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MINISTRY OF LIVESTOCK, FORESTRY AND RANGE

—

NEW JUBA FODDER FARM PROJECT

ECONOMIC AND TECHNICAL ASPECTS

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New Juba Fodder Farm Project

Economic and Technical Aspects

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This report is based on the findings of Mr. J. Leeuven Boomkamp (agro-economy), Dr. H. Jesswein (livestock and fodder) and Mr. L. Pieterse (irrigation) who visited Somalia during the period from October 1986 to February 1987.

Project Summary, Conclusions and Recommendations

1. Project Summary:

The principal aims of the project are the following:

- To establish a commercially viable farm operation for the production of dry fodder by making an effective use of available irrigation and drainage works and infrastructural facilities of a farm which in the past was used as a component of the Trans Juba Livestock project for the production of green fodder with an integrated feed lot production system.

- The farm's output in dry fodder would be sold in Kishmayo to enhance the export of live cattle to the target markets in the Middle East.

- The increase of fodder production in the project area will contribute to relieving the pressure of livestock numbers on available grazing areas enabling an increase in the destocking of excessive cattle which in turn will contribute to improving the productivity of livestock and the incomes of the traditional producers.

- In the middle to long run, it is expected that the project as a pilot scheme wll contribute to the extension of fodder production management mainly among the traditional livestock production sector in hands of the nomads.

- The project will enable the country to raise its foreign currency earnings by increased exports of livestock and will have positive effects upon the transition of subsistence livestock to more market oriented livestock management activities.

- To ensure an efficient management, the farm operations will be turned over by the Government to the private sector whenever and as soon as the basic conditions of privatisation have been duly assessed.

Economic Value of Dry Fodder

The principal aim of the project is to produce dry fodder to be sold to the trader/exporter of live cattle for the purpose of keeping the animals on their minimum exportable

weight of 320 kgs during a critical period of about 32 days: 21 days in quarantain stations plus 1 day maximum in marshalling yard at the Kishmayo harbour plus 10 days of ocean transport to Suez/Egypt. During this period, the average daily ration is 6/7 kgs of dry fodder per animal which is equivalent to 208 kgs over the 32 days period.

The C & F price in Suez paid for by the Egyptian Meat Corporation is 0.92 US$ per kg liveweight.

In case some animals do not conform, at arrival, to the minimum weight norm, they are reconditioned during some 10 to 15 days on basis of additional feeding which may include concentrate feed. The daily cost of reconditioning is being charged to the Somalian exporter who pays on an average 1 US$/day for this service. Accordingly, the maximum value to be attributed to the dry fodder on basis of an exchange rate of 160 SS = 1 US$ would be 11.5 SS/kg. (15 x 160 = 2400 : 208 = 11.50)

It can be argued that by avoiding the costs of reconditioning even some of the underweight animals, dry fodder is provided to offset the maximum costs of weight loss.

At present, the trader/exporter does not recover his full share of foreign currency according to the rate of exchange in the parallel currency market. In fact he receives only 50% according to the free market rate whereas the rest is paid according to the official rate of 90 SS/US$.

The following table illustrates the estimated costs and revenues per exported head of cattle and the benefits for the trader/exporter under each of the two situations: recovery of full share in foreign currency and recovery of half his share in foreign currency:

Costs, revenues and profits per exported animal*

Purchase value of non-fattened animal weighing 250kgs	10,000 SS
Annual wage of herding/animal	2,000 SS
Vaccines & Treatment/animal	500 SS
Value of dry fodder/animal: 208 kgs x 11.50 SS/kg	2,400 SS
Export fee/animal	325 SS
Ocean transport/animal (US$ 80.- x 160 SS)	12,800 SS
Export commission (5% on freight)	640 SS
Insurance (?)	- SS
Total cost C & F Suez	28,665 SS
Sales price at Suez (320 kgs x 0.92 x 160)	47,100 SS
Net profit/animal (Situation 1)	18,435 SS
Sales price recovered by trader/exporter (320 x 0.92 x 125)	36,800 SS
Net profit/animal (Situation 2)	8,135 SS

* The estimated costs are given by the TAWFIQ livestock export corporation and are based on information received from the Livestock Marketing & Health project.

It can be observed from above figures that at present (situation 2) the trader/exporter, due to the Government's currency regulations makes a profit of 8,135 SS/exported animal. His benefit/cost ratio = 1.28
This ration would reach 1.64 in case of full recovery of the foreign currency earnings according to the free market rate.

Taking into consideration the present rate of inflation of the Somali Shilling and the fact that part of the invested capital is tied up for a considerable period (6-9 months) and also the risk of mortality, it seems that the return on

investment is relatively modest under the present situation. The export incentives could be considerably improved by giving the exporters their full share in currency earnings according to the free exchange rate, provided that all foreign currency receipts are repatriated and will become available to the national economy.

Need for testing of suitable fodder species and cropping patterns

There is very little or no experience in Somalia as to the production of fodder crops, there is no knowledge about large scale commercial production of fodder while the research in this field undertaken by the Afgoi University on small plots is still in the implementing stage.

For this reason it is recommended that prior to the proper production phase and before making decisions on the major capital investments, an experimental or pilot phase be implemented for the purpose of selecting the most promising varieties in terms of yields, nutrient values, cropping pattern etc.

It seems that at least some two years of trials will be required before conclusive results will be available. It is suggested that the required research will be performed in the project area on small plots of irrigated land which could be leased from one of the existing estates: Mogambo, sugar estate etc. The research should be performed if possible by the research team of the Afgoi University assisted by a fodder production specialist and a specific financial contribution.

Results of the financial analysis

The estimated initial capital expentiture for the rehabilitation of the irrigation and drainage works, infrastructural development as well as the costs of acquisition of vehicles and equipment, required for the effective future use of 70 hectares of irrigated land amounts to 162,444,000 SS.

The breakdown of this expenditure is given in Annex III-11. In principle, the investment will be phased over a three year development period which would start once the variety testing estimated to cover the first two years would come to an end.

The annual production costs (at capacity) are as follows:

- Operating and maintenance	16,777,000 SS
- Annual charges of depreciation	10,881,000 SS
Total annual costs	27,658,000 SS

For a detailed break-down of these costs, please refer to annex III-10 and 12.

The expected annual revenues are based upon an assumed average yield of 20 tons of dry fodder from the 70 hectares area which were taken at the recently fixed price level of 8,888 SS/ton. At capacity, the annual proceeds from fodder sales would hence amount to 12,443,000 SS.

The operations of the farm would result in an annual loss of 15,215,000 SS.

The theoretical sales price of dry fodder at which the farm would break even is 19,750 SS/ton.*

* This is an indicative price, in fact the price at break-even point will be higher once the net present value of the cash-flow has been determined.

The benefit/cost ratio = 0.45

The production (harvest) of hay to be obtained from the 200 hectares rainfed area would equally result in a financial loss (please refer to annex III-16).

Project alternatives considered:

In spite of the high negative benefit/cost ratio, attempts were made to improve the financial parameters by considering the following alternatives:

- Reduction of housing component in the investment costs (please refer to annex III-14)

- Reduction of mechanised hay making (please refer to Annex I-4.5)

- Alternative use of rainfed area (see Annex III-17)

- Proposal for 100% perennial crop with 4 year rotation

For project planning, it was assumed that the 70 ha's irrigated area was used for 70% equivalent to some 50 ha's for perennial crops and for 30%, equivalent to 20 ha's for annual crops.

The reduction in annual operating and maintenance costs involving a 100% perennial crop would have a nearly insignificant impact on the financial parameters of the project.
The annual O & M costs of land preparation (see Annex III-1) are presently at 474,000 SS which represents only 2.8% of total O & M costs.
An increase of the perennial crops by 30% would imply a saving of only some 140,000 SS/year at maximum.

2. CONCLUSIONS AND RECOMMENDATIONS

The project is proposed for the production and sale of dry fodder for keeping export cattle on their minimum exportable weight during a short but critical period of livestock trading,

Besides being a bulky commodity which supports high costs of handling and transport per weight unit, it serves as roughage only in the daily feed ration and does not enable to fatten animals as in case of cereals which have a high caloric value and protein content. The unit value of dry fodder is accordingly low and although the expected farm's output was retained at a price of 8,888 SS/ton which is related to the costs involved of reconditioning export cattle at arrival in Suez, this price was retained only for planning purpose as indicated before.

Even at this relative high level, the price is not sufficient to cover the high costs of irrigation and the mechanised operations of hay production. There does not seem to exist alternatives in raising the fodder price even more since there are substitutes of an higher order such as maize and sorghum. These cereals are available at prices only slightly higher in the domestic market (10,000 to 12,000 SS/ton).

Alternative Resources of Dry Forage

During the past two years, the farm has been operating on basis of harvesting straw, hay and other residues of fallow land belonging to the surrounding estates (see annex I.3).

Since the Mogambo project is planned to produce some considerable quantities of irrigated rice, ample resources of rice straw may become available in the future which could be used for fodder purpose.

More insight information is required to assess the potential and feasibility of these resources.

Alternative Use of the Existing Project Structures

The only feasible (livestock) alternative would be to integrate a feedlot production unit into the proposed project which would enable to valorize the input of dry fodder in combination with concentrate feed through its conversion into quality meat and provided there exists a domestic market or foreign outlets for this commodity.

Due mainly to the low prices of cereals in the world market, meat production in most of the traditional producing countries has increased considerably over the last few years, leading to a severe competition in the deficit markets where meat is sold at near dumping prices.

On basis of past experience with the integrated fodder farm and feedlot as a component of the Trans Juba livestock project, the prospects of producing quality meat by the proposed project are not favorable since there does not exist a remunerative market for meat in Somalia.

Basically due to the fact that the feedlot operations in the past relied nearly altogether on the production and sale of canned meat by the Kishmayo Meat Factory as the only existing outlet, the feedlot operations came to a definite stop.

NEW JUBA FODDER FARM PROJECT

ANNEX I

Agronomic Aspects

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1. INTRODUCTION

The principal aim of the project is to establish a commercially viable fodder farm for the production of dry fodder to promote the live export of cattle from the nearby port of Kishmayo to the target markets of the Middle East.

The project would use the existing infrastructural facilities of buildings, houses, equipment, irrigation and drainage works which once belonged to the irrigated fodder farm and feedlot and which was an integrated component of the Trans-Juba Livestock Project.

Upto today, there is little practical experience in the country as far as the production of fodder is concerned and reliable technical or economic data are hard to come by. Earlier, but later discontinued trials at the actual project-site, dealt with maize and lucerne for silage and feedlot operations.

Examples of continuous hay production under irrigated conditions are extremely rare throughout the tropics. Available data on yields and general performance of various suitable fodder plants are of indicative value only. During the execution of the product study, the consultants imported some planting material of Echinochloa stagnina (Bourgou) from Niger, where in the context of a feedlot operation based on irrigated bourgou production only, hay of high feeding value was produced. Actual trials will show in the near future, whether this plant will also perform well under local environmental conditions.

Considering the special circumstances under which the project has to operate, it appears highly recommendable that rehabilitation works on the irrigation system and other major investments in the project, should be undertaken after careful testing of the agronomic and economic key elements of the intended venture. Such key elements, for example, are: plant suitability, cropping patterns; production costs, demand and sales prices. The time requirements for such testing procedures would cover a period of at least two years.

The assumptions used in the following chapters are based on data and experiences outside Somalia. The consultant took however grate care to make a realistic assessment thereby avoiding excessive security margins.

2. ENVIRONMENT AND USEFUL AREA

The area proposed for the implementation of the intended project occupies the north-eastern part of the former 1,200 ha Irrigated Fodder Farm and Feedlot (IFFF) of the Trans Juba Livestock Project, adjacent to the road Gelib-Kishmayo. The project would be situated between two major agricultural development schemes, the Juba Sugar Project in the north and the Mojambo Project in the south. The distance to Kishmayo is about 80km. (see scheme 1).

The potentially useful area of the project would consist of 70 ha of irrigable land, developed during 1978-80, but never fully used and at present in complete disrepair. In addition, there exists an area of about 200ha of bush-cleared land, which is possibly suitable for (rainfed) hay production. This area is located at a distance of ± 4km from the irrigable area and the farm compound.

A detailed description of the irrigation scheme and the environmental data (climate, soil) is given in Annex II.

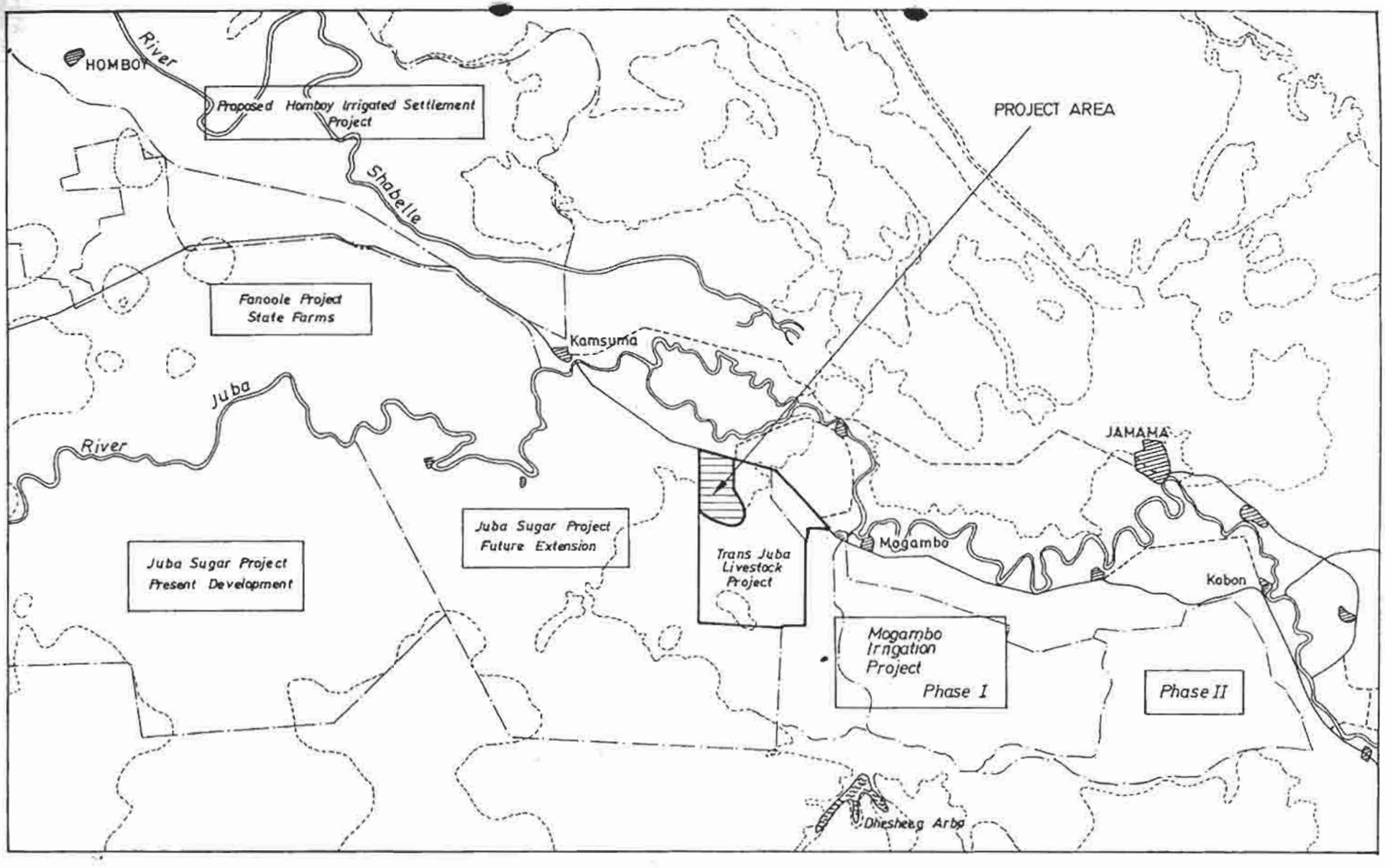
The project would also make use of existing buildings and suitable structures of the former IFFF project after repair and rehabilitation.

3. PRESENT ACTIVITIES ON THE PROJECT AREA

The farm proposed for the project is a remnant of the Trans Juba Livestock Project which operated more or less between 1976 and 1982. The project terminated in 1982 when the World Bank decided to discontinue its financial support.

At present the farm is operating under the Animal Production Department of the Ministry of Livestock Forestry and Range which supplies the necessary funds for the ongoing operations. During the last two years, the farm operations are exclusively related with the havesting of straw and hay on fallow land belonging to the nearby estates: Fanole, Mogambo and the Sugar Estates.

According to information received from the farm director, the quantities of straw and hay harvested during the years 1985 and 1986 were respectively : 1,794.6 tons and about 1500 tons.



A-I - Scheme 1

LOCATION OF THE PROPOSED JUBA FODDER FARM

For these operations, the farm uses tractors and equipment which is still in operating condition but most of which was acquired some 5 to 10 years ago. The staff directly involved in these farm operations consist of about 43 permanent workers.

The detailed monthly production, unit sales price and gross revenues are shown in the following table:

Contracted sales of fodder in 1985 and 1986

Date of sale	Production	Unit sales price	Value of sales
February 1985	477.6 tons	1,800 SS/ton	840,000 SS
March 1985	144.4 tons	1,800 SS/ton	250,000 SS
April 1985	133 tons	3,300 SS/ton	429,000 SS
May 1985	136 tons	2,300 SS/ton	450,000 SS
June 1985	136 tons	3,300 SS/ton	450,000 SS
July 1985	310 tons	3,300 SS/ton	1,024,000 SS
August 1985	400 tons	3,300 SS/ton	1,320,000 SS
Sept. 1985	60.6 tons	3,300 SS/ton	200,000 SS
Total for 1985	1,794.6 tons		4,993,000 SS
February 1986	170 tons	3,300 SS/ton	237,000 SS
March 1986	42.4 tons	3,300 SS/ton	140,000 SS
April 1986	20 tons	4,000 SS/ton	80,000 SS
May 1986	50 tons	4,000 SS/ton	200,000 SS
July 1986	45 tons	4,000 SS/ton	180,000 SS
Rest of year	1,172.6 tons	4,000 SS/ton	5,527,000 SS
Total for 1986	1,500 tons		5,527,000 SS

Note: The value of sales for February 1986 is probably based on an error (the present table is the one produced by the farm director)

Source of information: Trans-Juba Livestock Project
Livestock Devleopment Agency

It was not possible to obtain more detailed information on the harvesting operations: hectares harvested, costs involved etc.

It is possible that the major part of the production was in the form of rice straw and other residues from the rice harvest on the Mogambo estate, but also on this point no conclusive information was received.

4. AGRONOMIC ASPECTS OF HAY PRODUCTION IN THE FUTURE JUBA FODDER FARM PROJECT

4.1 Chosen Parameters

Since actual data on continuous hay production under irrigated conditions are not available on Somalia, the following assumptions are based on the interpretation of experience gained in other and similar tropical countries.

The main parameters used for planning and financial evaluation are as follows:

Yields/Production:

- Irrigated area:	- Rainfed area:
70 ha	200 ha
20t DM/ha/year	2t DM/ha/year
1,400t hay/year	400t hay/year

Feeding value:

0.6 FU/kg DM	0.35 FU/kg DM
60g DCP/kg DM	20 DCP/kg DM

In respect of the main purpose of the produced hay, which is to keep cattle on the minimum exportable weight, the feeding value, especially the protein content (DCP), is not as important for the financial viability of the operation as the actual yields expressed in produced dry-matter per hectare.

The optimum between the yields/ha and the feeding value (FU/kg DM) is determined by the number of cuts (hay-harvests) per year. The following assumptions have been made:

- irrigated area : 7 cuts/year (average)
- rainfed area : 1 cut/year

The forage will be cut mechanically and after sun-drying pressed into rectangular bales by pick-up balers. The bales/final product will be

- weight :10-15kg
- dimension : 0.31 x 0.48 x 0.6 m (average)

Weight and dimensions of the bales have been chosen taking into account the manual handling during loading, stacking, transport and feeding operations.

4.2 Choice of Fodder Plants/Species under Irrigation

The determination/choice of suitable plants for the intended hay production has to consider the following requirements:

- suitable for hay-making
- performance under irrigation on heavy soils
- high yield in DM
- good to medium feeding value
- suitable for mechanised harvesting
- perennial

Plants responding best to these requirements are mainly graminees. In the context of the proposed project area (soils, climate) the following species appear suitable and should be tested during a pilot phase:

. Panicum maximum	(green panic)	: seeded
. Panicum coloratum	(blue panic)	: seeded
. Chloris gayana	(rhodes grass)	: seeded
. Paspalum dilatatum	(dallis grass)	: seeded
. Brachiaria mutica	(para grass)	: planted
. Digitaria decumbens	(pengola grass)	: planted

In order to produce a more homogenous output over a period of 3-4 years, the establishment of a mixture of several species should be achieved.

Grasses under intensive cultivation, usually demand a high nutrient availability, especially nitrogen.

To maintain and/or to improve soil fertility it seems necessary to include legume-species into the future cropping pattern:

. Lucerne: subseed-pure stand, perennial, (2-3 years)
. Trifolium alexandrium - subseed, annual
. Glycine w. - subseed, perennial (2-3years)

The maintenance of soil structure and soil quality may also require the eventual introduction of annual crops like Avena sativa ssp. or hybrid sorghums which have been developed recently for irrigated fodder production.

As an alternative to the cropping pattern based mainly on grasses/legumes the introduction of

. Echniochloa stagmnia (Bourgou) - planted

should be tested. If performing well under the local environmental conditions, this species would allow a monoculture perennial cropping pattern of high yields (± 30t/DM/ha/year). As said before this plant has been introduced recently and is actually under observation in the Afgoi Research Station.

4.3 Rainfed Area

The actual grass-cover of the 200ha of rainfed area which in the past, has been subject to clearing operations, consist of:

. cenchrus ciliaris (buffed grass) - dominant
. cynodon dactylon (bermuda gr.) - sporadic
. eragrostis ssp - sporadic
. chrysopogon ssp - sporadic
. chloris gayana (rhodes grass) - sporadic
. paspalum dilatatum (dallis grass) - sporadic
. penisetum clandestinum (kikuyu gr.) - sporadic

Due to the bush-clearing the area is suitable for mechanical harvesting of the spontaneous grass once a year. The potential yield is estimated at about 2T DM/ha/year.

Since rainfall is the major limiting factor, all measures for improvement of the producitivy should be carefully tested on their economic effects. This could be done on a limited number of trial plots. Trials for improvements should be made in several steps:

a) fertilizer (N, P_2O5) in various doses
b) trials with 2 cuts/year
c) minimum tillage and seed of additional species (e.g. legumes - stylnosanthes gracilis)

4.4 Operation Schedule and Available Periods (Irrigated Area)

In accordance with climatic conditions and the managerial requirements of the project, the farm operations would be scheduled as follows:

70 ha irrigated area: production, harvest and transport

Operation \ Month	J	F	M	A	M	J	J	A	S	O	N	D	No. of days/yrs available
Ploughing		———						———					90
Land preparation[1)]			———						———				90 - 100
Planting/seeding			———						———				100
Fertilizing	———			———		———			———			———	100
Weed/pest control	———			———		———					———		100
Harvest [2)]	- -												100
Hay transport/sale	- -												300

1) Disc harrow, Cambridge roller, leveller
2) Mower, rake, baler; total harvest area/year = 490 ha; 70ha x 7 cuts

The production of irrigated fodder within the available periods calls for an intensive use of mechanised operations even for a relative small plot of 70 hectares.

4.5 Tractor and machinery Operating Assumptions

Pending conclusive results from further research and trials to be undertaken prior to implementation, for planning purposes only, the following two alternative cropping patterns have been considered in order to assess the potential requirements in machinery and equipment.

Alternative I high flexibility

30% animal crops, 2 crops/year
70% perennial crops, renewal every 4 years

Alternative II mono-crop

100% perennial crop of which 25% replanted each year

Alternative I represents the assumption which allow for a high degree of flexibility which would be required during the first years after implementation in order to optimize farm operations and production pattern.

Alternative II represents the advantage of a more uniform mode of operation. Against the advantage of a simplified operation and the output of a homogeneous product however, the higher agronomic risks attached to a mono-crop pattern have to be considered.

The assumed machine operations and required capacities for the alternatives I and II are given hereafter under Table 1 and 2. As indicated in Table 1, the total estimated annual machine/tractor hours for Alternative I are 4,785 (including 20% down-time for tractors). In comparison Alternative II (monocrop) would save about 340 tractor/machine hours. However, the annual replanting of 25% of the cropping area would require about 500 man/days of additional labour.

An obvious alternative to the mechanised hay making would be a manual operation which would provide a considerable number of jobs. Assuming that one labourer with a sickel can cut one one fifth of an hectare per day, 490 hectares in 100 days would require over 2400 man days for cutting alone.

Raking, sheafing and stacking (in the field would probably take the same number.

Because of a high demand for unskilled casual labour in the project area by the banana, sugar and rice farms, the prevailing wage rage of about 300 SS/day is nearly double the rate paid elsewhere in the country for rural labour.

On basis of this wage rate, the annual harvesting operations would reach easily 1,470,000 SS which is equivalent in amount to the estimated operating and maintenance costs of mechanised operations (see annex III-2). Besides, the general lack of labour supply in the aea is an absolute constraint to considering a labour intensive alternative.

Table 1: Machine Operations - Irrigated Area

Alternative 1: Total irrigated area 70 ha; 30% = 20ha annual crops
x 2 time/year = 40 ha
70% = 50ha perennial crops
4 years = 50 ha

Item	capacity ha/hr	ha/year 1	2	3	4	average/year ha	hrs (tractor)
Cultivation:							
. disc plough	0.33	90	40	40	90	65	197
. disc harrow	1.60	180	80	80	180	130	81
. cant. roller	2.00	180	80	80	180	130	65
. leveller	1.60	90	40	40	90	65	41
. seed drill	1.50	90	40	40	90	65	43
. fertilizer (1)	3.00	280	280	280	280	280	93
. sprayer (2)	3.00	130	130	130	130	130	43
sub-total tractor hours							563
Harvest: (3)							
. mower	0.60		490				816
. rake	2.50 (2x)		980				392
. baler	0.6		490				816
sub-total tractor hours							2024
On-farm transport of hay	200 bales/hr - 14t hay/day - 100 days/year						1400
Total tractor hours (net)							3987
Allowance 20% downtime							797
Total tractor hours							4785

(1) fertilizing 4 times/year
(2) spraying pesticides 2 times/year
(3) 20t DM/ha; 7 cuts/year; 3t DM/cut/ha;
200 bales/cut/ha

Table 2: Machine Operations - Irrigated Area

Alternative II: 70ha perennial crops (Echinochloa stagnina or grass mixture with 25% of annual replanting)

Item	capacity ha/hr	ha/year 1	2	3	4	average/year ha	hrs tractor
Cultivation:							
. disc plough	0.33	17.5	17.5	17.5	17.5	17.5	53
. disc harrow	1.60	17.5	17.5	17.5	17.5	17.5	11
. cant. roller	2.00	17.5	17.5	17.5	17.5	17.5	9
. leveller (1)	1.60	17.5	17.5	17.5	17.5	17.5	11
. seed drill	1.50	17.5	17.5	17.5	17.5	17.5	12
. fertilizer	3.00	280	280	280	280	280	93
. sprayer (2)	3.00	130	130	130	130	130	43
sub-total tractor hours							232
Harvest and on-farm transport requirements identical to Alternative I							

(1) Planting requirements: manual harvesting of sets and replanting about 30 man/days/ha 17.5ha x 30 = 525 mandays of labour

4.6 Required Machinery for Farm Opeations and Hay Transport

For the assumed operation of the farm, the following equipment is proposed:

Tractor 100 HP	1
Tractor 65 HP	3
Disc plough 3 discs	2
Disc harrow 3.6m	2
Cambridge roller 3.5m	1
Land leveller 3m, mounted	1
Seed drill multipurpose, 3m	1
Fertilizer spinner 10m, mounted	1
Chemical sprayer 10m, mounted	1
Rotiry drum-mower, mounted	2
Side delivery rake, mounted	2
Pick-up baler	2
Farm-trailers 47t	2
Truck and trailer (20t)	1
4WD-vehicles	2

The type and numbers of machinery has been determined, taking into account the available time but also to some extent the aspect of operational security, in case of breakdowns. However, no large over-capacities have been provided for. As to the existing machinery on the present farm, all of it will have to be replaced except a heavy subsoiler and a bull-dozer, which can be repaired.

4.7 Major Input Assumptions

. Seed and Planting Materials

At full capacity the cost for seed is estimated at 30 US$/ha of renewed area per year. The necessary seed would be imported from neighbouring countries (e.g. Kenia) or international sources.

For the planting material it is assumed that after a first introduction this would be collected on the farm for the (yearly) renewals.

. Fertilizers

In order to maintain an average yield of 80t of green matter equivalent to 20t of hay/year fertilizer rates are estimated to be as follows:

- 200 kg pure N) graminees (average 50ha/yr)
- 100 kg pure P_2O_5)
- 100 kg pure P_2O5_5 for legumes (average 20 ha/yr).

As to potassium it is assumed that the soils have adequate reserve for the time being.

. Chemicals

Provision of pesticides (herbicides, fungicides, insecticides) to be used according to appearance of respective pests is estimated at an annual average cost of US$ 5,000/year.

4.8 Personnel

The high degree of mechanisation of the farm operations has technical reasons (continuous operation), but is also due to the limited availability and high cost of casual labour (banana, sugar, rice-estates). Labour intensive alternatives seem therefore less feasible. The degree of farm mechanisation is reflected in the list of proposed staffing of the farm:

Senior staff:

Farm manager	1
Administrator/bookkeeper	1
Master mechanic	1
Store keeper	1
Farm foreman	1

Semi skilled:

Mechanic	1
Pump attendant	2
Maintenance-man	1
Tractor driver	3
Truck driver	2

Unskilled:

Messenger	1
Guards	2
Farm labour	15

The proposed staff would be employed on a permanent basis. Additional casual labour would be required only to the possible planting/replanting of some fodder crops.

5. RECOMMENDATIONS

The present state of knowledge of the agronomic conditions for intensive fodder production and the prevailing economic situation call for a careful approach to the intended project.

Prior to the start of any implementation-phase, it is therefore recommended to conduct specific trials on the agronomic key elements of the proposed project especially on the comparative performance of the two proposed cropping patterns, i.e. grass-crops versus bourgou.

These trials should be carried out preferably on irrigable plots on nearby ongoing schemes, such as Mogambo rice estate or Juba sugar estate.

The design, establishment and supervision of the trials, would be carried out in close cooperation with relevant national research institutions. It seems however recommendable, that special funds are made available for the required physical inputs and the recruitment of a fodder production specialist, who would be responsible for the implementation and evaluation of the trial-phase.

Even in case the results of the economic feasibility of hay production would prove to be negative, the intended approach would nevertheless produce experience and data which would provide a valuable contribution to the still limited knowledge of intensive fodder production in Somalia.

A time-requirement of at least 5 years will be needed for a trial-phase plus implementation phase, until the new project would come on stream. To bridge this gap, an alternative and intermediate solution for the regular supply of roughage to the livestock-exporters should be envisaged:

- Complementary to the continuation of the actual activities under the Trans Juba Livestock Project a systematic use of available rice straw from the Mogambo-estate would provide a potential resource of dry fodder.

According to information, the Mogambo estate is planned to produce, once the full project would come on stream, about 2000 hectares of rice on irrigated land. Allowing a per hectare yield of some 4 tons of straw, the potential production output of rice straw would be about 8,000 tons/year. Although it seems that most of this output is earmarked to be used for underplowing, there will be a considerable supply of dry fodder which could be used for animal feeding.

The digestibility of this material is estimated at about 50% of the value of digestible nutrients which for irrigated hay is about 60 to 70%. Nevertheless, this potential resource of dry fodder to be produced by the Mogambo estate can be considered as a financially more advantageous alternative to the present operations of hay-making.

NEW JUBA FODDER FARM PROJECT

ANNEX II

The Irrigation Scheme

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Appendix

1 INTRODUCTION

The original layout for the irrigated fodder farm of the Trans Juba Livestock Project comprised a gross area of 1200 ha. The design was prepared in 1976 by Hendrikson Associierte Consultants (HAC), a German firm. Later, in 1978, the irrigated area was reduced to about 200 ha net, consisting of 2 units, both with a surface of about 100 ha. For this area a design was made by an expert of the FAO, Mr. Florin. It was on the basis of the latter design that the project was partly implemented, but until now irrigation has hardly been practised. However, existing infrastructure can, as will appear from this chapter, be made functional at reasonable costs and within a short time.

The available information on the revised FAO layout is limited to drawings. Written documentation, e.g. on design criteria could not be traced.

The following drawings were handed over to the Consultant by the EEC office in Mogadishu:

FAO project No. : FAO/TCP/6/SOM/03/1

- IFF/0: General Layout, 1:10,000; 27.6.1978
- IFF/3: Irrigation/Drainage Layout Sheet 1, 1:2,000, 7.8.1978
- IFF/7: Typical Cross Section of Irrigation Canals, 1:50/1:25; 19.7.1978
- IFF/8: Typical Cross Section of Drainage Canals, 1:25; 14.8.1978
- IFF/9: Division Boxes, 1:20; 21.8.1978 (constructed boxes are different)

Furthermore, the report "Trans Juba Livestock Project" (1976) was borrowed from HAC for general information.

2 DESCRIPTION OF THE EXISTING SITUATION

2.1 General Situation and Layout

The unit in which the irrigation system has been partly implemented is situated on the right bank of the Juba River and bordered by the asphalt surfaced road Gelib-Kismayo (see figures 1 and 2).

The area consists of alluvial deposits and is flat, with elevations varying between 11 and 12 m a.s.l.

Three types of soil are distinguished:
- gray clay soils
- black clay soils
- brown clay soils

(see figure 2).

Principal physical data on the soils are summarized in Table 1. The main clay type is montmorillonite, causing swelling and cracking, in particular of the SE-soil.

The permeability of the soils is suitable for the application of border strip irrigation, the method of which was proposed originally and which has been retained.

The area with irrigation infrastructure is indicated in figure 1. In this area, fields 9 to 25 have apparently been graded.

The gross area is 75 ha. The net area of these fields is 69.11 ha (see Table 2).

Table 1 : Principal Soil Physical Data

	Clay (0.002 mm)	Silt (0.002-0.06)	Sand (0.06-2.0)	Class	Infiltration rate (mm/hr) initial	final	Atterberg limits PL	LL	FC/WP
SE	32	51	17	silty clay loam	24	1			
GE	18	58	24	silt loam	102	12	20-30	55-80	?
BE	8	68	24	silt loam	38	17			

FC = Field Capacity
WP = Wilting Point
PL = Plastic Limit
LL = Liquid Limit

Table 2 : Net Surface of Irrigation Fields

Field No.	Surface ha
9	6.95
10	6.32
11	5.79
12	5.43
13	4.98
14	4.40
15	3.94
16	1.94
17	2.50
18	4.44
19	4.17
20	4.07
21	3.77
22	3.39
23	1.00
24	1.62
25	4.40
Total	69.11

According to survey checks done in fields 14 and 17 in December 1987, slopes in the direction of the borders are apparently not the same, but were adapted to the local topography (slope in field 14: around 5 °/₀₀, in field 17: around 2 °/₀₀).

The same checks revealed that important corrections will be required.

The length of the border strips is 140 m in most fields.

As long as the Baardheere Dam Project has not been constructed, it must be expected that the water level in the river is low in the dry season (January - March) and that sometimes, the salt content is too high for irrigation (according to information from the Juba Sugar Estate: EC values up to 3000 micromho/cm).

2.2 The Hydraulic and Infrastructural Components

For photographs supporting the following description, the reader is referred to the Appendix.

Pumping Station

There is a pumphouse off the Juba River with the shaft connected to the river by a steel pipe. Apparently, pumps have never been installed. During low water, the entrance of the steel pipe is well above the river's water level. This is probably the reason that the pumphouse has never been used.

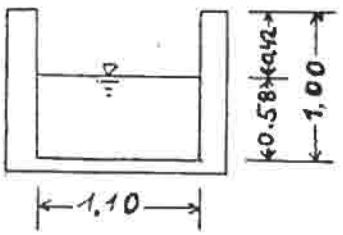
Water has been delivered to the project by a centrifugal pump with a capacity between 740 and 1240 m^3/h. This pump is situated next to the pumphouse. The suction pipe is connected directly to the river. Supports for the pipe have been washed away by floods. A second pump, of the same type, is available as a spare. Both pumps are mounted on a steel frame, together with diesel driven engines. Both units belong to a consignment of 400, which were granted by the GDR at the end of the seventies and still seem to be in a good condition.

The pump discharges water into two stilling basins with a concrete floor and plastered cement brick walls. The stilling basin was also planned as a sandtrap.

Head Reach and Main Canal

The head reach (from A to B, see fig. 1) consists of 2 parts.

(a) The upper part (from A to F, 470 m long) has a rectangular cross section with plastered cement brick walls and a concrete bottom. It was designed for a capacity of 650 l/s (Plan IFF/7).

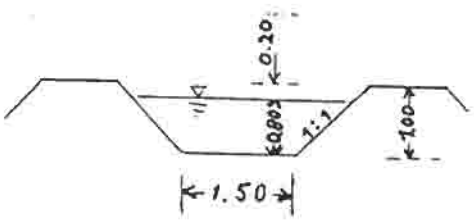


Canal width	b = 1.10	m
Canal depth	d = 1.00	m
Water depth	t = 0.58	m
Freeboard	f = 0.42	m
Slope	S = 0.5	°/₀₀
Flow area	A = 0.638	m^2
Velocity	v = 1.02	m/s
Roughness factor	k = 80	

The whole section is above the ground. The asphalt road and the northern field road are crossed by inverted siphons.

The walls show many cracks and at some places at the outer side they are supported by poles.

(b) The lower part (from F to B, 305 m long) is an unlined earth canal which had initially a trapezoidal cross section. It was also designed for a capacity of 650 l/s (Plan IFF/7):



Bottom width	b = 1.50	m
Slope of banks	1:1	
Canal depth	d = 1.00	m
Water depth	t = 0.80	m
Freeboard	f = 0.20	m
Slope	S = 0.5	°/₀₀
Flow area	A = 1.840	m^2
Velocity	v = 0.35	m/s
Roughness factor	k = 25	

The correct profile has gone but otherwise the canal is still in reasonable condition.

The main canal (from B to C, 1,045 m long) is, just as the second part of the head reach, unlined and designed for the same capacity and has the same dimensions.

There are 7 division boxes on the main canal. They are also built with cement brick walls and have movable steel gates (one of the main canal and one in each outlet). Most of them are in a state of disrepair.

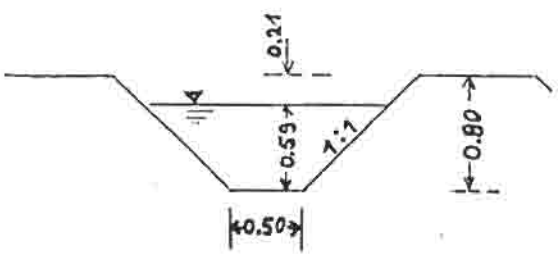
There is no emergency spillway on the main canal.

Field Ditches and Field Drains

The field ditches take off at the division boxes and run along the longer side of the fields. The field drains run along the opposite side of the field ditch and convey the surplus and drainage water to the main drainage system. Field ditches and field drains are both unlined. The total length of the canals is as follows:

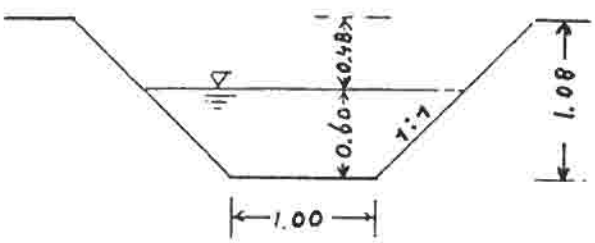
field ditches	5,292 m
field drains	4,018 m

Field ditches are designed for 230 l/s (Plan IFF/7).



Bottom width	b = 0.50	m
Slope of banks	1:1	
Canal depth	d = 0.80	m
Water depth	t = 0.59	m
Freeboard	f = 0.21	m
Slope	S = 1.0	°/₀₀
Flow area	A = 0.643	m^2
Velocity	v = 0.36	m/s
Roughness factor	k = 25	

Design flow (230 l/s) and the dimensions of the field drains have been computed from Plan IFF/8 as follows:



Bottom width	b = 1.00 m
Slope of banks	1:1
Drain depth	d = 1.08 m
Water depth	t = 0.60 m
Slope	S = 1.0 °/₀₀
Flow area	A = 0.96 m^2
Velocity	v = 0.24 m/s
Roughness factor	k = 15

Most of the field ditches and field drains are in moderate condition. The ditch and drain for field 25, the drain between 17 and 23 and 18 and 24 respectively still have to be constructed.

Main Drainage System

The main drainage system consists of the main drain and 5 secondary drains (see figure 1).

The main drain starts at the northern road (D), crosses the main canal (H) and the southern road (E) by culverts and ends in a natural depression (J). The reach within the scheme (D-E) is 1,035 m long, the reach outside (E-J), being a natural channel, is 550 m long.

Secondary drains are called those, which drain more than one plot.

2 secondary drains run along the northern road:

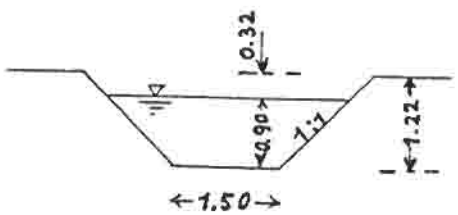
K-D 282 m long
L-D 142 m long.

They collect the water from the northern field drains; where they join (D), the main drain starts.

2 other secondary drains join the main drain south of the main canal. The total length of these 4 secondary drains is 824 m.

The 5th secondary drain runs along the asphalt road (F-G) but has actually no function for the scheme. It is possible that this drain was designed to evacuate surplus water from a spillway on the main canal.

The design flow and the dimensions of the main drain are not available but they may be similar to those of the 5th secondary drain (Plan IFF/8):



Design flow	Q = 660	l/s
Bottom width	b = 1.50	m
Slope of banks	1:1	
Canal depth	d = 1.22	m
Water depth	t = 0.90	m
Freeboard	f = 0.32	m
Slope	S = 1.0	°/₀₀
Flow area	A = 2.16	m^2
Velocity	v = 0.31	m/s
Roughness factor	k = 15	

The drains are in a reasonable condition. However, stone pitching at the culvert sites is severely damaged.

Project Roads

The irrigated area is surrounded by roads. Another road crosses the area along the main canal. The pumping station is connected to the main road by a road along the head reach.
The length of the various roads is as follows:

		Length (m)
East	Asphalt road	not applicable
North	Project road No. 1	1000
Middle	Project road No. 2	1070
South	Project road No. 3	1150
West	Project road No. 4	1125
Road to pumping station		350

The original shape of the project roads is deformed and the thickness of the gravel layer is sometimes not sufficient.

3 PROPOSAL FOR REMEDIAL MEASURES

3.1 Design Data

Irrigation Requirements

The irrigation requirements are based on the assumption that the fodder crops are irrigated the whole year around, and on climatic data, which were collected from the Juba Sugar Estate.

The computations are summarized in Table 3.

An irrigation efficiency of 60% has been assumed. This value has been adopted because losses in canals will be little, considering the short distances from the river to the fields. Also field losses may be kept low, as the border length is relatively short.

The gross annual requirement is about 28,000 m^3/ha in a year with average rainfall. This has been adopted as the criterion to compute operation costs (chapter X.5).

To compute the pump capacity, the maximum monthly requirement is decisive: 4330 m^3/ha in February. This corresponds to 3 l/s/ha when it is adopted that in the months with high irrigation demand (January, February, March and September), irrigation is practised 14 hours per day. The pump(s) and the conveyance system should thus have a capacity of at least:
69.11 ha x 3 l/s/ha = 210 l/s (rounded off).

Table 3 : Irrigation Requirements

Month	- Quantities in mm/month - J	F	M	A	M	J	J	A	S	O	N	D
Ref. Crop (1) Evapotranspiration	212	236	223	198	138	153	144	174	207	188	158	193
Crop Factor (2)	1.1	1.1	1.1	0.9	0.9	1.0	1.0	1.1	1.1	1.0	0.9	1.0
Actual Evapotranspiration	233	260	245	171	124	153	144	191	228	188	142	193
Average Rainfall	2	7	28	136	158	94	59	29	9	65	122	46
Effective Rainfall(3)	0	0	20	95	111	66	41	20	0	46	85	32
Net Irrigation Requirement	233	260	225	76	13	69	103	171	228	142	57	161
Gross Irrigation (4) Requirement	388	433	375	127	22	115	98	285	380	237	95	268

Gross Annual Irrigation Requirement in m^3/ha : 28,230

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(1) acc. to Penman
(2) from FAO publication "Crop Water Requirements"; mean values
(3) rainfall less than 25 mm: efficacy = 0; otherwise: efficacy = 0.7 x actual rainfall
(4) 60% efficiency

There are no data available on the content of soluble salts in the soils. But as the average salt content of the irrigation water is low, a provision for leaching has not been made. It is nevertheless recommended to investigate a few soil samples on salt content before execution of the project.

It is noted that the value of 3 l/s/ha corresponds quite well to the design criterion, which has apparently been adopted formerly (canal capacity 650 l/s for 200 ha).

This means that when the present capacity of the canal is retained, a later extension of the scheme up to about 220 ha would be possible without modifications to the existing system.

Drainage Criterion

For the drainage system, a design capacity of 4 l/s/ha has been adopted. This value is based on values for projects in areas with similar rainfall pattern and crops.

The capacity of the main drain at the lower end of the area should thus be at least 300 l/s (4 x gross area of 75 ha).

Subsurface drainage is not necessary for the time being, taking into account the favourable topographical situation, the solitary position of the scheme - little irrigation practised in its vicinity - and the present groundwater level of at least 5 m.

3.2 Pumping Station

Because it is still uncertain when the Baardheere Dam Project will be implemented, the following difficulties with pumping must be considered for the time being:

- The water level in the river can change up to several meters
- The water is loaded with sediments
- The banks are eroded by the river

This should be considered in the planning of the pumping station, for which the following solutions are possible:

1. The pumps are installed in a permanent structure.

1.1 Tower (in concrete) with pumps installed below the water level, driven either by a submerged motor or by a motor situated above high water level via a vertical axis (one of these solutions was originally selected).

1.2 Inclined pipe on the river bank with a pump with an inclined axis (centrifugal pump or Archimedes screw)

2. Semi-permanent construction

The pumping station is installed on a slipway. The pump and the engine are lifted or lowered according to the water level.

3. Pontoon stations

3.1 Pumps with electrical motor, supplied with electricity from the bank.

3.2 Pumps with diesel engine completely installed on the pontoon.

The advantages and the inconveniences of the various solutions can be summarized as follows:

1.1 Concrete stations are very often installed in irrigation schemes. The access to the station is easy and consequently also operation, maintenance and repair of the pumps. Sedimentation problems in the suction pit are quite often a major problem of this type.

1.2 A pumping station with inclined pipe needs a stable river bank or bank protection for stabilization. Cost are less than for a pumping station with tower but it is difficult to do any maintenance or repair during high water.

2. In order to avoid these maintenance difficulties, a submersible pump can be installed on a slipway. However, when the water level changes, the level of the pump must be adjusted from time to time and operation should be stopped during this time.

Both solutions 1 and 2 have the disadvantage that when the river level is very low, pumping becomes cumbersome (a weir in the river was planned originally, but that would entail very high costs).

3. Floating stations are cheaper than fixed stations but they need flexible pipes to compensate the fluctuations of the water level.

An advantage is that pumping is relatively independent of the water level and that the pontoon can be moved to the channel when the water level is very low.

3.1 If the pumps get the power supply from the river bank, the pontoon can be small, because it must carry only the pumps and the load of 3 people in case of inspection. It is also possible to use submerged pumps having no starting problems. If electricity is available, this is an additional advantage for this solution. However, if this is not the case, a generator must be installed on the river bank and this brings additional cost.

3.2 Therefore in such a case, the engine is often installed together with the pump on the pontoon and the pumps are driven directly. The inconvenience of this solution is the larger pontoon which is needed to carry the pumps, the engines, the tank for fuel and the inspection personnel.Vibrations of the engines have to be taken into account for the lay-out of the pontoon.

Each of the solutions is possible. Solutions 2 and 3.1 have been worked out, as they are both adaptable to the water level and bank erosion (which will stop after implementation of Baardheere) does not affect the installation.

The required maximum pumping capacity is 210 l/s. This quantity would be pumped for about 4 months per year, during 10 to 14 hours per day. During the other months, the required quantity is less than 180 l/s (assuming 10 hours irrigation per day). It is proposed to install 2 pumps, both with a capacity of 100 - 110 l/s. They will be both in operation for 10 to 14 hours per day during the peak demand periods; during the other months, one or two pumps will be in operation for not more than 10 hours per day. Sufficient time will remain for repairs and overhaul.

When a maximum dynamic head of 12 m is adopted, the required power is, for each pump:

$$P_N = \frac{Q \times H \times 10}{0.65} = 19{,}400 \text{ W} = 19.4 \text{ kW}$$

P_N = power (kW)
Q = discharge (l/s)
H = dynamic head (m)
0.65 = pump unit efficiency

Pump units with 20 kW power (rounded off) are thus recommended.

The pontoon (solution 3.1; see figure 3) must be designed to carry the following load:

2 pumps	900 kg
3 persons, incl.tools	300 kg
weight of the pontoon	400 kg
	1,600 kg

Cost calculations are given in chapter 5.

The solution with the pontoon (3.1) is about 14,000 DM more expensive than a solution with slipways (2). Because the perennial crops are not so sensitive to drought and extremely low river levels occur once in three to four years, it is proposed to opt for solution 2.

Considering the difficulties with regard to spare part supply, the GDR pumps can better be used as spares on other schemes, where similar units are in use.

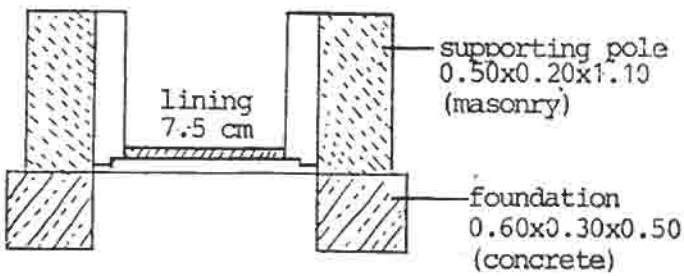
3.3 Head Reach and Main Canal

The two stilling basins and the upper part of the head reach, i.e. the part constructed in cement brick work show many cracks and water losses must be feared.

The following three possibilities for improvement could be considered:

1. New construction of the whole canal in concrete with expansion joints every 6 to 8 m.

2. Replacement of the most damaged reaches, repair of smaller defects, supporting poles every 6 m at the outer sides of the walls and new lining of the bottom with 7.5 cm concrete and expansion joints every 6 m:



3. Coating of the canal bottom and the walls with bitumen. However, major damages should be repaired in the same way as mentioned before.

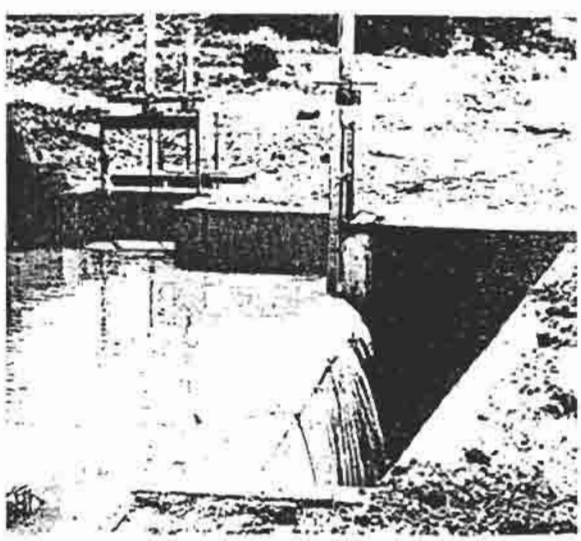
The cost - but also the quality and the durability - of the three solutions decrease in the above-mentioned order. It is proposed to retain as a compromise the second variant.

The earth part of the head-reach and the main canal must be reshaped and termite hills be removed. The quantity of earth work to be done is estimated to be 0.5 m^3/m. The cross section should be the same as before.

The division boxes (see figure 4) should be rebuilt. Attention should be paid to improvement of their foundation. In the cost calculations it is adopted that similar boxes as the existing ones are built, but their dimensions and hydraulic properties should be verified in the next phase.
A device to measure the discharge to the field ditches may be incorporated in a later stage (see also Chapter 4).

After finishing the survey works on the canals (see Chapter 6), it should be checked if gates in the main canal are necessary at every off take and where spillways can be installed.

It is assumed that two spillways would be sufficient, for instance one at point B and one at Point H (the latter one being incorporated in the flume crossing the maindrain, see figure 1). The spillways may be of the following type:

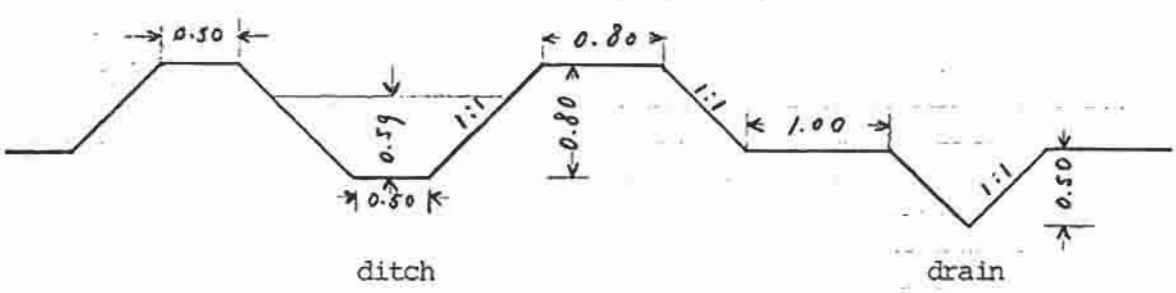


3.4 Field ditches and field drains

All field ditches and drains have to be reshaped, whilst the ditch along field 25 has to be constructed. On the fieldside the ditch embankment should be made such that portable syphons can be used (see chapter 4).

The minimum dimensions of the drains is defined by the dimensions of the ditches by which they are constructed and maintained. A suitable size, largely sufficient for conveyance of waste water (provided that the slopes are according to the design) is presented in the typical cross section of ditch and drain.

Eight actual cross sections were measured on various ditches and drains. Based here upon, the quantity of earth- work is estimated at 0.7 m^3 per meter ditch/drain.



At the connection from field drain to secondary drain, stone-pitching should be placed.

3.5 Fields

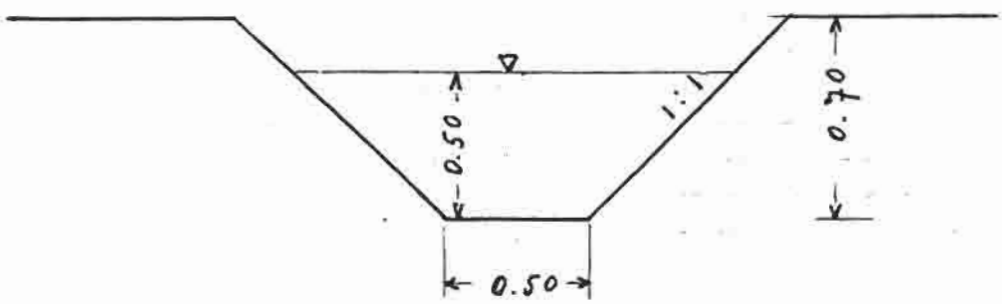
Adequate grading of the fields is a must, particularly because the infiltration rate of the soils is rather small and, thus, standing water would reduce yields and hamper field operations.

Based on the checks of the present topography it is estimated that about 100 m^3/ha still have to be moved.

Access facilities to the fields are at present not sufficient. It was observed that at various places access has been made by cutting the main canal. It is proposed to provide facilities by construction of culverts in the secondary drain or road drains, at the end, on top of the fieldditches. 16 culverts (see figure 5) would be required.

3.6 Secondary drains, main drain

For the secondary drain, a uniform minimum dimension has been adopted as given in the following sketch:

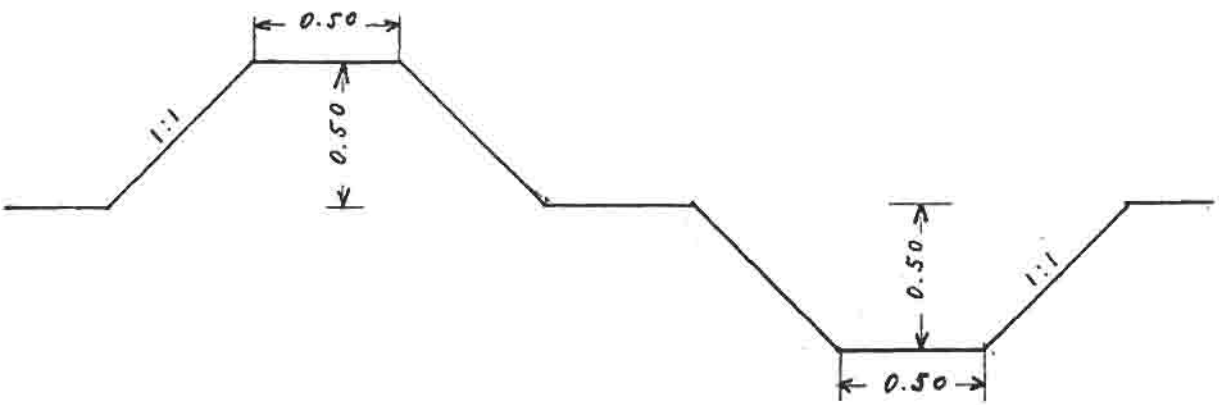


This is, for a minimum slope of 0.25 °/₀₀ sufficient to convey 100 l/s.
The dimensions of the main drains still have to be checked, but it is not expected that much more than cleaning is required.

However, at connection points of secondary drains and main drains and at crossings, protective stone pitching works have to be executed.

The natural channel, from point E (figure 1) downwards has, at first glance, a sufficient capacity. But also this must be verified.

The area is favourably situated as far as the danger of inundation is concerned.
It has been adopted that a combined bund and drain along the highest part of the scheme (the northern road) would be sufficient for protection:



The drain can be connected to the drain along the asphalt road. In order to verify the need, it is proposed to inspect the natural drainage in the area north of the project during the survey work still to be done (see chapter 6).

3.7 Roads

Roads have to be reshaped. It is, however, not necessary that all roads are gravelled. It is proposed to gravel only the northern road, part of the western road, the road to the office and village area and the road to the pumping station (2000 m). In the calculation of investments, only gravelling has been considered, whilst reshaping is regarded as maintenance work.

Along the roads, small drains should be constructed.

4 OPERATION AND MAINTENANCE

Pump Station

The annual water requirement of the actual scheme is

69.11 ha x 28,000 m^3/ha = 1,935,000 m^3

When pumps with a capacity of 0.1 m^3/s are operated, the total annual operation time will be

$$\frac{1{,}935{,}000\ m^3}{0.1\ m^3/s \times 3{,}600\ s} = 5{,}380 \text{ hours/year}$$

The annual fuel demand is

5,380 hours x 20 kW x 240 g/kWh = 25.82 mT = 30,400 l

For the operation of the pumping station 2 pump attendants will be required.

Maintenance will be a task of the workshop.

Irrigation

With 2 pumps in operation, 210 l/s have to be distributed.

Taking into account the irrigation practices along the Juba and Shebelle rivers, it is suggested to limit the "main d'eau" initially to between 60 and 70 l/s and compose irrigation crews of 3 persons. Three crews would

thus be necessary and three fields are irrigated at the same time. As it concerns here one project and the three crews are supervised by one foreman, it is proposed to not install any measuring equipment in the offtakes, but only include one measuring device - e.g. a venturi - in the head reach. Equal distribution to the fields is, in this case, not so critical.

There exist no data defining the relation between infiltration rate, border width, border length, slope and specific flow. As the slopes in the border strip direction are apparently not uniform, it is proposed to use portable PVC-syphons for discharge from the ditch to the border. This allows flexibility in application rate. The establishment of criteria for the specific flow (flow per meter or flow per border) is regarded as an important matter of investigation during the first years of operation.

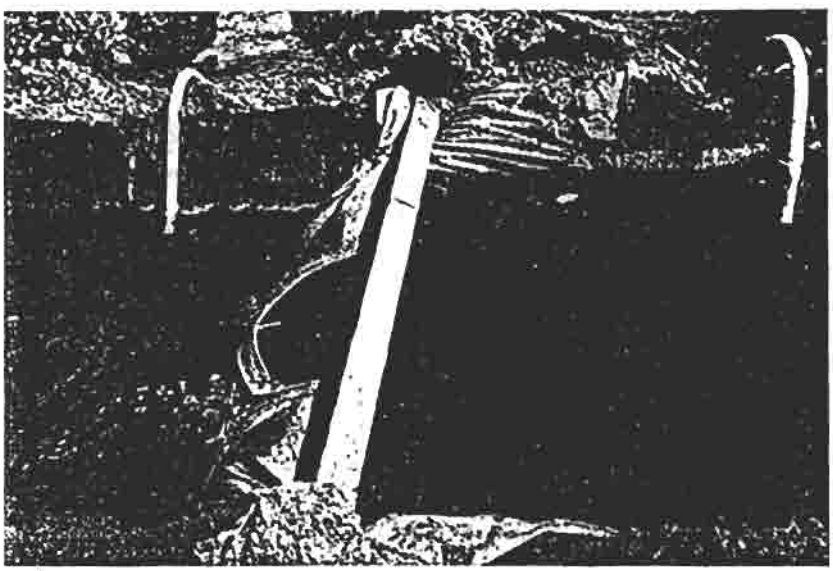
The size of the syphons should be limited to 10 or 12.5 cm diameter, giving a flow of 5 to 10 l/s. Hence, the number of syphons to be manipulated by one crew is between 7 and 15. The width of the border, between 5 and 10 m, should be related to the agricultural implements which will be used (border width equal to multiple of implement).

An idea of the time required for irrigation is given in the following example:

- flow in field ditch: 60 l/s
- specific flow: 4 l/s/m
- width of strip: 7 m, length: 140 m (surface: 980 m^2)
- flow per strip: 28 l/s
- No. of strips irrigated at the same time: 2 (approx.)
- irrigation depth: 100 mm

- required quantity per irrigation and strip: 98 m^3
- minimum time required for simultaneous irrigation of 2 strips: approx. 1 hour
- time required when a field efficiency of about 65% is assumed: approx. 1.5 hours

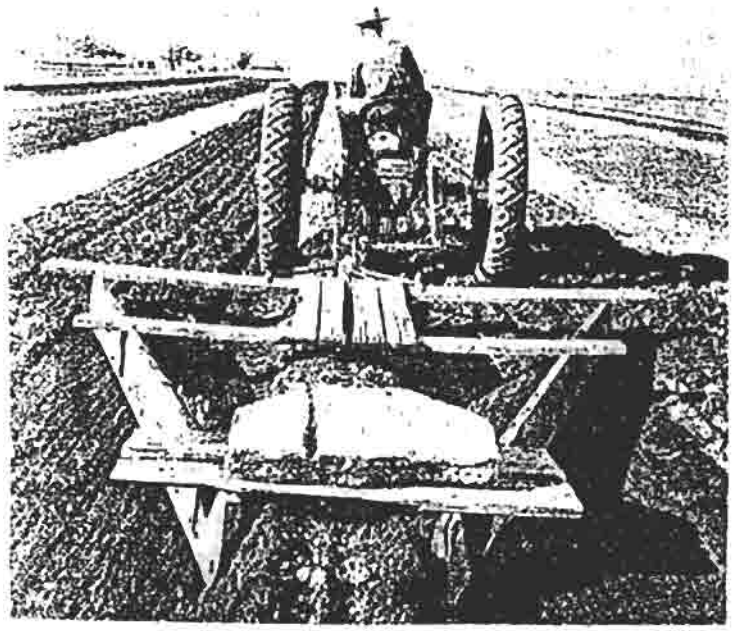
For control of the water level in the ditches, it is proposed to use portable canvas sheets:



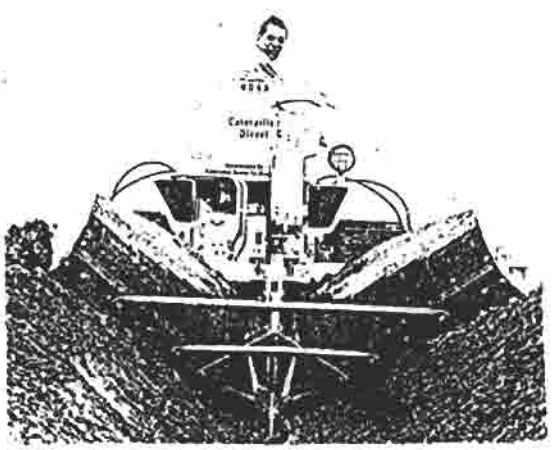
The height of the bunds between strips is usually about 25 cm.

Maintenance

The irrigation crews can do maintenance work like cleaning and weeding and for maintenance of the head reach. For mechanized maintenance operation it is proposed to purchase the following implements:

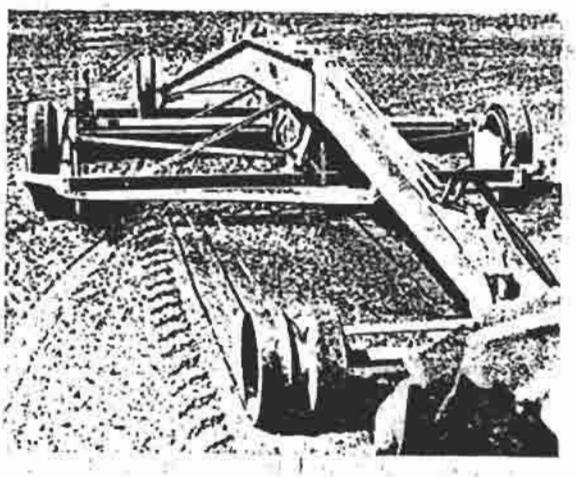


border-mould board



V-ditcher

In order to correct minor slope irregularities in the border strip, it is proposed to purchase a tractor-pulled land plane:



5 COST ESTIMATES

Cost estimates are based on information collected from suppliers and from recent projects and studies in Somalia (price level 1986; import taxes and duties excluded; 1 US$ = 160 SS).

		Total in 1000 SS	LC in 1000 SS	FC in 1000 US$
Investment Costs				
1.a Pumping station Solution 2				
2	pump units, 20 kW each, diesel driven (incl. discharge pipe, incl. transport	3735		
2	slipways	890		
	pumphouse (concrete floor, corrugated iron roof)	180		
	materials	90		
	installation	360		
		5255	356	30.6
1.b Pumping station Solution 3.1				
2	pump units, 20 kW each, electr. driven (incl. transport)	1780		
	pontoon	710		
40	m flexible pipes DN 225	355		
2	generators with diesel engines	3110		
	materials	100		
	installation	500		
		6555	450	38.0

	Total in 1000 SS	LC in 1000 SS	FC in 1000 US$
2. Head reach in cement brick work			
15 m^3 concrete in foundation at 31115 SS/m^3	468		
38 m^3 concrete for lining at 48895 SS/m^3	1858		
55 m^3 masonry at 40005 SS/m^3	2200		
	4526	1775	17.2
3. Reshaping and building of earthern canals, bunds			
6,000 m^3 earth work at 900 SS/m^3	5400	1800	22.5
4. Land levelling			
7,000 m^3 earth work at 1060 SS/m^3	7420	530	43.1
5. Roads			
1,000 m^3 laterite at 1750SS/m^3	1750	557	7.5
6. Structures			
7 division structures at 270,000 SS	1890		
16 culverts at 180,000 SS	2880		
2 spillways at 270,000 SS	540		
stone pitching 400 m^2 (0.2 m thickness) at 5000 SS/m^2	2000		
	7310	2610	29.4
Total 1.a - 6	31661	7628	150.3
Contingencies 20%	6332	1526	30.1
	37993	9154	180.4
Engineering 12%	4559	912	23.8
Grand Total	42552	10066	204.2

	Total in 1000 SS	LC in 1000 SS	FC in 1000 US$
Total of 1.b - 6	32961	7770	157.7
Contingencies 20%	6592	1554	31.5
	39553	9324	189.2
Engineering 12%	4746	949	23.7
Grand Total	44299	10273	212.9

Annual Operation and Maintenance Costs

Pumping (Solution 2)

fuel 30,400 l at 30 SS/l	912	34	5.5
maintenance 8% of investment costs	420	70	2.2
Sub-total	1332	104	7.7

Irrigation and drainage system

materials (canvas sheets, syphons, etc.)	90	-	0.6
implements (depreciation and maintenance)	270	-	1.7
grader 5 days at 50,000 SS/day	250	42	1.3
materials for maintenance of structures, head reach	500	100	2.5
Sub-total	1110	142	6.1
Total	2442	246	13.8

N.B.

1. The financial planning should take into account that in the first project year, the following costs arise:
   - spare parts for pump units (15% of investments): SS 560,000
   - implements for maintenance (ditcher, mouldboard, plane): SS 2.4 million

   (The implements are written off in 10 years).

2. The life time of the pump units is 10 years. For structures and canals, a 50 years life time is assumed.

3. It is assumed that large fuel tanks are installed at the workshop.
   In the cost calculation of the pumping station, only drums have been considered.

4. Tractor costs and costs for a foreman, labourers, pump attendants, watchmen and overheads have already been considered in the overall cost estimate (summary).

6 EXECUTION

In preparation of the execution it is proposed to carry out the following programme:

1. Survey work:
   - topographic levelling of all fields
   - longitudinal sections of all canals and drains

2. Design work:
   - final design of canals, structures and fields

3. Tender documents:
   The execution method should be duly considered here. The following repartition of works is proposed:
   - installation of pumps;
   - repair works on head reach and main canal and on main drains; repair and rebuilding of structures. These works involve much labour. On the other hand, the amount of work is difficult to define, especially repair works on canals. It is therefore proposed to execute these works by force account.
   - works on field canals and drains and field grading should be done by machines (scraper, grader, land plane). Also here, execution by force account is proposed.

In view of the amount of works it is suggested to invite a restricted number of local contractors or joint ventures of local and foreign contractors, working already in Somalia.

The items 1. and 2. could then be done by "small" contractors, mainly providing and organizing labour. Supervision could be done by a civil engineer attached to the project, who would be at the same time responsible for the preparation of working drawings and the supervision of mechanical operations and for the procurement of materials. In this way, costs could probably be reduced.

The implementation programme is summarized here below:

Months	1	2	3	4	5	6	7
Additional survey and design work							
Preparation of tender documents							
Tendering							
Execution							

The months 4, 5, 6 and 7 should be chosen such that interruption of works is prevented (e.g. December - March).

F I G U R E S

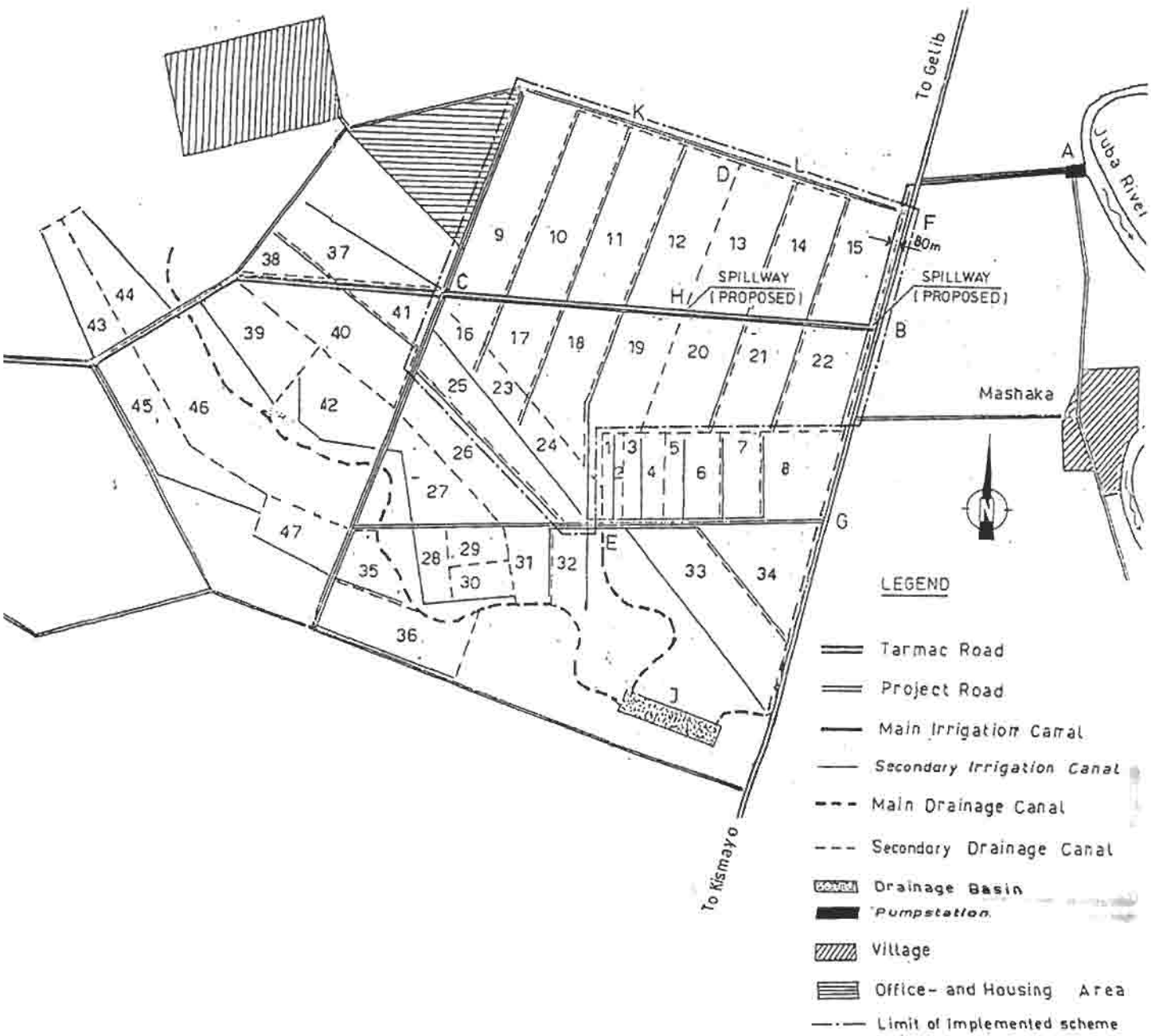


FIGURE 1: LAYOUT OF PARTLY IMPLEMENTED SCHEME

SCALE 1:10 000

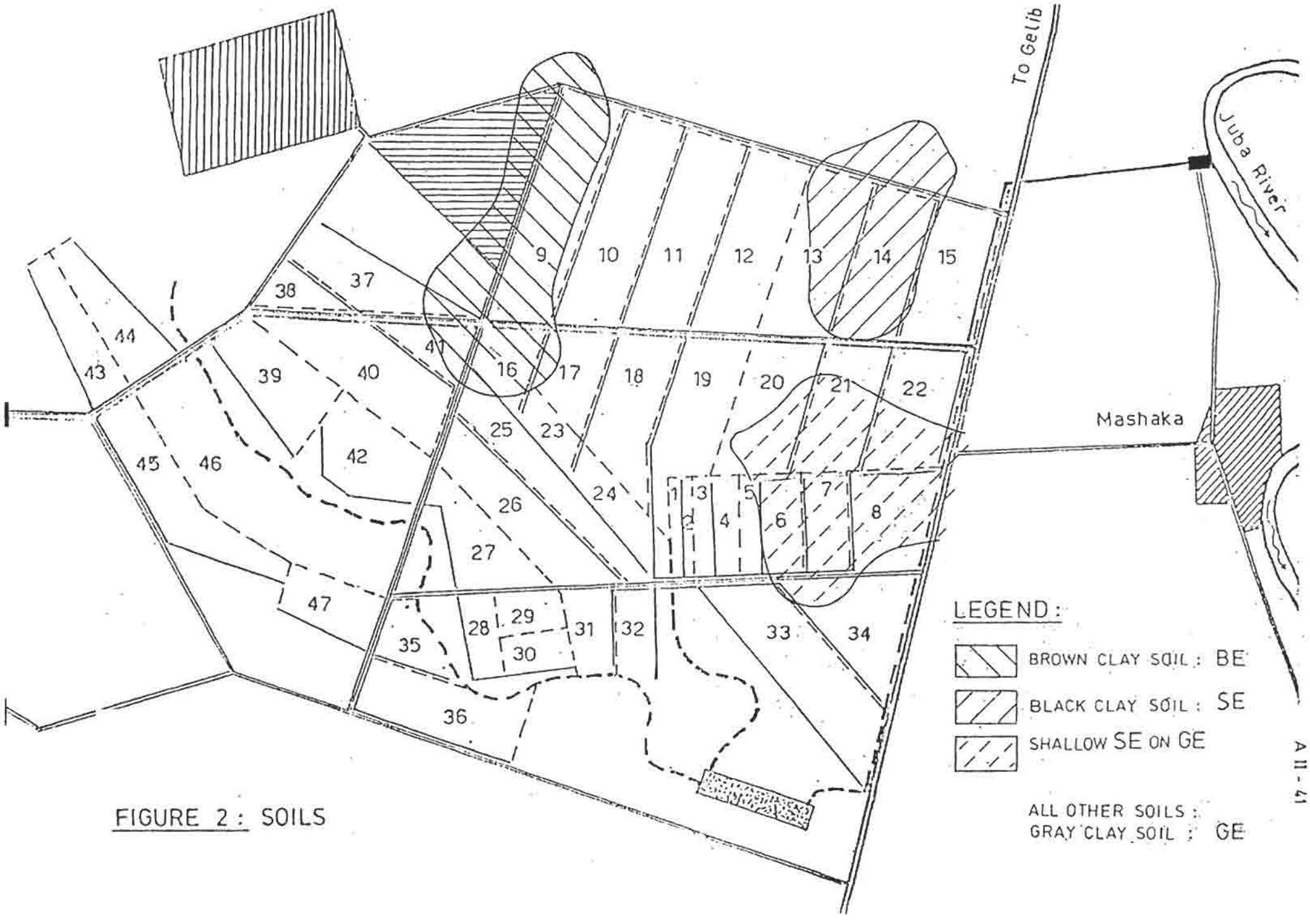


FIGURE 2 : SOILS

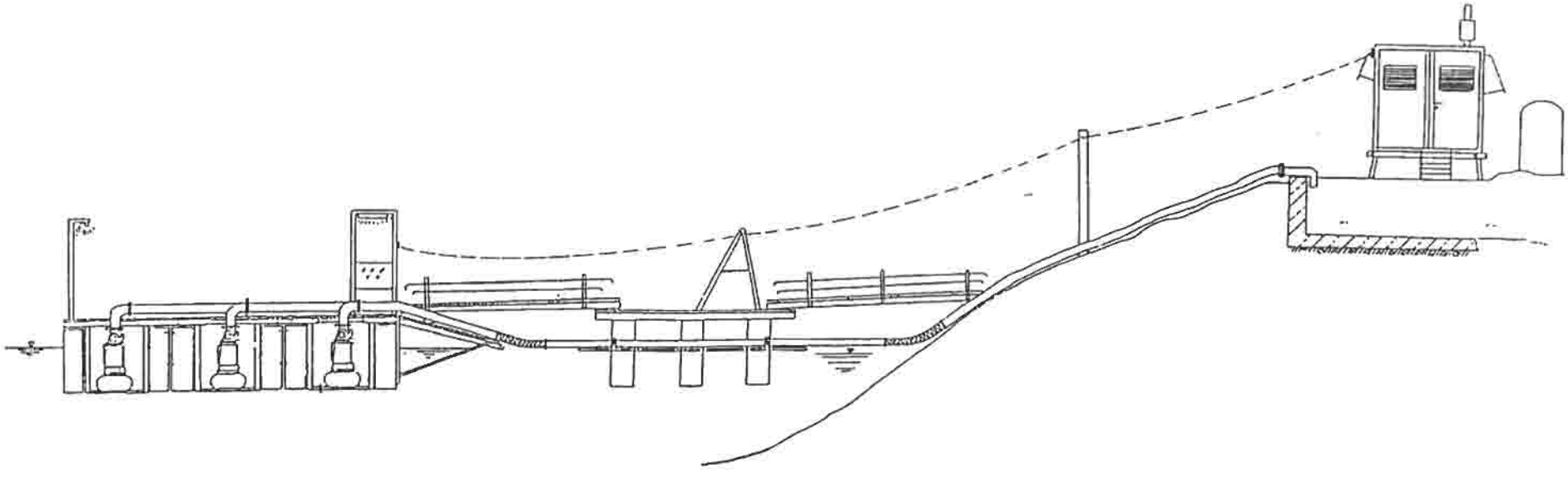
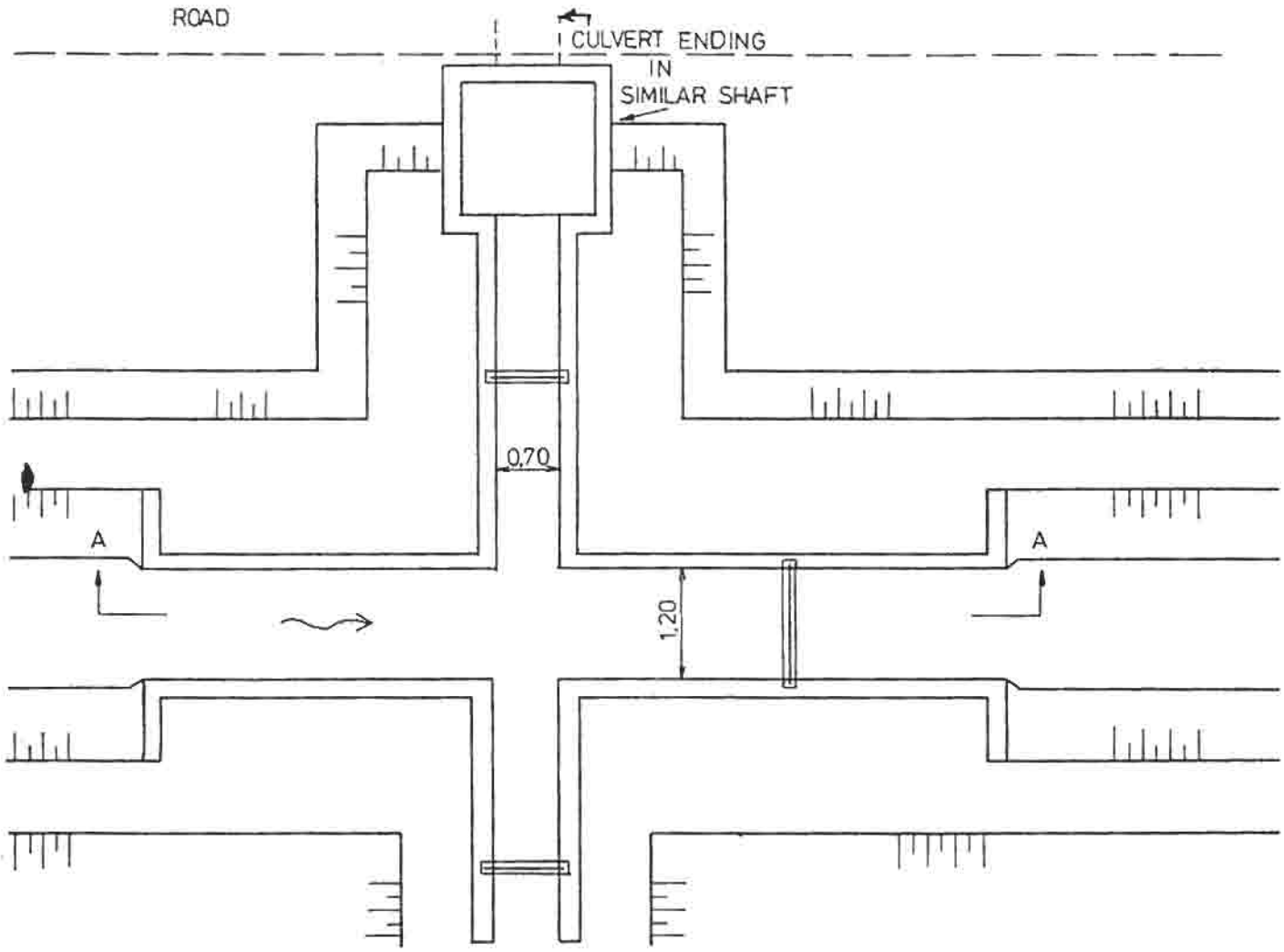


Figure 3 : Pumps installed on pontoon



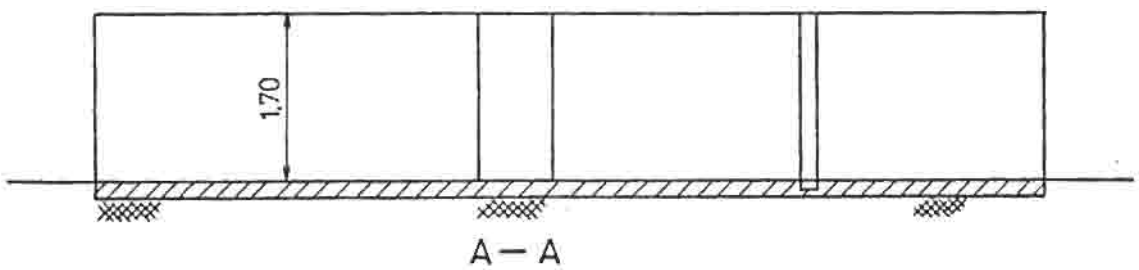
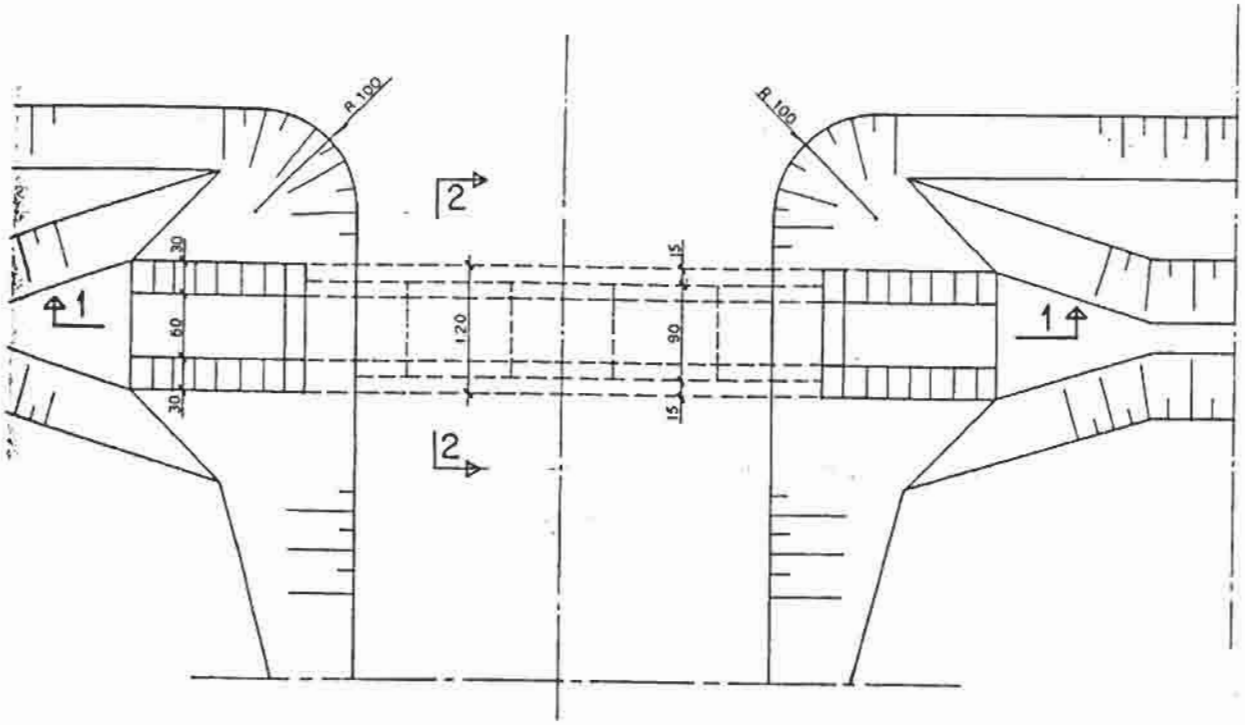


FIGURE 4 : SKETCH OF AS-CONSTRUCTED DIVISION BOX

SCALE 1:75



SECTION 1.1

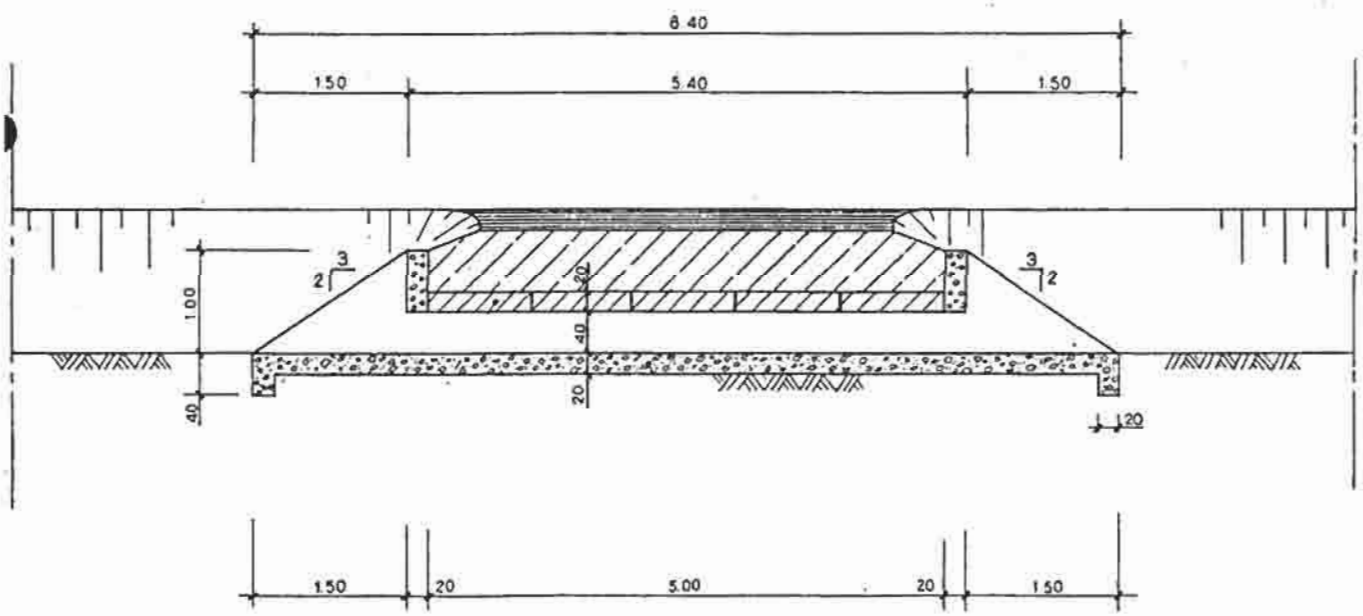


Figure 5 : Example of typical culvert under access path

NEW JUBA FODDER FARM PROJECT

ANNEX III

Financial Appraisal

Financial appraisal of the proposed Juba fodder farm project

Introduction

One of the principal objectives of the project is the proposed participation of the private sector in the future management of the farm.

This question was discussed with various high ranking officials of the Ministry of Livestock, Forestry and Range.

There exists a general consensus that privatisation of the farm is an essential requisite for an efficient management and an important condition for the future development of fodder production and of the livestock sector in general.

However, it should be emphasized that the eventual take-over by the private sector will require at least five years which is the estimated time required for the development phase of the project.

Besides there should be a proven evidence of the financial feasibility of the enterprise not only in the short but also in the long run.

Accordingly, the main task of the analysis is to determine whether this farm can become a financially sound undertaking. For this reason, the study has scrutinised more particilarly the purely financial aspects of the proposed project on basis of the available information and taking into consideration the following basic assumptions:

- all annual costs and revenues are assumed at capacity level (to be reached probably by the 5th year of project operations taking into consideration a two-year experimental phase)

- all costs and revenues are given in constant prices (those prevailing at the present: January/February 1987)

- the exchange rate of the US$ was taken at 160 SS (this rate corresponds roughly with the prevailing rate on the paralel currenty market)

- expatriate expert services have not been considered as a project cost. (The costs of the required expertise have been considered as a grant to the project as a technical assistance support)

- the sales price of dry fodder was taken at the recently established level of 8,888 SS/ton delivered Kishmayo

The new price fixed by the Government since January 1987 represents a 122% increase of the one effective since April 1986 which was 4,000 SS/ton.

No information was available on the arguments used for the raise, apparently the new quotation covers all types of dry fodder irrespective of nutrient values, type of bales etc. It also appears that no previous negotiations were held with the principal customers: Tawfiq livestock export corporation but that the price was imposed unilaterally by the Government. Officials of Tawfiq have expressed their concern in view of the negative impacts of the new fodder price on the export of live cattle as well as their reluctance in procuring fodder at this level.

The raise of the official fodder price may contribute to an increase in the competition and the supply of fodder at the Kishmayo hay market which in turn will depend of the seasonal availability of this product.

In view of above arguments, the assumed sales price of dry fodder is a rather weak assumption, since it was not established on basis of relevant marketing studies, nevertheless, the indicated price was retained as an indicative price to be used only for planning purpose.

The analysis has included the alternative of rainfed hay production vis a vis the use of the rainfed area for direct extensive grazing.

Additionally the sensitivity of the project's financial results was tested by assuming a reduced investment in housing (III-14). Calculations were made also to test the sensitivity on basis of a cropping pattern of 100% perennial fodder crops during a four year rotation.

Although the results of these tests have somehow improved the financial parameters, they have not contributed to an assessment of the financial feasibility of the project proposal. For this reason it was not deemed necessary to determine a phasing schedule for the required capital expenditure; for the same reason no cash flow analysis and calculation of returns was made.

A detailed analysis of the financial aspects is shown on the following paragraphs:

III - 1) Annual costs of land preparation (irrigated fodder)

2) Annual harvesting costs (irrigated fodder)

3) Annual costs of hay transport

4) Annual costs of on-farm transport

5) Annual costs of inputs

6) Annual costs of management and labour

7) Capital costs of building and housing

8) Annual costs of electricity and water

9) Costs of irrigation and land development

10) Summary of the O & M costs

11) Summary of the capital investment costs

12) Annual charges of depreciation

13) Revenues, costs and profits and loss

14) Sensitivity analysis with respect to housing

15) Rainfed harvesting costs

16) Finanial analysis of rainfed hay production

17) Alternative use of rainfed area

18) Importance of livestock sector to Somalia's economy

III - 1

Operational and Maintenance Costs for Mechanical Operations

Annual Costs of Land Preparation at Capacity

Vehicles	Ploughs	Harrows	Rollers Levellers	Seed drill Fertilizer Chemical Spr.	Tractor 100 HP	Total
Hectares/year operations	65	130	130 R 65 L.	65 S.D. 280 F. 130 C.S.		
Capacity ha's/hour	0.33	1.6	2.0 R. 1.6 L.	1.5 S.D. 3.0 F. 3.0 C.S		
Annual working hours	197	81	65 R. 41 L.	43 S.D. 93 F. 43 C.S.	676*	
Number required	2	2	1	1 of each	1	
Unit price (US$)	1000	1150	2000 R. 2000 L.	4000 S.D. 2000 F. 2000 C.S.	17600	
Investment cost (1000 SS)	320	368	320 R. 320 L.	1280 total	2,816	5,424
Maintenance & spares	16	18	32	64	141	
Fuel & lubricants**					203	
Total O & M*** costs (1000 SS)	16	18	32	64	344	474

* tractor hours include 20% down time
** 0.1 liter gasoil/hour x HP (gasoil: 30 SS/liter + 5% for lubricants)
*** costs of insurance and taxes are not considered

III - 2

Operational and Maintenance Costs of Mechanical Operations

B) Annual Harvesting Costs at Capacity

Vehicles	Cutters	Rakers	Balers	Trailers 4.7 tons	Tractor 65 HP	Total
Hectares/year* operations	490	980	490	200 bales per hour		
Capacity ha's/hour	0.6	2.5	0.6	14 tons of hay/day		
Annual working hours	816	392	816	1400	4109***	
Number required	2	2	2	2	3	
Unit price (US$)**	2700	2700	13000	2500	13000	
Investment cost (1000 SS)	864	864	4160	800	6240	12,928
Maintenance & spares (5% of investment)	43	43	208	40	312	
Fuel & lubricants					841	
Total O & M costs (1000 SS)	43	43	208	40	1153	1487

* basic data on yearly operations are taken from Annex I-2
** price CIF Mogadishu
*** tractor hours include 20% dowtime
*** 7 cuts per year: harvesting is a continuous operation throughout the year during maximum 100 days/year (see annex I-2)

III - 3

Operational and Maintenance Costs for Hay Transport*

Vehicles	Truck and trailer	
Capacity	total 20 tons	
Hay stowing capacity	maximum 10 tons	50% of transport capacity (in bales of 10 kgs)
Annual working hours required	538	(140 hauls of 160 kms + 20%, at average speed of 50kms/hour)
Unit price (US$)	75000	(includes truck and trailer)
Investment (1000 SS)	12000	
Maintenance & spares	600	(5% of investment cost/year)
Fuel & lubricants (1000 SS)	339	(20 liters of gasoil/hour + 5% for lubricants)
Total O & M costs (1000 SS)	939	

* Although it could be considered to subcontract the hay transport operation to third parties, for the purpose of valuing transport costs to the minimum cost level and to provide the farm with the required type of transport it would strengthen the autonomy and flexibility of the project in this field. Accordingly, this operation is supposed to be fully integrated as a specialised project component.

III - 4

Operational and Maintenance Costs for on-farm Transport

Vehicles	4-wheel drive vehicle - type : Landrover	
Annual working hours	20,000 kms each	(400 hours at 50 kms/hour)
Number required	2	
Unit price (US$)	22,000	
Investment cost (1000 SS)	7,040	
Maintenance & spares*	352	
Fuel & lubricants (1000 SS)	189	(15 liters/100 kms at 30SS/liter + 5% lubricants) based on 20,000 kms/year/unit
Total O & M costs (1000 SS)	541	

* costs of insurance and taxes are not included

III - 5

Operational and Maintenance Costs : Inputs

1) Seeds

The several options between grass species will be tested during the first two years (experimental phase) prior to the proper production start as of year 3. The estimated costs of seed, which will have to be imported, (Kenya) is US$ 30.-/hectare.
The average annual cost of seed for an average surface of 65 ha's will be accordingly 312,000 SS. (see annex I-3).

2) Fertilizers

In order to maintain an average yield of 80 tons of green matter, equivalent to 20 tons of dry matter/year the fertilizer requirements are as follows:

200 kgs pure N for grass/hectare (50 ha's/year)
100 kgs pure P_2O5 for grass/hectare (50 ha's/year)
100 kgs pure $P2_O5$ for legumes (20 ha's/year)

The annual need of fertilizers will be:

21.7 tons of Urea (46% N)
38.7 tons of Triple phosphate (18%)

The annual costs of fertilizers will be:

21.7 x 200 US$/ton (CIF Mogadishu)	=	US$ 4,340.-
38.7 x 300 US$/ton (CIF Mogadishu)	=	US$ 11,619.-
Total		US$ 15,950.-

This represents a cost of 2,550,000 SS/year

3) Chemicals

The required use of pesticides is estimated at an annual cost of 5,000,- US$ for the total surface which is equivalent to 800,000 SS.

III - 5 (continued)

Summary of input costs:

The total annual costs of inputs are shown in the following table:

Seed	312,000 SS
Fertilizers	2,550,000 SS
Chemicals	800,000 SS
Grand total	3,662,000 SS

III - 6

Costs of Management and Labour

Manpower Costs at Capacity include only Local Permanent Staff and Labour*

Senior staff	No.	Monthly pay	Annual pay
Farm manager	1	22,500 SS	270,000 SS
Administrator/Bookkeeper	1	18,000 SS	216,000 SS
Mechanic master	1	18,000 SS	216,000 SS
Store keeper	1	13,500 SS	162,000 SS
Farm foreman	1	13,500 SS	162,000 SS
Semi-skilled			
Mechanic	1	11,250 SS	135,000 SS
Pump attendants	2	11,250 SS	270,000 SS
General maintenance man	1	11,250 SS	135,000 SS
Tractor drivers	3	11,250 SS	405,000 SS
Truck drivers	2	11,250 SS	270,000 SS
Un-skilled			
Messenger	1	8,000 SS	96,000 SS
Guards	2	8,000 SS	192,000 SS
Farm labour***	15	8,000 SS	1,440,000 SS
Total	32	10,336 SS (average)	3,969,000 SS
Labour related costs** (estimated at 10% of base-costs)			397,000 SS
Total annual cost of management and labour			4,366,000 SS

* no expatriate expertise services are included in the project costs

** includes cost of administration, overheads, insurance against sickness and accidents etc.

*** since the labour harvesting operations will take place throughout the year, no casual labour has been considered, consequently all staff is supposed to be permanently employed

III - 7

Capital Cost Requirements

Construction and Renovating Costs of Buildings

According to an inventory made of the various buildings which occupy the farm compound at present, there are:

- one office building
- one small office building
- one hay shed of considerable capacity
- one repair and machinery yard
- water tower
- some small non itemised buildings
- 21 housing units

The following houses for permanent staff and labour are available:

- two A-category houses
- one B-category house
- eight C-catetory houses
- ten D-category houses (twin-type)

According to the list of required project personnel, the needs for housing, at capacity level, are as follows:

- 2 A-category houses (for 2 long term expatriates)
- 2 B-category houses (for 2 or more short term expatriates)
- 5 B-category houses (for 5 senior staff members)
- 8 C-category houses (for 8 semi-skilled)
- 17 D-category houses (for the 17 required un-skilled)

Hence there is a need for constructing 6 B-category and 7 D-category houses to meet the requirements at capacity. All the premises need various types of repairs before they can be used again (roofing, tiles, plumbing, carpentry, sanitary equipment, painting etc.)

The estimated costs of new construction and repairs are detailed as follows:

	Unit cost	Total
- construction of 6 new B-category houses	8,000,000	48,000,000
- construction of 7 new D-category houses	2,500,000	17,500,000
- renovating 2 A-category houses	800,000	1,600,000
- renovating 1 B-category house	500,000	500,000
- renovating 8 C-category houses	150,000	1,200,000
- renovating 10 D-catetory houses	50,000	500,000
- repairs for office building	800,000	800,000
- repairs for hay shed	500,000	500,000
- repairs for machinery yard	800,000	800,000
- repair for water tower and equipment	200,000	200,000
- repair for miscellaneous buildings	1,000,000	1,000,000
Total estimated investment in buildings required		72,600,000

Note: For the construction of the B and D category houses, it was considered that these units will be in the form of pre-fabs to be imported, the foundations will be made locally. The indicated prices take into account this type of buildings. No physical contingencies have been considered.

Besides housing and buildings, the present farm owns various types of tractors, agricultural implements, tanks for molasses and fuel and miscellaneous equipment which generally are more than 10 years old. Except a heavy cultivator (subsoiler and a bull doser which can be repaired as well as the tanks, the remaining equipment will have to be replaced in the foreseeable future.

III - 8

Costs of Electricity and Drinking Water

Electricity will be required for the pumping of drinking water, lighting and other energy needs, The existing facility will have to be replaced.

A new 35 KW diesel generator plus a stand-by will be required, assumed to operate 16 hours/day.

Accordingly the annual operating time will be 5840 hours. The estimated fuel costs are based on a daily consumption of 50 liters of diesel oil and hence the annual fuel costs will be 548,000 SS (365 x 50 x 30 SS/liter).

The capital costs of the generators is estimated at US$ 16,000 which includes installation. (2,560,000 SS)

Maintenance and repair at 5% per annum will amount to 128,000 SS.

Drinking Water Costs

The water pump presently operating in the compound is at least ten years old and will have to be replaced by a new electro submersible pump at a depth of 25 meters.

The costs of replacement and installation for a pump able to pump 1 liter/second is estimated at US$ 1500.- which is equivalent to 240,000 SS.

Taking the maintenance costs at 5%, they will amount to 12,000 SS/annum.

Summary

The O & M and the capital costs of electricity and water can be summarised as follows:

Maintenance and spare parts	140,000 SS
Fuel costs	548,000 SS
Total O & M costs	688,000 SS
The total investment costs	2,800,000 SS

III - 9

Costs of Irrigation and Land Development

1) Annual operating and maintenance costs:

Pumping of irrigation water:*

Fuel (30,400 liters/year x 30 SS/liter	912,000 SS
Maintenance pumping station: (8% of investment cost: 5,255,000 SS)	420,000 SS

Irrigation and drainage systems:

Materials for maintenance (see annex II-5)	860,000 SS
Rental cost of grader (5 days/year x 50,000 SS/day)	250,000 SS
Total operating and maintenance costs	2,442,000 SS

2) Investment costs: (includes only rehabilitation of irrigation and drainage works and roads for the 70 ha's irrigable area)

Pumping station**	5,255,000 SS
Head reach	4,526,000 SS
Reshaping and building of earthen canals	5,400,000 SS
Land levelling	7,420,000 SS
Roads	1,750,000 SS
Structures*	7,310,000 SS
Sub-total	31,661,000 SS
20% physical contingencies	6,332,000 SS
Sub-total	37,993,000 SS
12% engineering	4,559,000 SS
Grand total	42,552,000 SS

The average development cost per hectare unit is US$ 3,800.-

* considers only alternative Ia (solution 2) see annex II-5

** see annex II-5 for details

III - 10

Summary of the Operating and Maintenance Costs

The annual O & M costs, at capacity, are summarised as follows for each of the project operations:

- annual land preparation costs	474,000 SS
- annual harvesting costs	1,487,000 SS
- hay transport costs	939,000 SS
- inputs	3,662,000 SS
- electricity and water	688,000 SS
- buildings and houses	2,178,000 SS
- irrigation and land development	2,442,999 SS
- on-farm transport	541,000 SS
- management and labour	4,366,000 SS
Grand total	16,777,000 SS

The above cost estimate is equivalent to a cost per ton of hay of 11,980 SS.

These are only the direct production costs which do not include the annual depreciation charges.

III - 11

Summary of the estimated investment costs:

The following table provides a resumee of the estimated initial capital expenditure.

No phasing of expenditures has been considered at this stage.

- land preparation equipment	5,424,000 SS
- harvesting equipment	12,928,999 SS
- hay transport equipment	12,000,000 SS
- on-farm transport equipment	7,040,000 SS
- electricity and water	2,800,000 SS
- buildings and housing	72,600,000 SS
- irrigation and land development	42,552,000 SS
- working capital*	7,100,000 SS
Grand total	162,444,000 SS

Note: The capital expenditure indicated above does not include miscellaneous equipment, such as weigh bridges, containers etc., which are still available in the farm compound. This equipment is still in reasonable condition of operation.

The above estimated capital expenditure represents an amount of 1,015,000 US$

* includes: 6 months need of fuel, spare parts, materials and sundries (including requirements of pumping station and machiners repair yard)
4 month of salaries and wages

III - 12

Annual Charges of Depreciation:

The rates of depreciation used are based on the expected life of the assets with due consideration of the annual operating hours.

The following rates are used:

Land preparation equipment	12.5%	of	5,424 =	678,000 SS
Harvesting equipment	12.5%	of	12,928 =	1,616,000 SS
Hay transport equipment	20 %	of	12,000 =	2,400,000 SS
On-farm transport equipment	20 %	of	7,040 =	1,408,000 SS
Electricity and water	5 %	of	2,800 =	140,000 SS
Buildings and housing	5 %	of	72,600 =	3,630,000 SS

Irrigation and land development:

Pumping station	5 %	of	5,255 =	263,000 SS
Other items	2 %	of	37,297 =	746,000 SS
Grand total				10,881,000 SS

III - 13

Revenues, Costs and Profit and Loss:

1) Revenues

The anticipated annual revenues of the farm at capacity (assumed to be the 5th year of project operations which include a 2-year experimental phase) are based on the following parameters:

- Average yield per hectare unit: 20 tons of dry matter
- Irrigated area under production: 70 hectares
- Selling price of dry fodder: 8,888 SS/ton of dry matter delivered Kishmayo.

The price of dry fodder produced by the farm has been fixed by the Ministry of Livestock, Forestry and Range since 1985. The price was initially fixed at 1,800 SS/ton and was increased steadily to the levelof 4,000 SS in April 1986. In January 1987 the price was raised to 8,888 SS/ton.

It is assumed for planning purposes that the total expected annual production of 1400 tons can be sold at this newly established price. Accordingly, the anticipated annual revenues will amount to 12,443,000 SS at full capacity.

2) Production Costs

The total annual production costs as derived from the estimates are:

- Total operating and maintenance costs	16,777,000 SS
- Total annual depreciation charges	10,881,000 SS
Total annual production costs	27,658,000 SS

Accordingly, the production costs per ton of dry fodder is 19,750 SS.

3) Profit and Loss

The annual operations of the farm at capacity, would result in a loss of 15,215,000 SS (12,443,000 - 27,658,000). It can also be observed that at a sales price (delivered Kishmayo) of 19,750 SS/ton the farm would break even.

III - 14

Alternative for the Housing Component

The building and housing cost component represents an important investment of the project (46% of total initial investment expenditure).

Most of the investment concerns the construction of 13 houses: 6 B-houses and 7 D-houses for senior staff and semi-skilled permanent personnel with a total outlay of 65.5 million SS.

The annual depreciation allowance is 5% or 3,275,000 SS on this amount.

Instead of constructing these 13 houses (of which the least costs are in the form of imported prefab's plus local construction of the foundations), it could be considered to house the senior staff and semi-skilled in most of the existing C and D houses.

The remaining personnel (13 persons) would be housed in the nearby village. Since these are non-skilled labourers, they probably could accomodate in a type of environment familiar to them. In this case the project would have to use a small bus to commute these people to and from their work every day. This commuting service would consist of a small bus to be owned by the project.

The investment would be about US$ 25,000 (delivered Mogadishu). The O & M costs would be approximately 300,000 SS/year. The depreciation 20% of 4,000,000 SS would be 800,000 SS/year.

III - 14 (continued)

Balance:

Reduced investment on housing	65,500,000 SS
Increased investment on bus	4,000,000 SS
Total reduced investments	61,500,000 SS
Reduced O & M costs on housing	1,845,000 SS
Increased O & M costs for bus	300,000 SS
Total reduced O & M costs	1,545,000 SS
Depreciation costs for housing	3,275,000 SS
Depreciation costs for bus	800,000 SS
Total reduced depreciation per year to	2,475,000 SS

The total impact of reducing the housing component and increasing the transport for personnel on the total cost will be a reduction from 27,658,000 SS to 23,638,000 SS. The annual operating loss would become 11,195,000 SS. the theoretical break-even price of fodder would become 16,800 SS/ton.

III - 15

Rainfed Harvesting Costs per Hectare Unit

Vehicles	Cutters	Rakers	Balers	Trailers	Tractors	Total
Hectares/year* operations	200	200	200	200 bales per hour		
Capacity ha's/hour	0.6	4.0	2.0	14 tons of hay/day	65 HP	
Annual working hours	330	50	100	170	900	
Number required	1	1	1	1	1	
Unit price (US$)	2700	2700	13000	2500	13000	
Investment cost (1000 SS)	432	432	2080	400	2080	5424
Maintenance & spares	22	22	104	20	104	272
Fuel & lubricants					184	184
Total O & M costs	22	22	104	20	288	456

* only one harvest per year is assumed

III - 16

Financial Analysis of Rainfed Hay Production (200 Hectares)

Hectares	:	200
Yield/hectare	:	2 tons net
Annual output	:	400 tons
Gross revenue	:	8,888 SS/ton (delivered Kishmayo)
Average revenue/ha	:	17,764 SS

Operating and Maintenance Costs:

Rainfed harvesting (III-15)	456,000 SS

Share of rainfed in total O & M costs:*

Hay transport	208,000 SS
On-farm transport	120,000 SS
Electricity and water	153,000 SS
Buildings and housing	484,000 SS
Mangement and labour	969,000 SS
Rainfed area's share in O & M costs	2,390,000 SS

Share of rainfed area in depreciation charges:*

Rainfed harvesting equipment*	678,000 SS
On-farm transport	313,000 SS
Electricity and water	31,000 SS
Buildings and housing	806,000 SS
Hay transport equipment	532,000 SS
Rainfed area's share in depreciation charges	2,360,000 SS

Gross revenue for the 200 ha's rainfed = 200 x 8,888 x 2 = 3,552,000 SS

The annual operating loss = 3,552 - (2,390 + 2,360) = 1,198,000 SS

share of rainfed area production (400 tons) in total annual farm production (1800 tons) = 22.2%

III - 17

Analysis of Alternative Use of Rainfed Area

Since the financial parameters for hay harvesting on rainfed area do not appear to be an attractive proposition (see annex III-16) an alternative use of this area should be considered.

Although the natural bushland in Somalia has a very low carrying capacity, estimated at about one animal to ten hectares, the 200 hectares of rainfed area belonging to the farm have been cleared from brush and stones and it seems that for this rason it could be used for direct extensive grazing by a small herd of 100 heads of cattle during most of the year.

It is assumed that an animal of about 250 kgs when procured, could raise its weight with 70 kgs especially during the rainy season and over a period of some 6 to 9 months.

After a sufficient gain of weight to the minimum exportable standards of 320 kgs, the animals would be sold as export cattle to Egypt or some other Middle Eastern country as practiced by the export traders.

On basis of information obtained from the livestock export corporation Tawfiq in Mogadishu, the estimated costs and revenues for this alternative situation are as follows:

(The calculation is based on the fattening and export of 100 heads of cattle)

Procurement of 100 animals (average weight 250 kgs at the current estimated price of 10,000 SS/animal	1,000,000 SS
Annual wage of 2 herders	200,000 SS
Vaccines and treatments	50,000 SS
Cost of dry fodder for quarantain and ocean transport: (100 animals x 208 kgs x 8.89/kg)	185,000 SS
Export fee (325 SS/animal)	33,000 SS
Freight (Kishmayo to Suez at 80 US$/animal x 160)	1,280,000 SS
Export commission (5% of freight)	64,000 SS
Total cost C & F Suez	2,812,000 SS
Sales revenue (320 x 100 x 0.92 x 160)	4,710,000 SS
Net profit	1,898,000 SS

III - 17 (continued)

Note: Above figures are exclusive of insurance costs and risk of mortality.

The above calculation takes into consideration a sales price of dry fodder of 8.89 SS/kg.

The average profit per exported animal would be 18,980 SS. The benefit/cost ratio of the investment = 1.67.

However, at present, the exporter of live cattle does not recover his full share in foreign currency. The export receipts are repatriated against the free market rate for only 50%, the other 50% is exchanged against the official exchange rate of 90 SS/US$.

Accordingly, the sales revenue is less and amounts to 3,680,000 SS which represents a net benefit of 8,680 SS/exported animal. This is equivalent to a benefit/cost ratio = 1.30.

Conclusion:

According to the estimated costs and revenues of fattening and exporting live cattle, the alternative of direct extensive grazing the 200 hectaes of rainfed area, appears to be profitable.

The profitability depends however on the currency regulations imposed by the Government.

Since the export of fattened live animals requires the tying up of capital during a considerably time lapse and taking into consideration the pevailing inflation rate in Somalia, the indicated benefit/cost ratio of 1.30 possibly does not represent a sufficient incentive for the export development of live cattle.

III - 18

Importance of the Livestock Sector to the Somalian Economy

The following statistical information illustrates the importance of the livestock sector to the Somalian economy:

National account aggregates:

(million of SS) (in constant prices; base year 1977)

Year	Gross Domestic Product (at factor price)	Indirect Taxes	GDP at market price	Added value of livestock sector	
1977	5373	572	5945	2006	34%
1978	5304	939	6243	2155	35%
1979	4801	854	5655	1592	28%
1980	5347	475	5822	1810	31%
1981	5810	568	6378	2193	34%
1982	6222	534	6756	2354	35%
1983	5169	562	5731	1404	25%
1984	5883	252	6105	1995	33%
1985	6950	353	7303	2406	33%

Source of information: Ministry of National Planning

III - 18 (continued)

Export of Live Cattle*

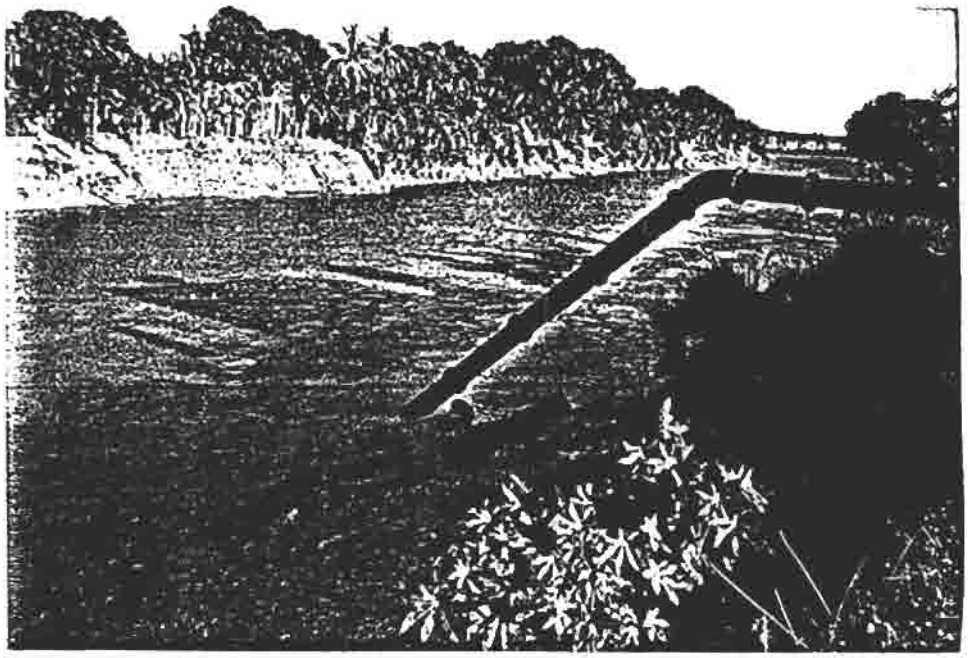
Year	(1000 heads) Export	Share of Saudi Arabia (%)
1975	40	97.5%
1976	74	91.9%
1977	54	98 %
1978	73	100 %
1979	79	92.5%
1980	85	94 %
1981	116	89.6%
1982	157	93 %
1983	44	50 %
1984	8	0 %
1985	44	0 %
Average	70	

Source of information: Livestock marketing and health project

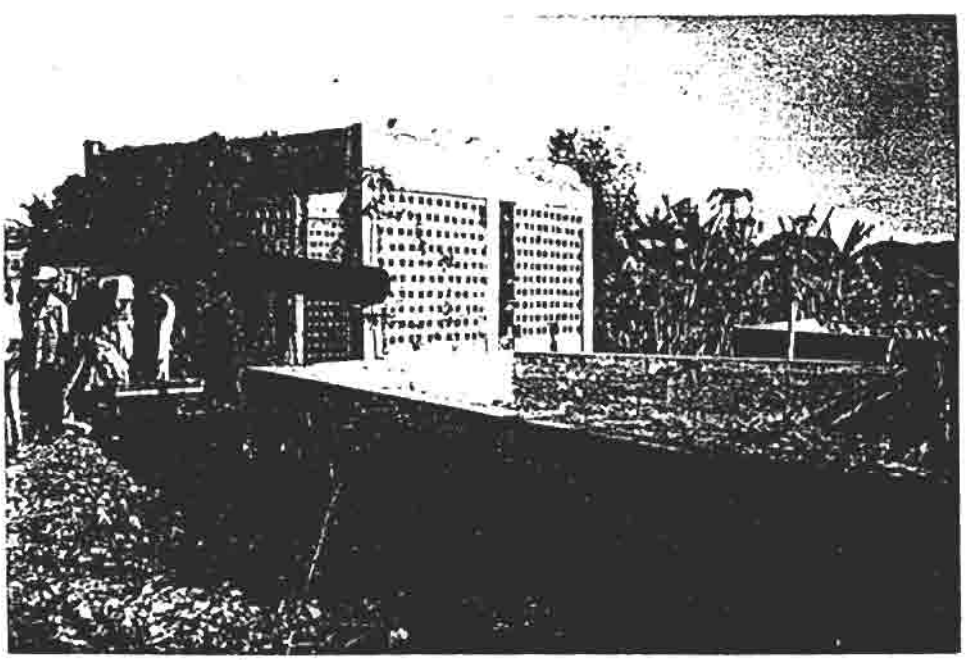
* during the year 1985 the port of Kishmayo was used for the export of 22,300 animals, the remaining exports used the port of Berbera (20,100 animals)

A P P E N D I X

Photographs made in the project area
in November 1986



Juba river and suction pipe of presently installed pump

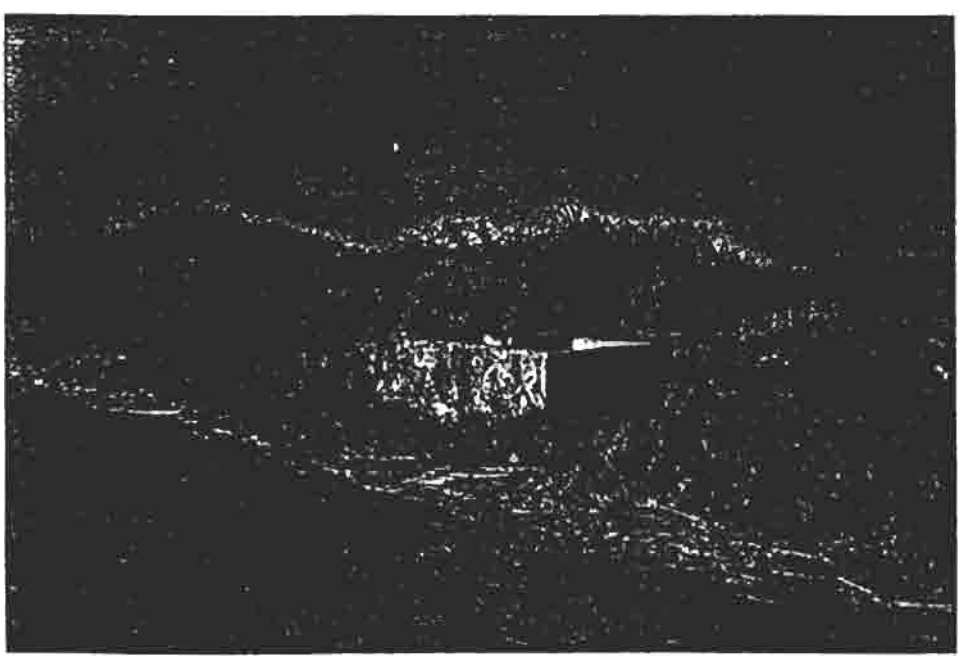


Pump outlet (left), pumphouse (not used) and stilling basin

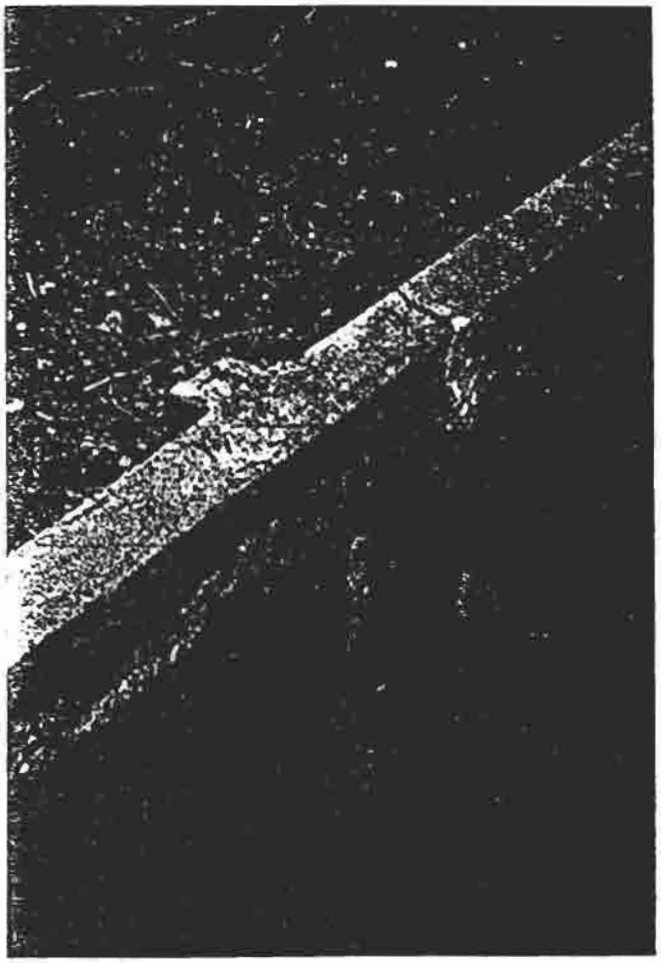
Inlet pipe to pumphouse
(above water level)

Stilling basin

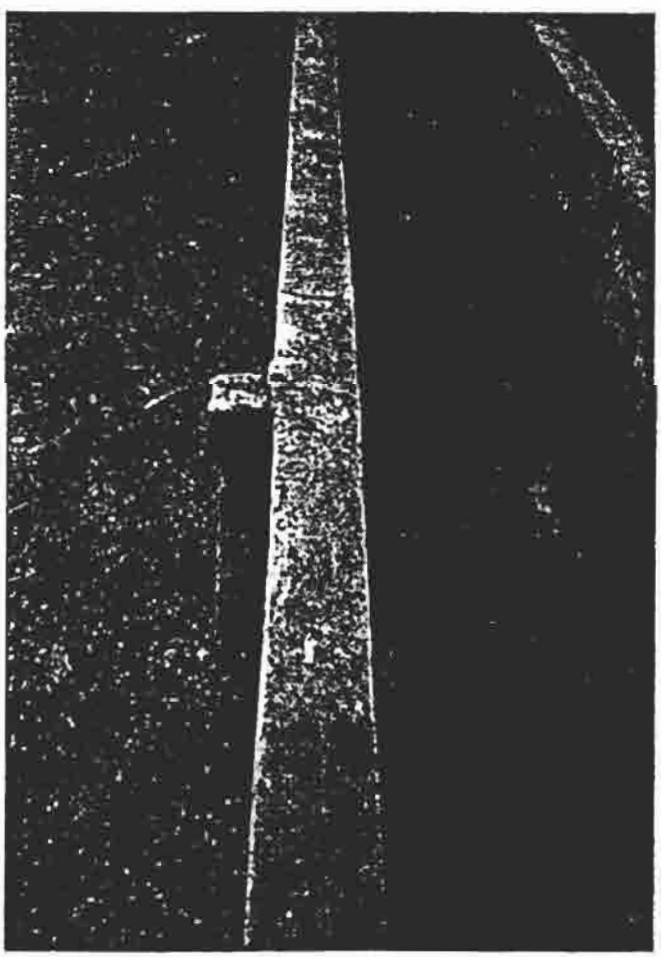
Head reach (note crack)

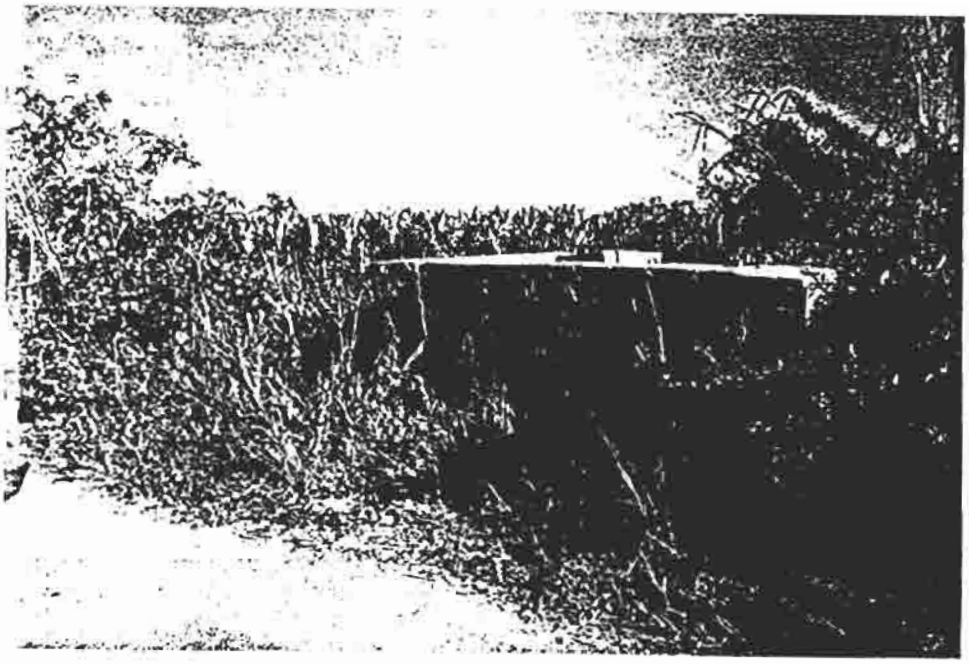


Road crossing in head reach

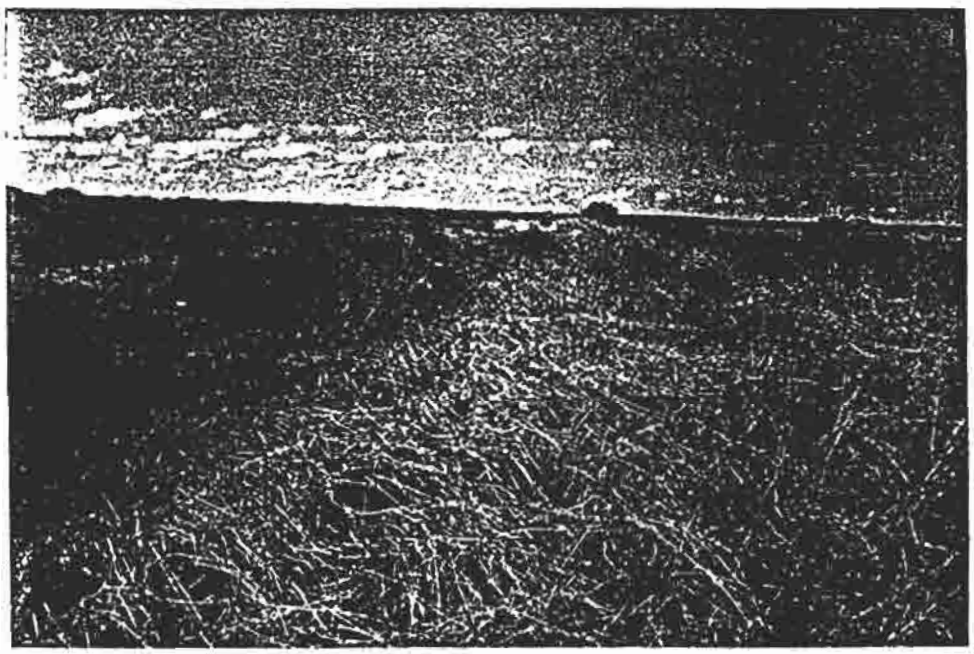


Head reach (note supporting pole)



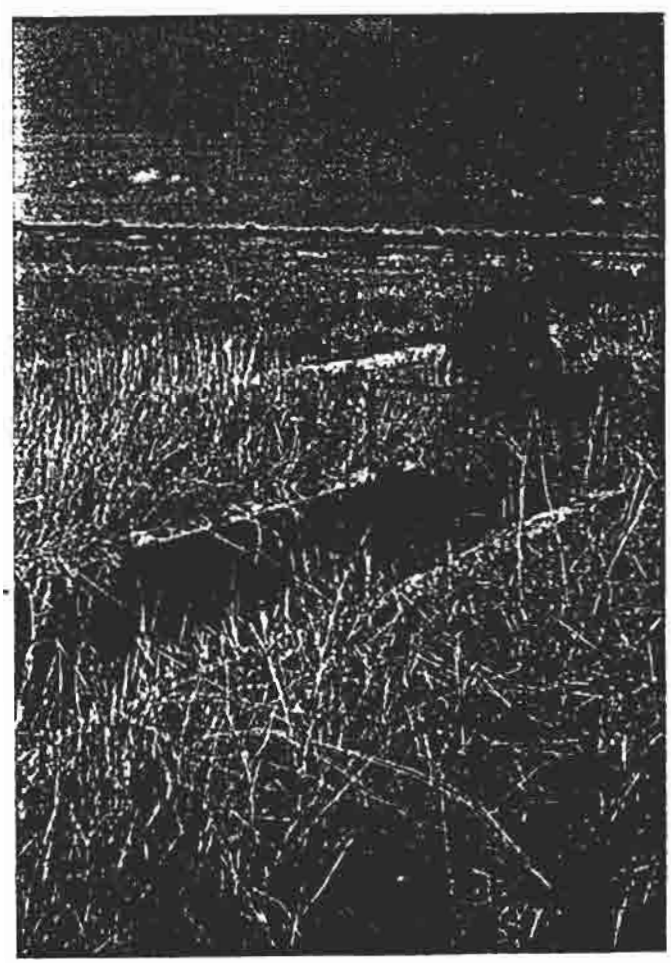


Road crossing in head reach

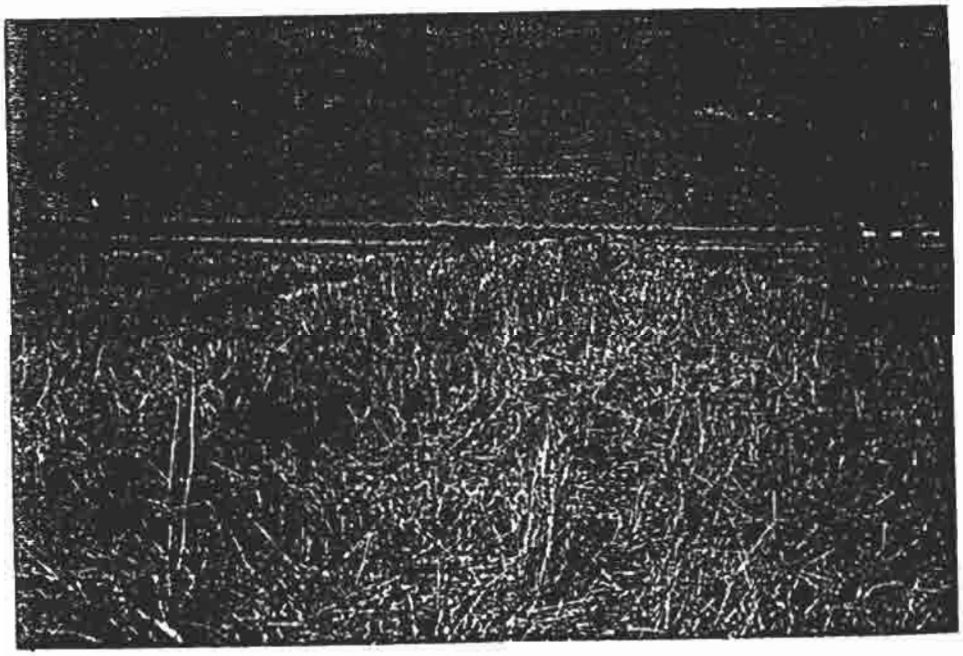


Main canal (earth part)

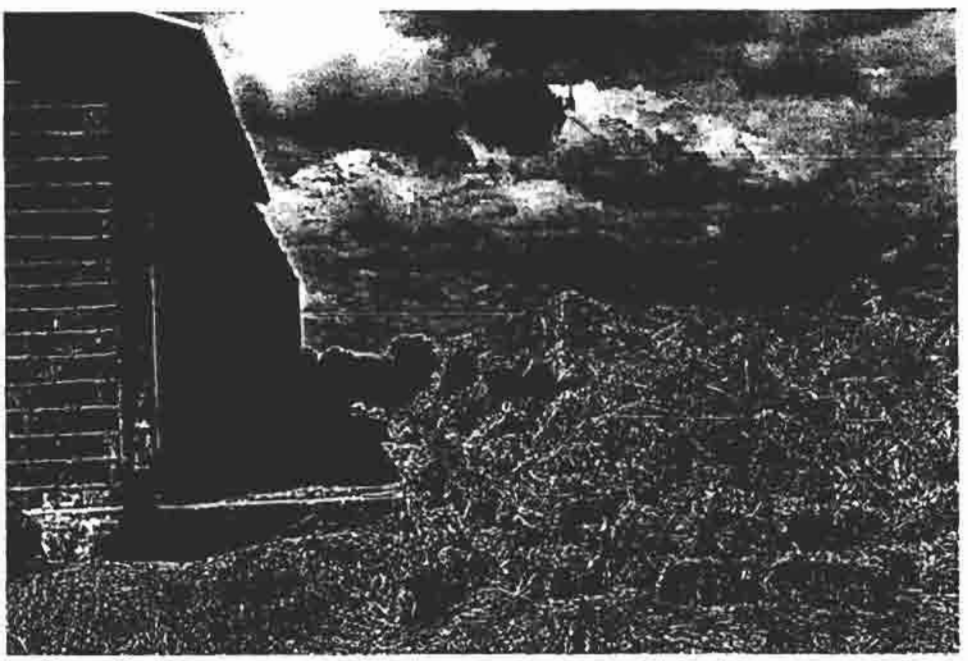
Division box



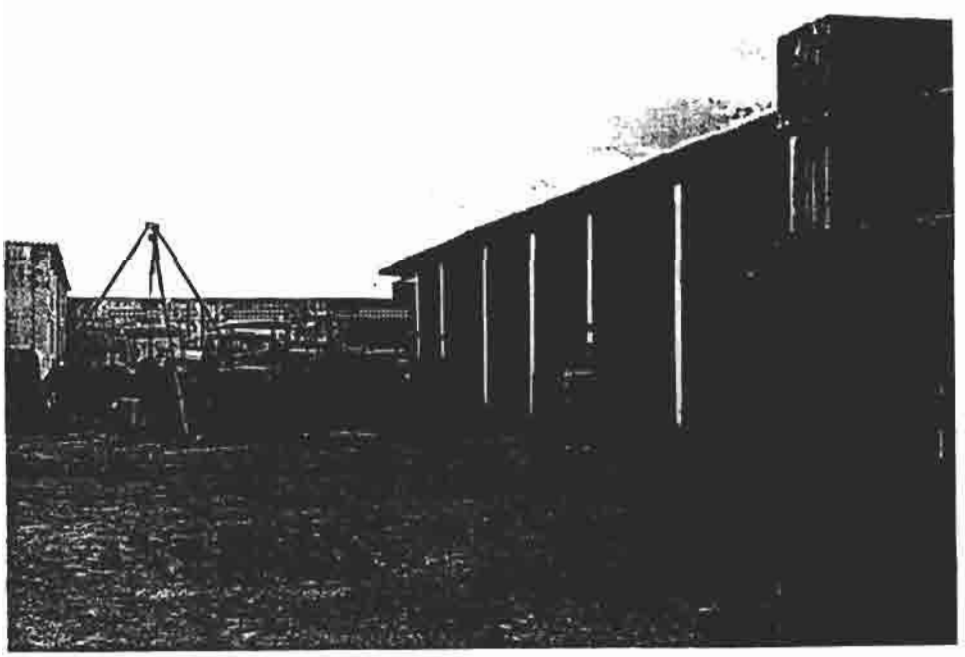
Division box



Embankment of field ditch



Hay-shed and bales of roughage



Machinery yard