-	1,190	6,640
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	-	-	-	-	-	-	-	-	-	1,050	-	1,050	1,050
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3) Check Dam				-				-		-	-				-	-
4) Winter Irrigation				-				-		-	-				-	-
Whole Area	270	510	-	780	5,450	170	190	5,915.9	2,190	2,190	8,886	2,380	2,100	-	4,480	13,365.9
1) Water Harvesting Measures																
- Micro-catchment	-	-	-	-	5,450	150	-	5,600	-	-	5,600	2,380	-	-	2,380	7,980
- Stone Walls/Earth Bank	-	-	-	-	-	20	190	210	-	-	210	-	-	-	-	210
- Stone Walls/C. Furrow	-	510	-	510	-	-	-	-	2,190	2,190	2,700	-	2,100	-	2,100	4,800
2) Mechanized Farming	270	-	-	270	-	-	-	-	-	-	270	-	-	-	-	270
3) Check Dam				-				72		-	72				-	72
4) Winter Irrigation				(33.9)*				33.9		-	33.9				-	33.9

* Inter cropping

Table F.1.2 (1/3) GROSS DEVELOPMENT AREA

Annual Rainfall 200 - 300mm (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand Total
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	
I. Ohiban															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	254	-	-	-	-	-	-	254	-	-	254
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	315	-	-	-	315	-	-	315
- Stone Walls/C. Furrow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2) Mechanized Farming	141	-	-	-	-	-	-	-	-	-	141	-	-	-	141
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	51	-	-	-	-	-	-	51	-	-	-	51
2) Mechanized Farming	141	-	-	-	-	-	-	-	-	-	141	-	-	-	141
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/Earth Bank	-	-	-	-	28	-	-	6	-	-	-	34	-	-	34
- Stone Walls/C. Furrow	-	-	-	795	-	-	-	-	-	3,645	795	-	-	3,645	4,440
2) Mechanized Farming	186	-	-	-	-	-	-	-	-	-	186	-	-	-	186
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	254	-	-	-	-	-	-	254	-	-	254
- Stone Walls/Earth Bank	-	-	-	-	28	-	-	321	-	-	-	349	-	-	349
- Stone Walls/C. Furrow	-	-	-	846	-	-	-	-	-	3,645	846	-	-	3,645	4,491
2) Mechanized Farming	468	-	-	-	-	-	-	-	-	-	468	-	-	-	468
Total	468	0	0	846	282	0	0	321	0	3,645	1,314	603	0	3,645	5,562

Table F.1.2 (2/3) GROSS DEVELOPMENT AREA

Annual Rainfall 100 - 200mm (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand Total
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	
I. Dhiban															
1) Water Harvesting Measures															
- Micro-catchment	-	5,861	17	-	-	-	-	-	-	-	-	5,861	17	-	5,878
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	-	-	1,407	-	-	-	-	-	-	1,407	-	1,407
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	3,151	3,894	-	-	-	-	-	-	-	-	3,151	3,894	-	7,045
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	-	-	1,795	-	-	-	-	-	-	1,795	-	1,795
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	67	45	-	-	-	-	-	-	-	-	67	45	-	112
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	-	-	304	-	-	-	-	-	-	304	-	304
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	9,079	3,956	-	-	-	-	-	-	-	-	9,079	3,956	-	13,035
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	-	-	3,506	-	-	-	-	-	-	3,506	-	3,506
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	0	9,079	3,956	0	0	3,506	0	0	0	0	0	9,079	7,462	0	16,541

Table F.1.2 (3/3) GROSS DEVELOPMENT AREA

Whole Area (Annual Rainfall 100 - 300mm) (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand Total
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	
I. Dhiban															
1) Water Harvesting Measures															
- Micro-catchment	-	5,861	17	-	254	-	-	-	-	-	-	6,115	17	-	6,132
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	315	-	-	-	315	-	-	315
- Stone Walls/C. Furrow	-	-	-	-	-	1,407	-	-	-	-	-	-	1,407	-	1,407
2) Mechanized Farming	141	-	-	-	-	-	-	-	-	-	141	-	-	-	141
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	3,151	3,894	-	-	-	-	-	-	-	-	3,151	3,894	-	7,045
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Stone Walls/C. Furrow	-	-	-	51	-	1,795	-	-	-	-	51	-	1,795	-	1,846
2) Mechanized Farming	141	-	-	-	-	-	-	-	-	-	141	-	-	-	141
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	67	45	-	-	-	-	-	-	-	-	67	45	-	112
- Stone Walls/Earth Bank	-	-	-	-	28	-	-	6	-	-	-	34	-	-	34
- Stone Walls/C. Furrow	-	-	-	795	-	304	-	-	-	3,645	795	-	304	3,645	4,744
2) Mechanized Farming	186	-	-	-	-	-	-	-	-	-	186	-	-	-	186
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	9,079	3,956	-	254	-	-	-	-	-	-	9,333	3,956	-	13,289
- Stone Walls/Earth Bank	-	-	-	-	28	-	-	321	-	-	-	349	-	-	349
- Stone Walls/C. Furrow	-	-	-	846	-	3,506	-	-	-	3,645	846	-	3,506	3,645	7,997
2) Mechanized Farming	468	-	-	-	-	-	-	-	-	-	468	-	-	-	468
Total	468	9,079	3,956	846	282	3,506	0	321	0	3,645	1,314	9,682	7,462	3,645	22,103

Table F.1.3 (1/3) NET DEVELOPMENT AREA

Annual Rainfall 200 - 300mm (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand Total
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	
I. Dhiban															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	150	-	-	-	-	-	0	150	0	0	150
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	190	-	-	0	190	0	0	190
- Stone Walls/C. Furrow	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
2) Mechanized Farming	80	-	-	-	-	-	-	-	-	-	80	0	0	0	80
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	30	-	-	-	-	-	-	30	0	0	0	30
2) Mechanized Farming	80	-	-	-	-	-	-	-	-	-	80	0	0	0	80
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/Earth Bank	-	-	-	-	20	-	-	0	-	-	0	20	0	0	20
- Stone Walls/C. Furrow	-	-	-	480	-	-	-	-	-	2,190	480	0	0	2,190	2,670
2) Mechanized Farming	110	-	-	-	-	-	-	-	-	-	110	0	0	0	110
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	-	-	-	150	-	-	-	-	-	0	150	0	0	150
- Stone Walls/Earth Bank	-	-	-	-	20	-	-	190	-	-	0	210	0	0	210
- Stone Walls/C. Furrow	-	-	-	510	-	-	-	-	-	2,190	510	0	0	2,190	2,700
2) Mechanized Farming	270	-	-	-	-	-	-	-	-	-	270	0	0	0	270
Total	270	0	0	510	170	0	0	190	0	2,190	780	360	0	2,190	3,330

* Conversion factor from gross to net areas: 60%

Table F.1.3 (2/3) NET DEVELOPMENT AREA

Annual Rainfall 100 - 200mm (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand Total
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	
I. Dhiban															
1) Water Harvesting Measures															
- Micro-catchment	-	3,520	10	-	-	-	-	-	-	-	0	3,520	10	0	3,530
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	-	-	840	-	-	-	-	0	0	840	0	840
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	1,890	2,340	-	-	-	-	-	-	-	0	1,890	2,340	0	4,230
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	-	-	1,080	-	-	-	-	0	0	1,080	0	1,080
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	40	30	-	-	-	-	-	-	-	0	40	30	0	70
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	-	-	180	-	-	-	-	0	0	180	0	180
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	5,450	2,380	-	-	-	-	-	-	-	0	5,450	2,380	0	7,830
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	-	-	2,100	-	-	-	-	0	0	2,100	0	2,100
2) Mechanized Farming	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
Total	0	5,450	2,380	0	0	2,100	0	0	0	0	0	5,450	4,480	0	9,930

* Conversion factor from gross to net areas: 60%

Table F.1.3 (3/3) NET DEVELOPMENT AREA

Whole Area (Annual Rainfall 100 - 300mm) (Unit: ha)

	0 - 8%			8 - 12%			12 - 30%				Total				Grand
	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Field Crops	Fruit Trees	Fodder Shrubs	* Mixture	Total
I. Dhiban															
1) Water Harvesting Measures															
- Micro-catchment	-	3,520	10	-	150	-	-	-	-	-	0	3,670	10	0	3,680
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	190	-	-	0	190	0	0	190
- Stone Walls/C. Furrow	-	-	-	-	-	840	-	-	-	-	0	0	840	0	840
2) Mechanized Farming	80	-	-	-	-	-	-	-	-	-	80	0	0	0	80
II. Abyad															
1) Water Harvesting Measures															
- Micro-catchment	-	1,890	2,340	-	-	-	-	-	-	-	0	1,890	2,340	0	4,230
- Stone Walls/Earth Bank	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0
- Stone Walls/C. Furrow	-	-	-	30	-	1,080	-	-	-	-	30	0	1,080	0	1,110
2) Mechanized Farming	80	-	-	-	-	-	-	-	-	-	80	0	0	0	80
III. Tafila															
1) Water Harvesting Measures															
- Micro-catchment	-	40	30	-	-	-	-	-	-	-	0	40	30	0	70
- Stone Walls/Earth Bank	-	-	-	-	20	-	-	0	-	-	0	20	0	0	20
- Stone Walls/C. Furrow	-	-	-	480	-	180	-	-	-	2,190	480	0	180	2,190	2,850
2) Mechanized Farming	110	-	-	-	-	-	-	-	-	-	110	0	0	0	110
Whole Area															
1) Water Harvesting Measures															
- Micro-catchment	-	5,450	2,380	-	150	-	-	-	-	-	0	5,600	2,380	0	7,980
- Stone Walls/Earth Bank	-	-	-	-	20	-	-	190	-	-	0	210	0	0	210
- Stone Walls/C. Furrow	-	-	-	510	-	2,100	-	-	-	2,190	510	0	2,100	2,190	4,800
2) Mechanized Farming	270	-	-	-	-	-	-	-	-	-	270	0	0	0	270
Total	270	5,450	2,380	510	170	2,100	0	190	0	2,190	780	5,810	4,480	2,190	13,260

* Conversion factor from gross to net areas: 60%

Table F.1.4 DEVELOPMENT AREA OF CHECK DAM AND WINTER IRRIGATION

Annual Rainfall 100 - 300mm (Unit: ha)

	Field Crops	Fruit Trees	Fodder Shrubs	Mixtur	Total
I. Dhiban					
1) Check Dam**	-	29	-	-	29
2) Winter Irrigation	-	-	-	-	-
II. Abyad					
1) Check Dam**	-	28	-	-	28
2) Winter Irrigation	(20.5)*	20.5	-	-	20.5
III. Tafila					
1) Check Dam**	-	36	-	-	36
2) Winter Irrigation	(13.4)*	13.4	-	-	13.4
Whole Area					
1) Check Dam**	-	93	-	-	93
2) Winter Irrigation	(33.9)*	33.9	-	-	33.9
Total	(33.9)*	126.9	-	-	126.9

* Inter cropping

** Farm area of check dam was estimated as follows:

Priority Area	Study Area (ha)	Potential Area (ha)	No. of Site	Farm Area (ha)
Dhiban	36,300	29,200	97	29
Abyad	35,700	28,100	94	28
Tafila	48,100	36,100	120	36
Total	120,100	93,400	311	93

Table F.4.1 MAIN FEATURES OF ACC LOANS

Purposes	Amount of Loan (JD)	Interest Rate	Repayment Period*1 (Year)	Grace Period (Year)
a) Dry Land Development Works				
(1) Drilling and equiping deep wells and development of surface water resources	< 1,000	6 %	10	1
(2) "	1,001-10,000	7 %	10	1
(3) Soil conservation	Any amount	6 %	15	-
(4) Olive tree planting	"	6 %	15	6
(5) Other tree planting	"	6 %	12	6
(6) Grapes planting	"	6 %	8	3
(7) Purchasing loans for small farmers	> 5,000	7 %	10	-
b) Irrigation Land Development Works				
(1) Banana trees planting	< 1,000	6 %	6	1
(2) "	1,001-50,000	7 %	6	1
(3) "	>50,000	8 %	6	1
(4) Citrus trees planting	< 1,000	6 %	10	4
(5) "	1,001-50,000	7 %	10	4
(6) "	>50,000	8 %	10	4
(7) Grape trees planting	< 1,000	6 %	8	3
(8) "	> 1,001	7 %	8	3
(9) Establishment of modern irrigation networks	<50,000	7 %	6	1
(10) "	>50,000	8 %	6	1
(11) Plastic houses	<50,000	7 %	6	1
(12) "	>50,000	8 %	6	1
(13) Nurseries (vegetables)	<50,000	7 %	10	1
(14) "	>50,000	8 %	10	1
(15) Nurseries (trees)	<50,000	7 %	10	2
(16) "	>50,000	8 %	10	2
(17) Irrigation projects (engines & pump for individual farmers)	< 1,000	6 %	10	1
(18) "	1,001-50,000	7 %	10	1
(19) "	>50,000	8 %	10	1
(20) Irrigation projects for group farmers	< 1,000	6 %	11-15	1
(21) "	1,001-50,000	7 %	11-15	1
(22) "	>50,000	8 %	11-15	1
c) Animal Husbandry Development Project				
(1) Poultry (layers & broiler)	<50,000	7 %	10	1
(2) "	>50,000	8 %	10	1
(3) Dairy cows and calves, fattening sheep farms	< 5,000	6 %	10	1
(4) "	5,001-50,000	7 %	10	1
(5) "	>50,000	8 %	10	1
(6) Others (bee-hives, purchasing draft animals, etc.)	Any amount	6 %	5	-
d) Farm Mechanization and Agricultural Processing Plants				
(1) Purchase of farm machinery and equipment	Any amount	7 %	8	1
(2) Processing of agricultural products	Any amount	7 %	11-15	1
e) On-Farm and Rural Buildings				
(1) Rural buildings	< 5,000	6 %	10	1
(2) "	5,001-50,000	7 %	10	1
(3) "	>50,000	8 %	10	1
f) Operational Loans				
Seasonal Loans				
(1) Purchase of production supply inputs for animal and plant	< 1,000	6 %	1	-
(2) "	1,001- 5,000	7 %	1	-
(3) "	5,001-10,000	7.5 %	1	-
(4) "	10,001-20,000	8 %	1	-
(5) "	20,001-50,000	8.5 %	1	-
Short-Term Loans				
(1) Purchase of production supply inputs for animal and plant	< 1,000	6 %	1-2	-
(2) "	1,001-20,000	7 %	1-2	-
(3) "	20,001-50,000	8 %	1-2	-

*1 Including grace period
Source: Agricultural Credit Corporation

Table F.4.2 MAIN FEATURES OF JCO LOANS

1) Short loan	For cereal crops	
		Repayment period: 9 - 12 months Interest: 5 - 6 %/year
2) Medium loan	For animal	
		Repayment period: 2 - 3 years Interest: 6 %/year
3) Long loan	For tree crops	
		Repayment period: 3 - 5 years Interest: 7 %/year
4) Long loan	For drip irrigation of vegetable cultivation	
		Repayment period: 3 - 5 years Interest: 7.5 %/year

Table F.5.1 ANNUAL DEVELOPMENT AREA

(Unit: ha)

	Phase-I & II					Phase-III				Annual Development Area										
	Field Crop (ha)	Fruit Crops (ha)	Mixture (ha)	Fodder Shrubs (ha)	Total	Fruit Crops (ha)	Fodder Shrubs (ha)	Total	Ground Total	Phase-I		Phase-II					Phase-III				
										4	5	6	7	8	9	10	11	12	13	14	15
Crop Production Scheme	780	486.9	2,190	-	3,456.9	5,450	-	5,450	8,906.9	33.9	-	678.6	678.6	678.6	688.6	698.6	1,090	1,090	1,090	1,090	1,090
1) Water Harvesting Measures																					
- Micro-catchment	-	150	-	-	150	5,450	-	5,450	5,600	-	-	30	30	30	30	30	1,090	1,090	1,090	1,090	1,090
- Stone Walls/Earth Bank	-	210	-	-	210	-	-	-	210	-	-	40	40	40	40	50	-	-	-	-	-
- Stone Walls/C. Furrow	510	-	2,190	-	2,700	-	-	-	2,700	-	-	540	540	540	540	540	-	-	-	-	-
2) Mechanized Farming	270	-	-	-	270	-	-	-	270	-	-	50	50	50	60	60	-	-	-	-	-
3) Check Dam	-	93	-	-	93	-	-	-	93	-	-	18.6	18.6	18.6	18.6	18.6	-	-	-	-	-
4) Winter Irrigation	(33.9)*	33.9	-	-	33.9	-	-	-	33.9	33.9	-	-	-	-	-	-	-	-	-	-	-
Fodder Shrub Production Sche	-	-	-	2,240	2,240	-	2,240	2,240	4,480	-	-	450	450	450	450	440	450	450	450	450	440
1) Water Harvesting Measures																					
- Micro-catchment	-	-	-	1,190	1,190	-	1,190	1,190	2,380	-	-	240	240	240	240	230	240	240	240	240	230
- Stone Walls/C. Furrow	-	-	-	1,050	1,050	-	1,050	1,050	2,100	-	-	210	210	210	210	210	210	210	210	210	210
Whole Area	780	486.9	2,190	2,240	4,646.9	5,450	2,240	7,690	13,386.9	33.9	-	1,128.6	1,128.6	1,128.6	1,138.6	1,138.6	1,540	1,540	1,540	1,540	1,530
1) Water Harvesting Measures																					
- Micro-catchment	-	150	-	1,190	1,340	5,450	1,190	6,640	7,980	-	-	270	270	270	270	260	1,330	1,330	1,330	1,330	1,320
- Stone Walls/Earth Bank	-	210	-	-	210	-	-	-	210	-	-	40	40	40	40	50	-	-	-	-	-
- Stone Walls/C. Furrow	510	-	2,190	1,050	2,700	-	1,050	1,050	4,800	-	-	750	750	750	750	750	210	210	210	210	210
2) Mechanized Farming	270	-	-	-	270	-	-	-	270	-	-	50	50	50	60	60	-	-	-	-	-
3) Check Dam	-	93	-	-	93	-	-	-	93	-	-	18.6	18.6	18.6	18.6	18.6	-	-	-	-	-
4) Winter Irrigation	(33.9)*	33.9	-	-	33.9	-	-	-	33.9	33.9	-	-	-	-	-	-	-	-	-	-	-

* Inter cropping

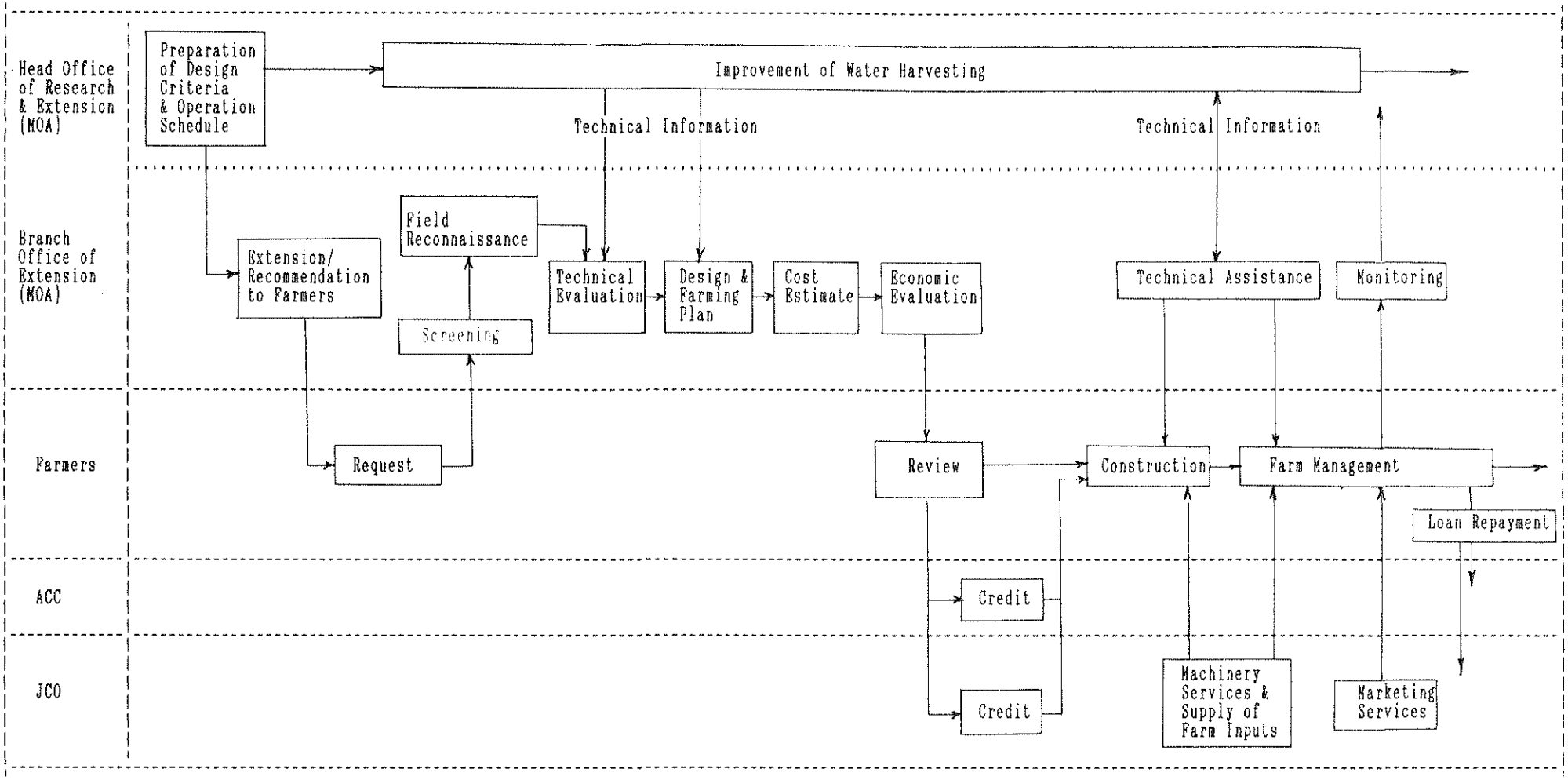


Fig. F.3.1 Implementing Procedure - Crop Production
(Water Harvesting and Check Dam)

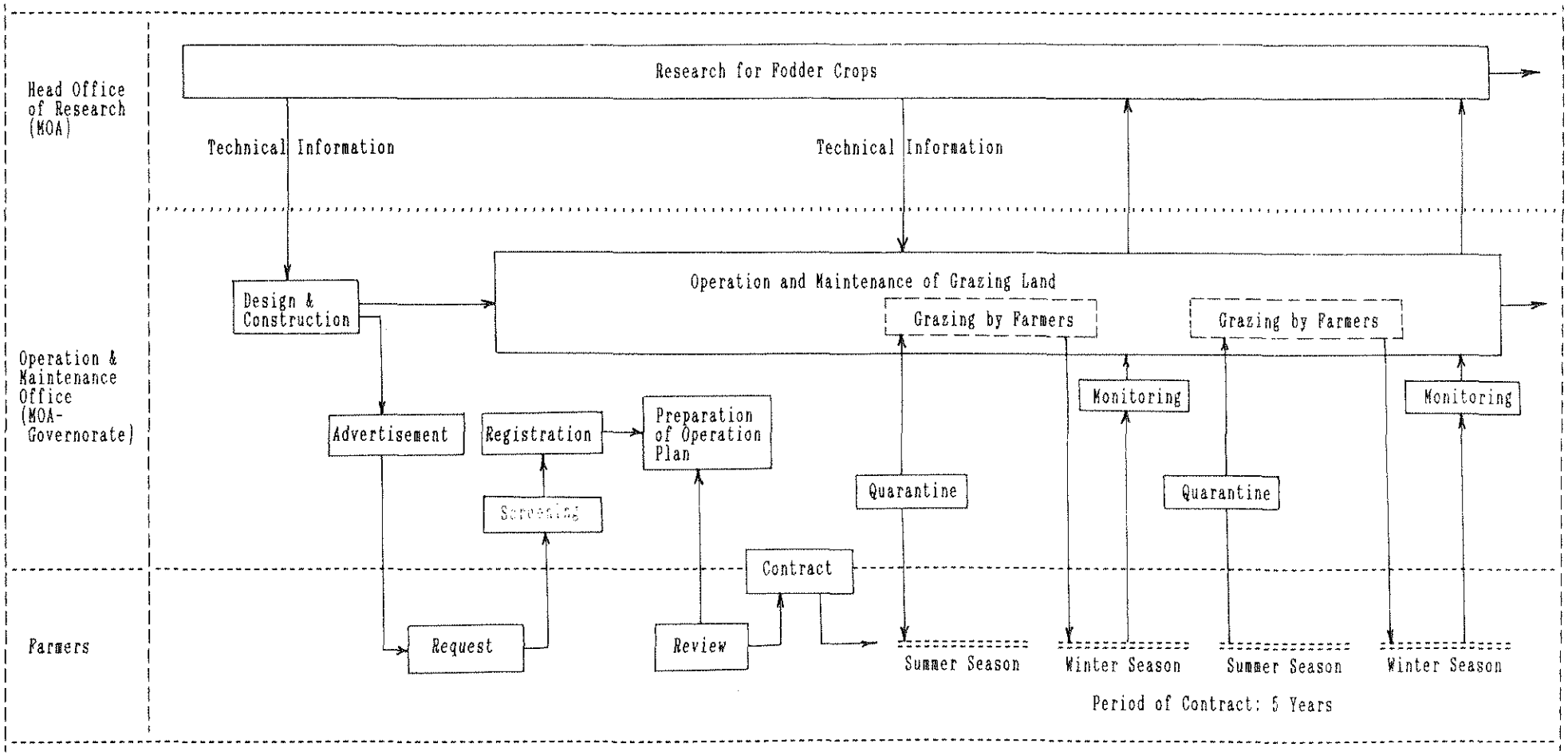


Fig. F.3.2 Implementing Procedure - Fodder Shrub Production

Fig. F.5.1 Implementation Schedule

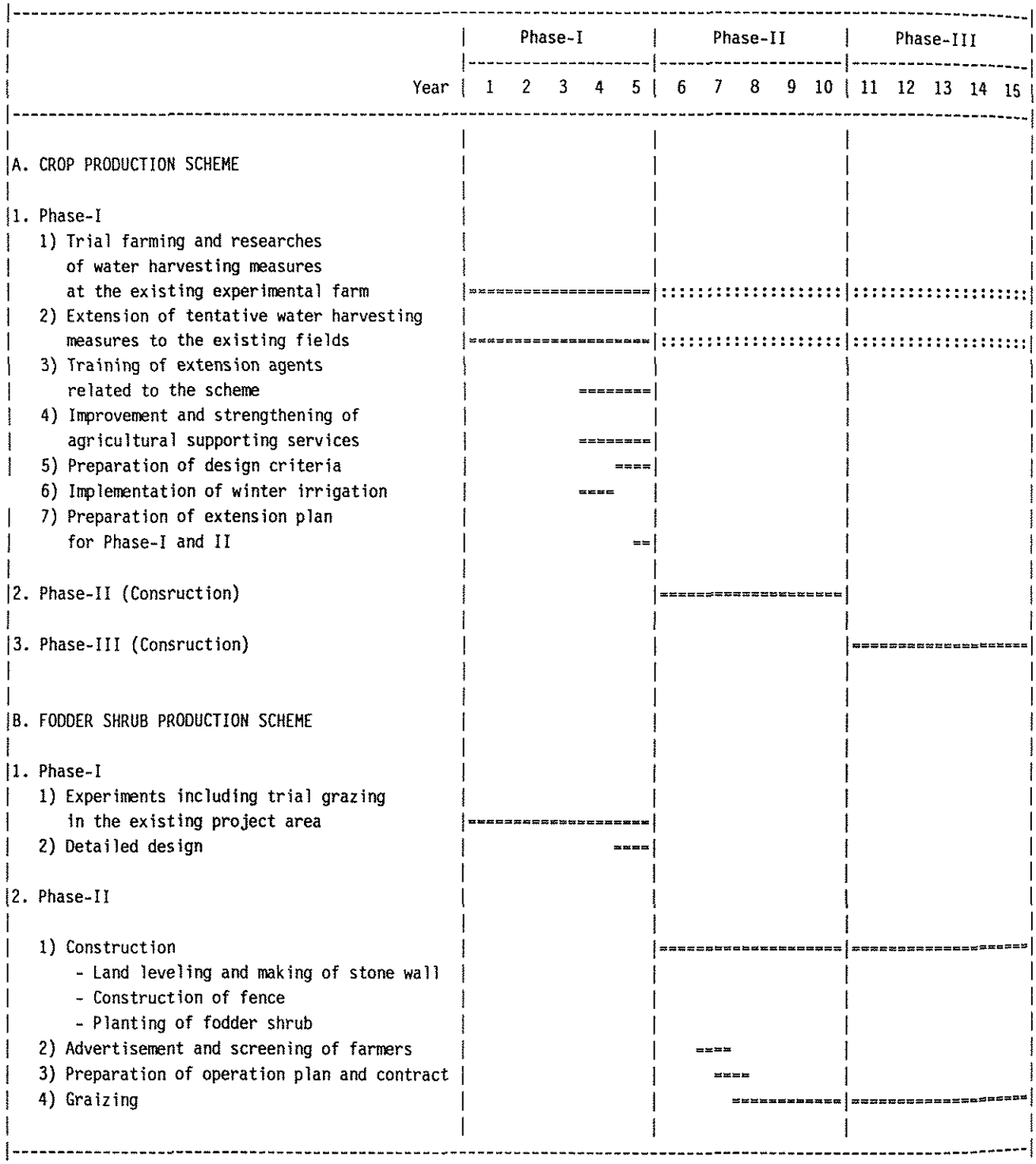


Fig. F.5.2 CONSTRUCTION TIME SCHEDULE