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Homboy Irrigated Settlement Project

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The Project Area

1.1 LOCATION AND DESCRIPTION

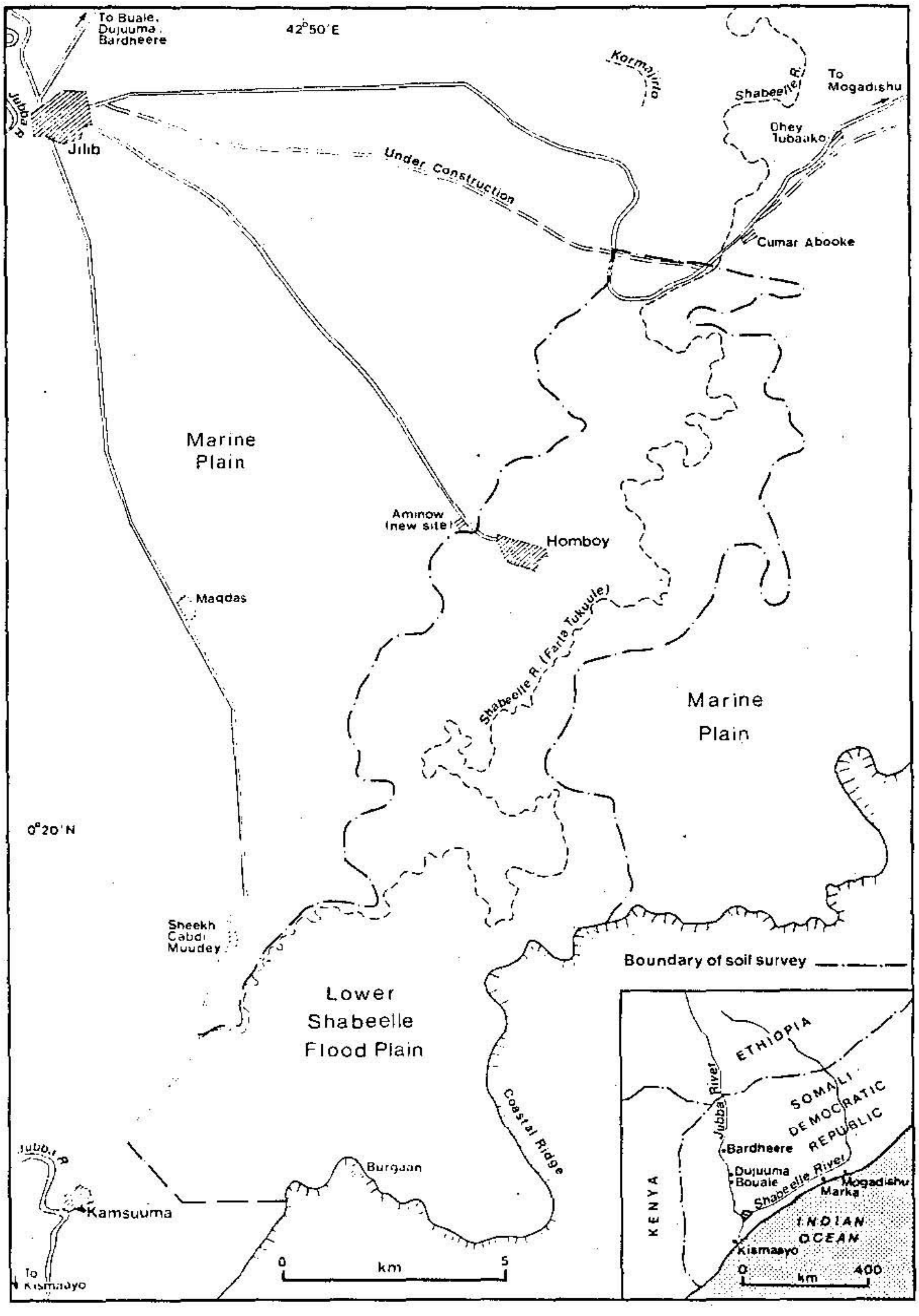
The area covered by detailed topographic survey and semi-detailed soil survey was selected from the Reconnaissance Report as being the area most suitable for irrigation development. The location of this area is shown in Figure 1.1. It comprises the entire floodplain of the lower Shabeelle River between the new Jilib-Golweyn road which is presently under construction, and the northern limit of the banana plantations around Kamsuuma. The area is bounded to the north west and south east by the extensive flat Marine Plain and associated 'Beach Remnants', to the north by fairly extensive swamps and to the south by the sandy Coastal Ridge and the banana plantations. The area comprises 15,100 ha. and lies between the geographical co-ordinates 0°15'and 0°30'N and 42°00'E. The area studied lies within the Lower Jubba region and is divided between Jilib and Jamaame administrative districts. Figure 1.1 illustrates the present pattern of settlements and communications within and adjacent to the study area. The project area of 14,200 ha. gross and 8,850 ha. net irrigable area was selected after taking into account both topographic and soils data.

Settlement within the project area is limited by flood hazard under the present situation in which no flood protection measures are employed. Homboy (population 3,813) is the only settlement of any size and is situated on an 'island' of Beach Remnant material about 3m above the surrounding floodplain. A few small villages, comprising less than ten families each are situated on higher level sites alongside the Farta Tukuule, and temporary camps are established on the floodplain by nomad graziers during the 'Haggai' and 'Gelal' seasons. A number of villages are situated around the perimeter of the floodplain, notably Burgaan (population 1,500) on the Coastal Ridge, and Aminow (population 574) which has been recently resited on the Marine Plain, close to Homboy. Villagers from these settlements exclusively farm the alluvial lands within the survey area.

Present communications to and from the project area are poor. Homboy is linked to Jilib by a relatively good dirt road, and to the Jilib-Golweyn and Jilib-Kismaayo roads by poor quality tracks. All these lines of communication are frequently cut in the rainy seasons. The track linking Burgaan to the Jilib-Mogadishu road at Kamsuuma is rarely passable in the rainy seasons and the track over the sand ridge to Jamaama is barely negotiable by four wheel drive vehicles even under dry conditions. The extreme south west of the project area has direct access to the metalled all weather Jilib-Kamsuuma road and the extreme north is accessible to the Jilib-Mogadishu road which is presently only seasonably passable. Within the project area, a few tracks link smaller settlements to Homboy. These are normally motorable only in the dry seasons.

Following completion of the Jilib-Golweyn road, the Jilib area will have assured communication with Mogadishu and with the port of Kismaayo. A network of all weather roads has been planned, which together with the farm road system will provide easy access to all the settler villages, and allow farm inputs and produce efficient access and transport. The all weather road network is shown on Figure 1.2

1.1 Homboy Irrigated Settlement Area
Location, settlements and communications



1.2 Proposed all weather road network

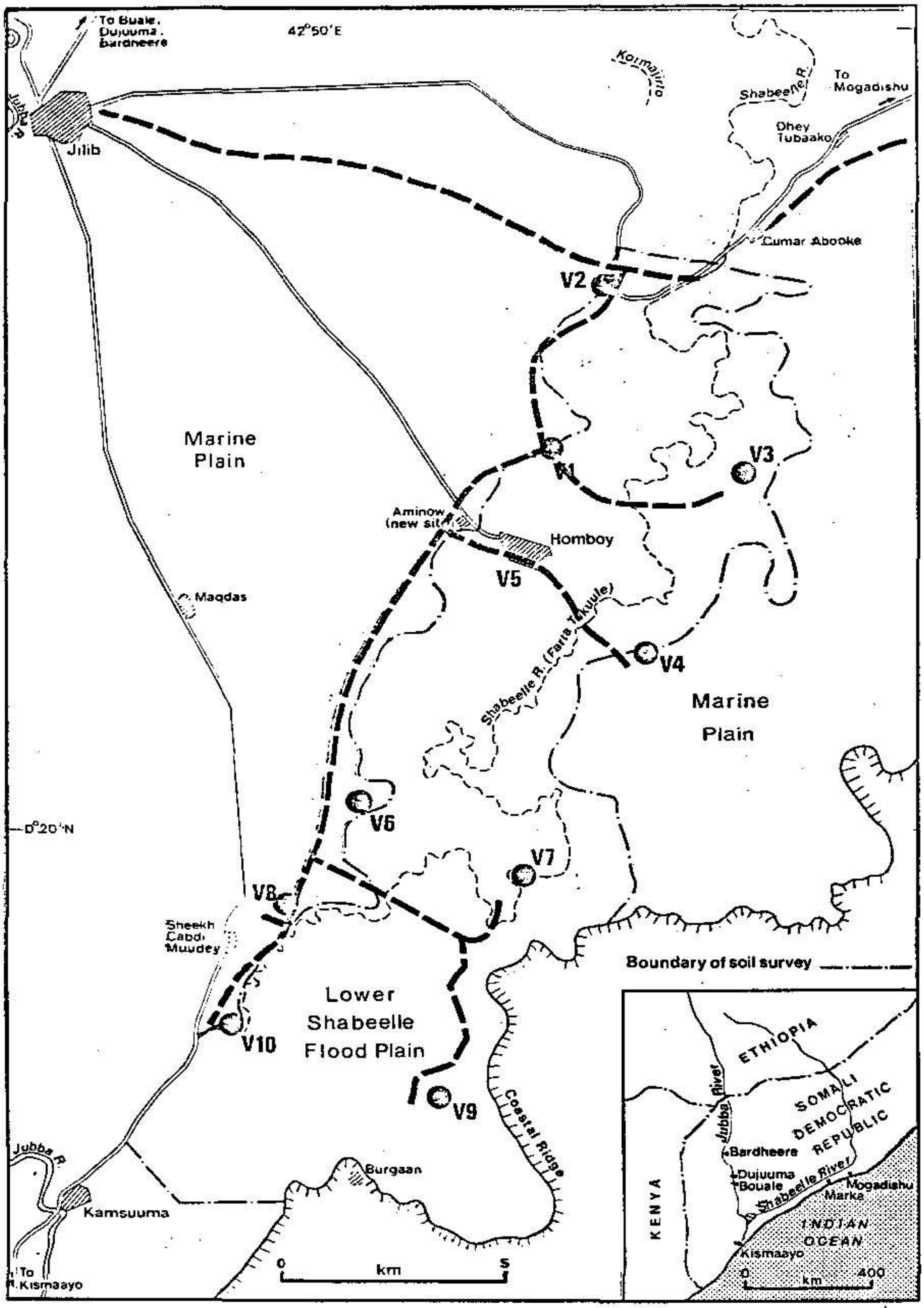


TABLE 1.1 CLIMATIC DATA FOR JILIB (ALESSANDRA)
00°30'00"N 40°46'00"E Altitude 24 m

Month	Period Years Complete Data	Temp °C 1923-63	Humidity % 1931-63	Wind Run km/day 1953-59	Sunshine hrs/day 1934-58	Penman Eo mm/day -	Rainfall mm 1922-60
		15	13	5	7	-	20
January		28.7	69	150	9.19	7.1	2.2
February		28.9	68	170	8.96	7.5	1.4
March		29.0	67	160	10.00	7.9	8.0
April		28.3	73	78	7.62	6.4	138.5
May		28.0	78	35	7.62	5.8	111.2
June		26.5	79	52	6.87	5.2	54.0
July		25.8	77	52	6.98	5.2	52.5
August		26.1	75	60	7.93	5.8	18.0
September		26.6	73	86	8.51	6.4	17.7
October		27.3	73	95	7.47	6.3	74.6
November		28.0	76	78	6.72	5.9	59.7
December		28.1	74	95	8.21	6.3	48.3
Year		27.6	74	93	8.01	6.3	585.9

1.2 CLIMATE

The climate of the project area is classified as tropical semi-arid. Rainfall is bimodally distributed with maxima occuring in the 'Gu' (April to May) and 'Der' (October to December) seasons respectively. The 'Gelal' season (January to March) is generally hot and dry, but showery weather is common in the 'Haggai' season (June to September). Jilib (Alessandra Research Station) is the closest meteorological station to the project area with reasonably continuous records extending over a period of time. Table 1.1 summarises climatic data for Jilib, together with Penman evapotranspiration estimates based on HTS (1977).

1.2.1 Rainfall: Seasonal and Geographical Distriburion

Although less critical than under a rainfed system, the seasonal distribution of rainfall is, nevertheless, important under irrigation in deteriming water requirements and the timing of cultivation and harvesting operations. The latter point is particularly relevant during the harvesting and planting period between the 'Gu' season crops and the 'Der' season.

Available rainfall data from Jilib (Alessandra) was analysed in the Inter-Riverine Study (HTS, 1977). Table 1.2 illustrates major characteristics of the 'Gu' and 'Der' rainy seasons.

TABLE 1.2 CHARACTERISTICS OF 'GU' AND 'DER' RAINY SEASONS AT JILIB (ALESSANDRA)

	Gu Season	Der Season
Average Rainfall (mm)	356	183
Start[1]:		
1 year in 4	By 9th April	By 17th October
Average	14th April	26th October
3 years in 4	By 18th April	By 3rd November
Duration[2]:		
1 year in 4	95 days	50 days
Average	77 days	49 days
3 years in 4	59 dyas	40 days

Notes:

[1] *The average rainfall in the Gu season includes the 'Haggai' rains falling in June to July.*

[2] *Start and finish of rainy seasons has been taken as the first and last falls of 10mm or more. Isolated raindays seperated by 10-15 days from other raindays have been excluded from the main season.*

The geographical distribution of rainfall is important when applying meteorological data from Alessandra or other stations to the project area. According to the isohyetal map in the Inter-Riverine Report (HTS, 1977) total annual rainfall tends to decrease from Jilib towards the coast. However, data is insufficient to state that total annual rainfall varies significantly between Jilib and the project area or within the project area itself. Of greater significance is the local nature of most of the falls and the resulting variation in daily,

TABLE 1.3 VARIATION IN MONTHLY RAINFALL IN 1978 AT THREE STATIONS CLOSE TO THE PROJECT AREA

	Alessandra 0°30'N 42°46'E 24m		Jilib State Farms		Jubba Sugar Project 0°25'N 42°42'E 20[1] m	
	Rainfall (mm)	No. of Rainy Days	Rainfall (mm)	No. of Rainy Days	Rainfall (mm)	No. of Rainy Days
January	0	0	0	0	0	0
February	0	0	0	0	1.1	1
March	84.7	6	103	7	35.4	5
April	153.7	16	390	16	198.2	16
May	228.9	19	203	12	222.3	21
June	38.8	14	57	6	39.6	14
July	32.1	11	56	9	32.5	13
August	3.2	4	8	1	4.3	4
September	0.2	1	0	0	.0.0	0
October	37.1	5	39	3	101.4	10
November	225.6	17	273	13	163.5	15
December	83.4	11	141	8	174.1	11
Total	887.7	104	1,270	75	972.4	110

[1] *This is the geographical reference of the 'Permanent Meteorological Station'. From January to July, readings were taken from the 'Temporary Office Site'.*

monthly and annual total rainfall between stations located in fairly close proximity to one another. Table 1.3 illustrates the variation in monthly rainfall totals and the number of rainy days between three meteorological stations during 1978. These stations were situated not more than 12 km apart and lying to the north west and west of the project area. Figures are calculated from daily rainfall totals collected during the present study.

Table 1.3 shows that 1978 was wetter than the average year. In particular, the rainfall at the Jilib State Farms amounts to more than twice the annual average. Variation between stations occurs during both the 'Gu' and 'Der' rainy seasons. Diurnal variations are particularly significant.

Evidence suggests that most of the flooding which occurs in the project area under present conditions results from rainfall and, apart from imposing high demands on the surface drainage system, the very local nature of the precipitation hampers accurate prediction and application of irrigation water requirements. Adequate provision has been made in the project design to protect the area from flood waters from the north and the marine plain to the east and west. The internal surface drainage system can cope adequately with rainfall falling within the project area, although pumping will be necessary in the lower lying areas in the extreme south. A full meteorological station should be established as soon as possible during project implementation and, as development proceeds, a number of rain gauges should be established throughout the irrigated area, to assist in the management of irrigation applications.

1.3 SOILS

The soils of the project area are described in detail in the Soils report (H.T.S. 1979). Of the gross area of 15,085 ha. subjected to semi detailed soil survey, a total of 12,158 ha. was assigned to classes II & III and recommended as suitable for the development of Irrigated agriculture, and it is this land which forms the bulk of the net irrigated area. Inevitably, some other land classes fall within the boundary, some class IV, the levee soils associated with the Farta Tukuule, and some class VI in the deeper depressions at the southern end of the project area. As the main canal follows the elevated Farta Tukuule, no problems arise from the inclusion of the class IV land. Much of the class VI land is associated with lake Far Sitay which because of the expense involved in draining, will remain as standing water, while other small pockets will be utilized by mono-cropping paddy rice.

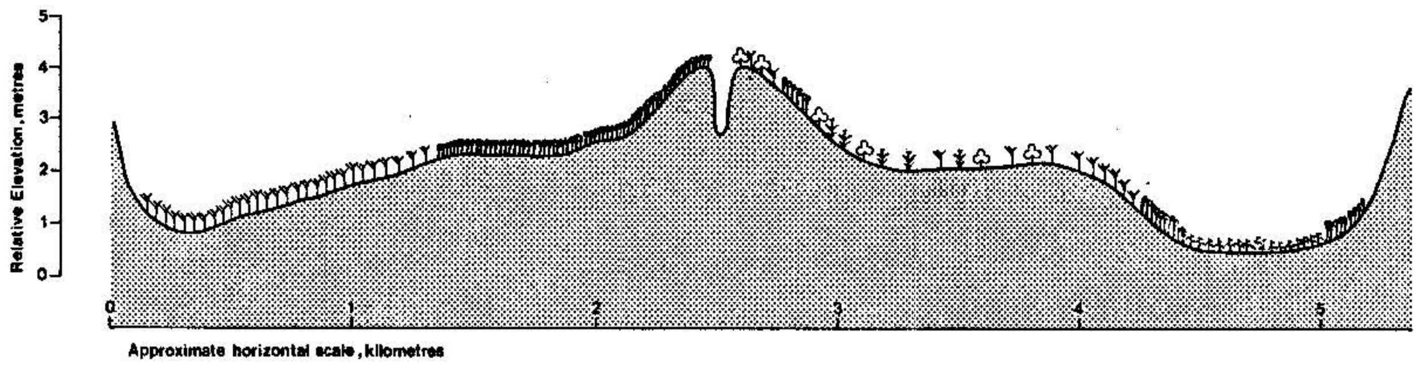
With the exception of the paddy rice areas, soil differences do not impose any serious constraints to cropping, and a general rotation can be applied over the remainder of the project area.

Although soil salinities are generally high in the subsoil, with little chemical variation between soil units, this does not impose a significant constraint upon cropping, and soil permeability tests suggest that there will be sufficient leaching to avoid salinity problems in the future.

1.4 NATURAL VEGETATION

Natural vegetation within the study area is primarily dependent on the duration of flooding under the current hydrological regime. As flood duration is primarily dependent on relative elevation, vegetation associations are strongly related to landforms units. The existing vegetation pattern has been affected by cultivation in some areas

1.3 Lower Shabeelle floodplain: idealised cross section



Landform	Marine Plain	Depression		Cover Floodplain		Levee	Channel	Levee		Cover Floodplain		Depression Sideslope	Depression	Marine Plain
Soil Mapping Unit*	SMP	Sd2	Sd1	Sb2	Sb1	Sl2	Sl	Sl1	Sl2	Sb1	Sb2	Sd1	Sd3	MP
Natural Vegetation	*Acacia*/non-thorny shrubland	Dominated by dense *Acacia nilotica* thicket		Mixed shrubland, including *Acacia nilotica* *Acacia zanzibarica* *Dobera glabra* *Thespesia dariis*		Mixed shrubland More non-thorny species	Dense shrubland	Mixed shrubland More non-thorny species		Mixed shrubland, including *Acacia nilotica* *Acacia zanzibarica* *Dobera glabra* *Thespesia dariis* and others		Dense *Acacia nilotica* thicket	Mainly swamp grasses and sedges. Few small *Acacia nilotica* and 'Eerib'	Mixed *Acacia*/ non-thorny shrubland
Current Land Use	Uncultivated			Cropped with Sorghum (Der season)			Sesame	Uncultivated	Sorghum Plot	Fallow, with remnant trees (mainly *Dobera glabra*) and low regrowth dominated by *Thespesia dariis* and *Dalbergia spp.*		Uncultivated	Sesame, Maize, Sorghum, grown on receding flood water	Uncultivated

*See Section 2·3

and this has resulted in changes in species distribution.

Figure 1.3 illustrates typical vegetation association on the most common landforms in the study area. In the predominantly flooded deeper depression areas, swamp grasses and sedges predominate with relatively few emergent trees. The shallower depressions are characterised by dense growth of Acacia nilotica while the cover floodplains support a mixed Acacia and non-thorny shrubland in which such species as A. nilotica, A. zanzibarica, A. bussei, Dobera glabra and Thespesia danis are well represented. On the higher levee areas, non-thorny species tend to dominate and often give rise to a more open cover. In the areas that have been under fallow for one or two years or more regrowth is dominated by such species as Ficus populifolia, Dalbergia spp. and Thespesia danis.

1.5 POPULATION

This section identifies population groups currently associated with the project area and gives some indication of how these groups may react to development of the proposed settlement project.

Although no accurate population statistics exist for the project area it is possible, on the basis of observation and local discussion, to classify the population with an agricultural or livestock interest in the project area into four groups:-

(i) Settled population
(ii) Settled and semi-settled nomads
(iii) Pure nomads
(iv) Town people, primarily from Jilib and Kamsuuma, who use parts of the area for agricultural purposes.

A decision has been taken by the Settlement Development Agency to offer the present population places as settlers in the proposed scheme, and a discussion with village chiefs revealed that most of the settled population and settled and semi-settled nomads (Groups i and ii) wished to participate. The distribution of population in these groups in the villages either within or adjacent to the project area is given in Tables 1.4.

TABLE 1.4 DISTRIBUTION POPULATION IN AND ADJACENT TO THE PROJECT AREA.

Homboy Village Communities:

	Population
Iftin	945
Kulmus	1,104
Xaafadh Barka	904
Holwadaag	775
Aminow	574
Bula Geduud	85
	4,387

Nearby settled Communities using land within the Project Area.

Dayax	250
Goorkha	300
Cumar Muuse	12
Sheek Cabdey Muudey	200
Kooskey	75
Burtuqam	93
Burgaau	1,497
Cabdihari	104
Xerer Mirsha	65
Xudda Saxalle	110
	2,706

Nearby settled and semi-settled nomad villages who use land within the project area.

Ged Subag	150
Cabdi Maamia	140
Demasera	40
Cumar Abooke	400
Deghadey	400
	1,130

Thus, it is estimated that a total of 8,223 people, around 1,500 families, may be attracted to settle on the scheme. On the basis of 1 ha. per family, they would occupy 1,500 of the net irrigated area of 8,850 ha, leaving 7,350 ha. available for the Dujuuma settlers. One major advantage of incorporating the existing population within the scheme is their familiarity with agricultural production, which is generally lacking in the Dujuuma group. In addition, because of a shortfall in the number of Dujuuma families, it will allow more of the scheme to be developed quickly. In this context it is important that the working of the scheme be so arranged as to attract the maximum number of present residents.

1.6 AGRICULTURAL LAND USE

Present agricultural land use practices are well adapted to the environmental conditions of the lower Shabeelle floodplain.

Figure 1.3 illustrates two types of agricultural land use which are typically found in the study area. These are:

(a) Cropping of cereals (sorghum and maize) on the cover floodplain and levees, and

(b) Cropping of sesame, maize, sorghum and pulses in the depressions and channels.

TABLE 1.5 ESTIMATED ANNUAL PRODUCTION - HOMBOY PROJECT AREA

Cover floodplain cultivation	2,358 ha.
Depression cultivation	828 ha.
	3,186 ha.

Gu Season Production

Type of Cultivation	Area (ha)	Crop	Yield q/ha	Total Production Quintels
Cover floodplain	2,358	Maize	2	4,716
Cover floodplain	784[1]	Pulses	2	1,568
Depression	552	Sesame	1.5	828
Depression	276	Maize	2	552
Depression	276[1]	Pulses	2	552

Der Season Production

Type of Cultivation	Area (ha)	Crop	Yield q/ha	Total Production Quintals
Cover floodplain	2,358	Sorghum	3	7,074
Cover floodplain	784[1]	Pulses	2	1,568
Depression	552	Sesame	1.5	828
Depression	276	Maize	2	552
Depression	276[1]	Pulses	2	552

Total Estimated Production:

Maize	-	5,820 quintals
Sorghum	-	7,074 quintals
Sesame	-	1,656 quintals
Pulses	-	4,240 quintals

Note:
[1] *Intercropped with maize or sorghum.*

Cropping on the levees and cover floodplain relies primarily on rainfall although some residual moisture is probably utilised from the relatively infrequent floods which cover these areas. The soils on these landforms generally have silty clay and silty clay loam surface horizons which made them more easily workable than the clay of the depressions. Crops frequently show uneven growth which may be due to moisture stress. Planting generally coincides with the onset of the 'Gu' and 'Der' rains and frequently two crops are grown in one year on each piece of cultivated land.

Cropping in the depressions, however, takes place mainly by utilising residual flood waters. The lower areas are progressively planted as the water recedes. Sesame is typically planted in the wetter sites. Cultivation is limited to preparation of small basins with a hand hoe or 'yambo'.

Crop husbandry is based on tradional practices with low levels of inputs and consequently low yields. Local varieties are grown and fertilisers are not used. Apart from 'seed dressing' pesticides are not used. More recently, however, villagers at Homboy have co-operated and hired ONAT tractors for primary cultivation operations. In the 'Der' season of 1978 a large area in the vicinity of Homboy was ploughed and subsequently planted to sorghum intercropped with green gram. These relatively progressive measures, together with the high rainfall in 1978, help to account for the sale of surplus crops amounting to 929 quintals of maize and 854 quintals of sorghum to ADC, Jilib. The Homboy area is at least self sufficient in grain in most years and surplus crops, not sold to ADC, are normally stored in pits. Government assistance was, however, required in the severe drought of 1973/4 Table 1.5 summarises estimated production in the project area.

Because pressure of population is not severe in the study area the overall density of agricultural land use is not high. Most of the existing cultivation is concentrated around the main centres of population such as, Homboy and Burgaan. Observations of current land use made during both topographic and soil surveys, showed that 20 per cent of the project area is cultivated, of which 26 per cent is farmed mainly on residual flood-water around the larger depressions and the remaining 74 per cent of the cover flood plain and levee areas

1.7 LIVESTOCK

The lower Shabeelle floodplain is an important grazing area for livestock. Cattle products, live animals, meat and hides are a major Somali export and a large proportion of the nation's cattle are concentrated in the LowerJubba region. It is estimated that some 40 per cent of the National cattle population may be found in the Lower Jubba and Lower Shabeelle area.

An aerial livestock survey census was carried out by FAO in the 'Gelal' season of 1975 and 1976, when the resident population is greatly increased by an influx of nomad graziers. The resulting statistics, however, are organised by districts and do not account for the much higher livestock concentrations on the alluvial floodplains at this time of year, when grazing on the marine plain is minimal. Field observations in the 'Gelal' season made during the present study suggested a cattle population far in excess of the 5,000 estimated by local sources to be the resident population, together with large number of camels, goats and sheep. Calculations on an available dry matter basis (see section 2.3 Chapter 7) put the holding capacity at between 2,600 and 3,100 cattle.

Livestock are owned by both 'settled nomads', who also cultivate crops (Section 1.5), and by semi-nomads, who return to the villages of their settled kinsman on a bi-annual cycle, which coincides with the dry season harvesting of arable crops and the availability of crop residues. A proportion of livestock is retained in the villages to provide a source of meat and milk, and a very active trade is carried on with the resident agricultural population.

Irrigation development of the project area will undoubtedly have a major impact on the livestock population and on the local economy of the resident population both by curtailing access through irrigation engineering works and by increasing population by nearly six fold. In a broader context, the planned development of the Jubba and Shabeelle floodplains could have a serious adverse effect on the regional livestock population and hence affect the volume of livestock exports, unless livestock can be integrated into schemes or adequate provision made for alternative grazing. The latter alternative would be difficult to realise, as the marine plain surrounding the floodplain area has a comparatively low carrying capacity due to poor soils and relative absence of flooding. With the present situation of co-operation between farmer and graziers within the project area, and the nomadic background of the Dujuuma settlers, integration of livestock into the scheme should have many socioeconomic advantages. The feasibility of doing so is discussed in detail in Chapter 7.

1.8 OTHER ACTIVITIES: FISHERIES AND WOOD GATHERING

Fishing is currently practiced in the depressional lakes and deeper depressions in the project area, particularly in the Far Sitay Lake, which rarely completely dries out. Fish is sold either fresh or dried, and forms an addition to the protein content of the local diet. It is unlikely that the deeper depressions will be utilised for cropping under the proposed irrigation system, and fishing activities could be continued or perhaps extended following project implementation.

The remaining woodland and shrubland in the project area is used as a source of timber for building poles and firewood. Most of this resource will disappear on project implementation. The ability of the surrounding marine plain to furnish alternative supplies is not known at present, but biogas may be able to relieve this situation.

1.9 WILD LIFE

The Lower Jubba region harbours a rich and varied assemblage of wildlife and a number of mammal species such as elephant, hippopotamus, greater kudu, gerenuk, waterbuck, wart hog, caracal, civet, dik-dik and baboons, along with numerous bird species, were observed during the course of the survey. Under present circumstances these animals compete for food and water with the resident farming population and with domestic livestock. It is recognised that wild game will inevitably be excluded from the proposed irrigation area but efforts should be made to ensure minimum disturbance of surrounding areas such as the Shabeelle swamps upstream of the Jilib-Mogadishu road. This recommendation does not preclude the use of this area as flood storage area, as flooding would only be temporary during periods of high flow in the Shabeelle River or the Harar Naga. The Somali government's policy is laudable in preserving a rich wild life resource which could have future potential for tourist exploitation, and current and future development of the region should take account of all its productive resources.

TABLE 1.6 SETTLEMENT POPULATIONS

(i) Changes in Population

Year	Dujuuma	Sablaale	Kurtun Waarey	Total
1975	47,896	29,486	26,295	103,677
1978	27,646	19,431	17,990	65,067
1979	24,972	16,551	18,088[1]	59,611

(ii) Breakdown by sex and age grouping as at 30.6.79.

Age Groups (Years)

Settlement	0 - 5		6 - 14		15 - 30		31 - 45		46 - 60		60 +		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
Dujuuma	1,374	1,333	7,085	5,110	2,434	2,683	891	2,543	476	496	252	245	24,972
Sablaale	1,037	1,061	4,360	3,327	1,714	1,923	710	1,510	311	315	132	151	16,551
Kurtunwaary	1,201	1,137	3,901	3,140	2,424	2,460	847	2,072	337	431	65	73	18,088[1]

Note[1]: *after a local village had been incorporated*

Source: *W.F.P Mogadishu*

1.10 THE DUJUUMA SETTLERS

Although not yet a component of the study area, the Dujuuma settlers are the raison d'etre of the present study and their numbers and agricultural activities are outlined below.

Table 1.7 shows the present and former population numbers on the three SDA settlements, and shows the distribution of settlers by age and sex in June 1978. Largely due to the partial failure of agricultural production, the population has declined in all three settlements, but Dujuuma, as the least successful, has suffered the greatest loss. Since the beginning of 1979, the number of families leaving the settlements has declined.

Agricultural production does not provide subsistence for the settlers and there is continued dependence upon the World Food Programme. Agricultural activities are confined to 100 hecates of irrigated vegetable production and 485 hecates of rainfed crops. Cultivations on the irrigated land are mechanised whilst traditional methods of cultivating and planting are maintained on the rainfed area. No fertilisers are used and yields are consequently low. Table 1.7 gives the yields obtained from rainfed crops during the 1977/78 'Der' season

TABLE 1.7 DUJUUMA YIELDS FROM RAINFED CROP PRODUCTION 1977/78 'DER' SEASON

Crop	Yield Quintals/Ha	Remarks
Sorghum	2.0	Bird damage severe
Sesame	0.8	
Maize	4.5	
Groundnuts	10.0	
Cowpea	2.0	

Although an estimated 4,000 adults are available to provide labour on the scheme, the average daily turn out is around 1,450 persons who receive payments ranging between 2/- and 5/- per day depending on the type of work. The remainder of the available work force are unemployed or underemployed. Resettlement in Homboy will mean that a much greater level of phycical commitment to working on the scheme will be required. This underlines remarks made in section 1.5. Lack of familiarity with regular agricultural work has been taken into account when calculating labour requirements. (See Chapter 6).

2

Agricultural Development Planning

2.1 INTRODUCTION

The Homboy Project is one of a number of irrigation projects which have been identified in the flood plains of the Shabeelle and Jubba rivers and allocated for the settlement of the nomadic people who had to be moved from the northern parts of the country as a result of the severe drought of 1973 and 1974. Since 1975 the prospective settlers for the Homboy Project have been living at Dujuuma where for various reasons, agricultural development has not been a success. The major objective of the Homboy development is to provide these former nomadic people with a permanent abode and with the resources required to sustain acceptable living standards.

The prospective settlers for the Homboy Project are former nomads and were previously almost totally dependent upon livestock for their livelihood. The background of these people suggests that problems will inevitably arise during the early stages of project implementation. The only experience of agriculture and regular work and working hours that they have gained, has been at the Dujuuma settlement where they have resided since mid 1975. However, the failure there of agricultural development, where only 100 ha. of land is irrigated and around 500 ha. farmed as rainfed, has meant much enforced idleness.

The initial period of adaptation and acclimatisation of the prospective settlers to a more disciplined way of life is likely to be prolonged and the successful development of the Homboy Project in the short term will require a strong management team. In order to ensure the long term success of the Project, training facilities will be required to provide suitably qualified people at all levels including a general up-grading of educational standards amongst the settlers themselves.

Agricultural development planning must take into account the full range of relevant information that is available including both natural and human resources. The land and water resources of the Homboy Project Area provide adequate scope for the development of irrigated agriculture. The human resources, on the other hand, initially limit the development possiblilities, both in terms of lack of farming skills and in terms of availability of manual labour. A further factor of some importance is the policy of the present Government with regard to the disposition of human resources which must also play a major role in determining future agricultural development planning strategy.

2.2 HUMAN RESOURCES

In order to put the problems facing the scheme into perspective, a short discussion on the human resources available to the scheme is necessary. Prospective settlers for Homboy scheme come from two sources, first and foremost, the present Dujuuma population, representing approximately 80% of the final settled population, and the present population of the project area, who will provide the remaining 20%. This situation precludes any form of settler selection on the basis of suitability, a feature normally associated with settlement schemes elsewhere. With a recent background of a purely nomadic existance, the Dujuuma settlers have little experience or knowledge of agriculture, and although the existing population of the project area have been practicing sedentary agriculture for many years, even they lack experience in irrigation. The problem is compounded by the abnormal family composition of the Dujuuma group, where because of imigration back to the rangelands during the past few years, nearly half of the families have no head of household. Although to a degree the Dujuuma settlers have become demoralised though failures in agricultural production and much enforced idleness, encouragement can be taken from settler attitudes towards development at Kurtun Waarey and Sablaale settlement schemes, which have, In relative terms, been successful. This does however underline the need for good planning and good management especially in the critical early years of development.

2.3 LAND AND WATER RESOURCES

Before discussing alternative development strategies, an overall appreciation of the physical characteristics of the project area is essential. The area is approximately 30 km in length and between 3.5 km and 8 km wide. It is dissected by the main canal, which follows the old Farta Tukuule channel. Both Kurtun Waarey and Sablaale schemes, which are smaller in size and more regular and rectangular in shape, are managed centrally and settlers live in one large central village. Because of the size and shape of the Homboy project area, a similar structure could present untold problems. Apart from this, the SDA have indicated their dissatisfaction of the other schemes managerial model, where the centralised development phase has persisted to the detriment of the long term objectives of a more developed cooperative system with a high level of settler participation. A sub-division of the project area was therefore indicated, and this has been achieved taking into account physical limitations which affect the layout of the irrigation system, and the socio-administrative structure desired by the SDA. The project area is thus divided into ten blocks, each served by its own distributary canal(s), and ranging in size from 575 to 1,525 ha. Each block will be worked by one village, sized according to the area of irrigated land on the basis of 1 ha per family. The basic unit of the irrigation in field works is 25 ha and irrigation design is such that it imposes no constraints on management systems or cropping.

2.4 ALTERNATIVE DEVELOPMENT STRATEGIES

2.4.1 State Farm

As the name implies, this method of development would involve the centralisation of the management for the whole of the irrigated land of the Homboy Scheme. The prospective settlers would become no more than paid labour on the scheme. Profit-sharing according to the amount of inputs supplied by individuals could be attempted but would be difficult to define, cumbersome and time consuming to implement, and expensive to administer.

The development of the Homboy Scheme as a state farm was initially favoured by the S.D.A. The more obvious advantages of the state farm development include:

(a) it minimises the requirements for skilled and semi-skilled personnel. In the present situation trained people are in very short supply in Somalia. The state farm can make the best use of the few capable well trained people that are available.

(b) it can provide economies of scale in a wide range of activities including land preparation and harvesting operations, processing and storage facilities, marketing, servicing and accounting procedures etc.

The main disadvantages of the development of the Homboy Scheme as a state farm, in the light of the major objective which is to settle nomads, are mainly related to the settlers themselves and include the following:

(a) the prospective settlers are not likley to readily accept the discipline necessary to establish a productive force of paid labourers and are likely to opt out of the scheme in significant numbers.

(b) the state farm is unlikely to be able to provide the incentives necessary to overcome the natural inclination for the settlers to reject regular paid employment.

(c) the state farm will have to pay minimum wage levels and high labour costs could lead to increasing pressure for higher mechanisation levels with a corresponding decline in demand for labour; thus defeating the major objective of the development which is to provide the maximum number of people with the opportunity of becoming independent, self sufficient and able to enjoy an acceptable standard of living.

(d) the benefits that accrue a state farm would presumably be passed on to Central Government which would be of little benefit to the local community and to the broader objectives of regional development.

2.4.2 The Village Collective

The village collective, based on the village blocks, would attempt to involve all settlers in the production process. In theory members of a village collective receive a share of the production or profits based on their contribution to the production process. However a system of incentives in which rewards were related to effort would be difficult to implement particularly when dealing with people who are unaccustomed to accepting orders and to working regular hours. Major difficulties would certainly arise in carrying out the administration involved in the operation of such a system of incentives which would require the most detailed recording of all aspects of the farming activities.

There are also serious doubts about the acceptability of village collectives to the prospective settlers. The successful operation of a village collective will necessitate considerable changes in the way of life of thesettlers; in particular the traditional values of individual or family independence of nomadic people must be radically changed to an enthusiasm for group activities and a belief in co-operative effort. It is unlikely that such changes can be achieved amongst a heterogeneous group of prospective settlers at the village level. Smaller groupings within the village blocks would have a much greater chance of success in galvanising collective or co-operative efforts amongst the prospective settlers.

2.4.3 Co-operatives Within the Village Blocks

Both the state farm and the village collective require centralised management and do not involve the settlers in the decision making process nor can the settler identify with any particular piece of land or group of people. The longer term success of the Homboy Scheme, as measured in terms of settler satisfaction with his life and living standard, will depend to a large extent on giving as much freedom of action as possible to the settlers themselves and enabling them to obtain rewards commensurate with their efforts. Thus it may be concluded that the establishment of small groups of farmers, as co-operatives, within the village unit will enhance the chances of long term success of the Homboy Scheme as compared with the state farm or village collective.

The organisation of groups of farmers within the village blocks into 50 ha. co-operatives would not be immediately attainable because of the shortcomings of the prospective settlers. During the initial stages of implementation of the development of irrigated agriculture, a period would be required for farmer acclimatisation to sedentary agriculture and farmer education in the art of arable farming. It will however be possible for groups of 50 families (one 'udud') to be identified and allocated 50 ha. (two fields) of irrigated land right from the start. The basic component of the villages proposed has been designed with this in mind, as have the irrigation in-field works. Although during the early stages of development the settler families will provide labour only on their 50 ha. units under a centralized block management regime, this action could pave the way for a smooth and gradual transition to a more devolved system of co-operatives.

2.5 THE PROPOSED FORM OF DEVELOPMENT

A major development criterion laid down by the Settlement Development Agency was that each settler family should be allocated 1.0 hectare of irrigated land. This allocation was aimed at providing an acceptable standard of living for the settlers whilst at the same time maximising the number of people that could be accomodated on the Settlement schemes.

The development of a large irrigation project based on individual one hectare holdings obviously creates considerable managerial problems particularly in relation to water distribution and to the use of farm machinery designed for large fields. Indeed these managerial problems are such that they preclude any possibility for farming one hectare holdings as Independent units. Thus for the Homboy scheme some form of amalgamation of holdings will be required and in the previous section 2.4 three possible agricultural development strategies were considered; none of which included individually farmed one hectare holdings.

Of the three strategies considered, the 50 ha. co-operative is the most favourable and agricultural planning is based on this strategy. Thus the scheme would be divided into ten village blocks, and each block into a number of 50 ha. co-operatives. It is proposed that each village block should be largely self sufficient in terms of management, machinery services, infrastructural requirements, administration and credit, thus providing the necessary support for the 50 ha. co-operatives to operate. Some services however, must be centralised to obtain maximum efficiency, these would include; workshops for major machinery repairs and the organisation, operation and maintenance of the main irrigation and drainage system. The project headquarters would also co-ordinate and liaise with the ten blocks, provide the main link with the S.D.A. in Mogadishu and provide technical back-up on request.

During the initial stages of development however, there is a clear need for more centralised control, as has proved to be the case at both sister schemes. The main difference with the Homboy Scheme will be that each 'udud' will be allocated 50 ha. units of land from the start, and that with careful management, these embryo co-operatives will develop as their capacity to manage and make decisions grows.

It is proposed that strong central management at block level will be necessary for a period of five seasons, and that thereafter the co-operatives be established, and decision making progressively devolved to them. Because the proposed method of financing production will inevitably lead to the accumulation of a deficit, sufficient financial control will need to be retained at block level during the defecit recovery period.

2.6 RATE OF DEVELOPMENT

The proposed rate of development on which the agricultural planning is based, can be derived from the engineering construction programme. It is assumed that there are no agricultural constraints to rate of development i.e. as soon as the land has been levelled and prepared for irrigation, cropping can commence. The construction of villages, the movement of settlers, the supply of machinery and other agricultural inputs etc. must all be geared to the programme for the construction of the irrigation works and land development. It is also assumed that the whole scheme will be developed despite a short fall in the number of families available from Dujuuma and the resident popualtion of the project area.

The rate at which land will be brought into production is shown in Table 2.1.

TABLE 2.1 AGRICULTURAL DEVELOPMENT PROGRAMME

Year	Season	Block	Area	Cumulative Total
1982	der	1	600	600
1983	gu	2 & 3	1,525	2,125
1984	gu	4	925	3,050
1984	der	5	1,025	4,075
1985	gu	6 & 7	1,925	6,000
1986	gu	8 & 9	2,100	8,100
1986	der	10	750	8,850

2.7 THE DEVELOPMENT OF THE CROPPING PATTERN

Because of the limitations imposed by the human resources, the high demands on settler labour during irrigation and drainage and village construction and managements heavy initial involvement in planning and setting up the permanent management structure, it is proposed that a simplified cropping pattern be applied to each block for the first three seasons of production. The 160 per cent cropping intensity will be applied, but only two crops namely maize and upland rice will be grown in equal proportions. From the fourth season on, the full cropping pattern will be applied, but it is not ancitipated that yield build-up will start to occur until the eighth season of production, thus allowing ample time for management and farmers alike to settle down to the routines of production.

The build up of areas under the various crops is shown at Table 2.2. This covers the period from the commissioning of block 1 in the der season of 1982 until 1987 when full development is reached.

TABLE 2.2 CROPS - CUMULATIVE AREA BY SEASON (ha)

	1982		1983		1984		1985		1986		1987	
Crop	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
Vegetables	-	30	106	106	152	203	299	299	378	406	406	406
Groundnuts	-	-	319	-	458	-	901	-	1,137	-	1,219	-
Sesame	-	90	-	319	-	612	-	901	-	1,219	-	1,219
Maize	-	120	425	425	610	815	1,200	1,200	1,515	1,625	1,625	1,625
Upland Rice	-	120	425	425	610	815	1,200	1,200	1,515	1,625	1,625	1,625
Cotton	-	240	-	850	-	1,630	-	2,400	-	3,250	-	3250
Paddy Rice	-	-	-	-	-	-	-	-	315	725	435	725
Total	-	600	1,275	2,125	1,830	4,075	3,600	6,000	4,860	8,850	5,310	8,850

3

Crop Selection, Agronomy and Cropping Patterns

3.1 CROP SUITABILITY

Soils and climate are normally the primary factors determining the range of crops which are agronomically suitable. Although the soils in the Homboy area are generally fine textured and slow draining there are distinguishable differences between the soils of the levees and depressions, the latter being slightly finer textured. On both, however, infiltration rates and available water holding capacities are acceptable but the salinity levels at the lower horizons, 50-100 cm, indicate a slight potential hazard from salinity. Apart from the depression soils being better suited to paddy rice, the soils in the project area are unlikely to exert any major influence on the range of crops which can be grown.

Climatically the area is suited to a wide range of crops. The main limitation is rainfall but this can be alleviated by the introduction of irrigation. Without construction of a storage reservoir on the Jubba, however, cropping will still be limited by a period of low river flows between the latter part of January and mid-April. The effective growing season therefore, with irrigation but without a storage reservoir on the Jubba, is about 240-260 days and effectively eliminates the possibility of growing perennial crops. The range of main crops considered was confined to the annual crops; rice, maize, sesame, groundnuts and cotton. Fruit and vegetables were also considered as potential minor crops.

3.2 MAIZE

Maize is one of the most widely grown and important crops in both the Jubba and Shabeelle valleys. As significant quantities are imported annually (currently around 20,000 tonnes), any increase in production would increase the amounts available for local consumption and reduce the national import requirement. Present production is largely dependent upon rainfall and residual soil moisture after flooding. The construction of a formal irrigation scheme could lead to more intensive production systems and significantly higher yields. Although it can be grown in both the 'gu' and 'der' seasons, yields in the 'gu' season are usually higher than in the 'der'.

(a) Varieties

A number of local varieties and a recently developed Somali composite variety are currently available. The composite far out-yields the local varieties and although it is less acceptable for local consumption because it is yellow seeded, it is the variety recommended for immediate production on the scheme. It is short-statured, matures within 105 days and is easily double-cropped. In the longer term, however, it is recommended that every effort should be made to develop a white seeded composite which would be preferred for local consumption. Recent work by the FAO Seed Production and Certification Project at Afgooye is promising and could provide a solution.

(b) Land Preparation and Planting

Primary cultivations should be mechanised and would comprise a combination of ploughing and disc harrowing. Levelling would be carried out every other year or prior to every third crop season. Pre-planting operations would comprise ridging for the furrow irrigation system proposed. Inter-row cultivation would be necessary during the early stages of growth.

Planting would be by hand at a rate of 20 kg of seed per hectare giving a population of around 50,000 plants. Seed would be dressed with Fernasan D.

Planting in the 'gu' season would coincide with the onset of the rains (normally mid-April) and would be completed by early May. Later planting could lead to a higher incidence of stalk borer and limit the potential for double cropping. Harvesting would be in August when the expected rainfall is minimal. 'Der' season planting should be limited to the period between mid-September and mid-October. 'Gu' maize would be harvested in early August and 'der' season maize in late December/early January.

(c) Fertilisers

Without specific fertiliser trials in the area, it is difficult to make precise recommendations on the levels which should be applied. There is enough information available however, from CARS and the FAO Pilot Project (between 1965 and 1974) to give an indication of the levels at which economically worthwhile responses are likely to be achieved. Rates of 50 kg per hectare of diammonium phosphate and 150 kg per hectare of urea supplying 79 kg nitrogen and 25 kg of P_2O_5 per hectare would probably be of the correct order.

(d) Pests and Diseases

The most serious pest in the area is the maize stem borer (*Chilo partellus*). Effective control can be achieved by applying two sprays of Nuvacron Combi (Monocrotophos/DDT) at 10 and 20 days after planting i.e. 5 litres per hectare total application. Cutworms can occasionally (1 year in 3) cause serious damage. Furadan (Carbofuran) granules mixed with the seed (1 per cent active ingredient per 100 kg of seed) will provide adequate control.

(e) Weed Control

It is expected that weed control could be achieved by hand weeding. Three weedings at 10, 20 and 40 days after planting would probably suffice.

(f) Harvest

Hand harvesting is recommended. Direct picking of cobs would probably be the most practical method. It would allow full grain drying to take place and as harvest would be in August and January there should be little risk of rain damage.

(g) Yields

Although there is little information available on the current maize yields in the Homboy area, it is considered unlikely that they should differ markedly from yields being achieved by smallholders growing maize under traditional cultivation systems elsewhere in the Jubba. These usually vary between 2 and 5 quintals per hectare. With the development of irrigation and the introduction and acceptance of recommended practices, the yield potential would be considerably higher. Yields of 1,700 kg per hectare (after considerable rat damage) have been recorded at the Jilib

State Farm, almost 2,000 and 2,500 kg per hectare in the 'gu' and 'der' seasons respectively have been achieved at the FAO Pilot Project and considerably higher yields, 6,000 and 7,000 kg per hectare, have been achieved under experimental conditions (CARS 1964-1975; FAO 1975). Overall there is sufficient evidence within Somalia and from neighbouring countries, (e.g. Kenya) that under reasonable husbandry conditions, yields of 3,500 to 4,000 kg per hectare can be achieved with composite varieties. Since there is no technical reason why these could not be achieved in Somalia the following yield build-up is expected:

	Year 1	Year 5	Year 10
'Gu' season (kg per hectare)	2,000	3,000	4,000
'Der' season (kg per hectare)	1,800	2,800	3,500

(h) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Note
Seed	-	20.0	
Seed dressing	Furadan granules	0.2	Control of cutworms
Fertiliser	Diammonium phosphate	50.0	
	Urea	150.0	
Pesticide	Nuvacron Combi[1]	5.0	Control of stem borers

Note:
[1] *Mechanisation requirements.*

(ii) Mechanisation Requirements

Operation	Machinery	Hrs/ha.
Land preparation	Tractor + plough	2.65
	2 x tractor + disc harrow	1.90
	Tractor + ridger	0.89
Inter- row cultivation	Tractor + inter-row cultivator	0.89
Transporting	Tractor + trailer	2.60

(iii) Labour Requirements

Operation	Man Hrs/ha.	Notes
Basal dressing fertiliser appl.	5	Broadcast before ridging
Planting	25	By hand
Pest control	2	2 ULV sprays at 10 and 20 days after planting
Top dressing	25	Placed by hand 20-25 days after planting
Weed control	150	By hand 3 x up to 45 days after planting
Irrigation	100-117*	6 or 7 applications
Harvesting of cobs	25	At 105 days
Carting and shelling	16	Shelling by machine
Stover cutting and carting	40	Fed to livestock
Miscellaneous activities (+ 10%)	39	
Total	**427 - 444**	

* *Will vary according to rainfall.*

3.3 RICE

Annual imports of rice have risen, in recent years to around 30,000 tonnes and are of a similar order to the other major grains wheat and maize. It is important therefore, that domestic production is increased to meet the growing consumer demand and to reduce imports.

Rice is grown under both upland and paddy conditions and is cultivated in the 'gu' and 'der' seasons, although rice planted in the former is more susceptible to damage by birds (mainly *Quelea quelea*). Yield differences are related to the system under which the crop is grown (upland or paddy) rather than to the season, paddy yields are significantly higher than those from upland conditions. 'Upland rice' however, is generally preferred by the consumers, and commands a price premium of around So Shs 70 per quintal. This reflects varietal differences rather than the actual system under which rice is cultivated. Upland rice is of the long grained type (indica) whereas paddy is more usually short grained (japonica).

3.3.1 Upland Rice

(a) Varieties

Vista, the variety currently recommended, was recently released after trials at Afgooye. It is a 105 day variety and has outyielded the two 120 day varieties Dawn and Saturn which, until recently, were the standard recommended varieties. Vista has higher yield potential and its shorter growing season allows greater flexibility for double cropping, avoiding water shortage and bird damage. The seed stocks currently under multiplication at Afgooye are impure and new seed should be introduced.

(b) Land Preparation and Planting

Primary cultivations would comprise a combination of ploughing and disc harrowing. Land levelling would be required between alternate crops and spike toothed harrowing could be necessary to create a medium tilth. Seed should be dressed with Fernasan D and be drilled in 15 cm rows at a seed rate of 90-100 kg per hectare.

The recommended planting dates are:

'Gu' season. As soon as possible after water is available in April in order to avoid bird attacks which would become a problem from mid July onwards.

'Der' season. Late August for crops to be harvested in December. Earlier planting would mean harvesting in the November rains whilst later planting would increase the incidence of bird damage.

(c) Fertilisers
Without experience of rice growing in Homboy it is difficult to make precise recommendations on the levels of fertiliser to be applied. Rice, however, is known to respond to fairly high levels of nitrogen and phosphate. It is considered likely therefore, that economic responses would be achieved up to levels in the order of 75 kg N and 25 kg P_2O_5 per hectare. This could be supplied as 50 kg of diammonium phosphate (DAP) at planting and 140 kg urea applied as a top dressing 25 days later.

(d) Weed Control
Without herbicides the maintenance of adequate weed control would be extremely difficult and up to six or seven hand weedings would be required. Herbicide control comprising a post emergence spray of Propanil/Preforan at 12 litres per hectare, 10 days after crop emergence is therefore recommended. This may have to be supplemented by 'spot' herbicide application and one or two hand weedings between the fifth and seventh week (when full canopy is reached) after ear emergence.

(e) Pests and Diseases
The major problems are likely to be associated with rice stem borer (*Chilo partellus*) and birds (mainly *Quelea quelea*). Planting as early as possible and rapid harvesting by combine harvester will help to minimise the damage.

- Rice stem borer: can be effectively controlled by ULV sprays at tillering with 2.5 litres per hectare of Carbicron (Dicrotophos) and at heading with 2.5 litres per hectare of Nuvacron. Both chemicals have been tried at the Libsoma farm (Afgooye) and have been shown to provide effective control.

- *Quelea quelea:* Bird scarers (at least 3 per hectare) are likely to be required in most years from the onset of heading until harvest. Planting as early as possible and in the 'gu' season and rapid harvesting by combine harvester with help to reduce the damage.

(f) Irrigation
Water requirements are discussed in Chapter 4. Because of its high demand and shallow rooting irrigations would be at frequent intervals of between 4 and 10 days, until about 90 days after planting.

(g) Harvesting
Although Vista is not prone to excessive shattering, rapid harvesting will be essential to minimise bird damage. Mechanised harvesting by combine harvester is therefore recommended.

(h) Yields
The average yield achieved in recent years, at the Fanoole State Farm has been 17.2

quintals per hectare; yields up to 27 quintals per hectare however have been recorded. Good results have been achieved at the FAO pilot project where 8 hectares yielded 30 quintals per hectare in 1973 and 29.5 quintals per hectare in 1974. Since these yields were achieved with the lower yielding varieties Dawn and Saturn it is likely that yields of 25 to 30 quintals per hectare should be consistently achieved using Vista. The expected yield build up with implementation of the project is as follows:

	Year 1	Year 5	Year 10
Kg per hectare	2,000	2,500	3,000

(j) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Note
Seed	-	100.0	
Seed dressing	Fernasan 'D'	0.5	Cutworm control
Fertilisers	Diammonium Phosphate	50.0	
	Urea	140.0	
Herbicide	Propanil/Preforan (I)	12.0	
Pesticide	Carbicron (I)	2.5	Stem borer control
	Nuvacron (I)	2.5	

(ii) Mechanisation Requirements

Operation	Machinery	Hrs/ha.
Land preparation	1 x tractor and disc harrow	0.95
	1 x tractor and plough	2.65
	1 x tractor and disc harrow	0.95
	2 x tractor and Eversham 3212 R.T.	0.74
Seeding	Tractor and drill	1.20
Bunding and minor canal formation	Tractor and 'A' frame	0.18
Harvesting	Self-propelled combine harvester (MF 307)	1.23
Carting	Tractor and trailer at planting etc.	0.50
	Tractor and trailer at harvest	0.67

(iii) Labour Requirements

Operation	Man Hours/ha	Notes
Drilling-seed + basal fert. appl.	2	Assisting tractor driver
Pest control	2	Using ULV sprayers
Top dressing N. fertiliser	5	Broadcast
Weed control	121	Traditional methods
Irrigation	90	10 appl. basin irrigation
Carting inputs, grain and straw	6	
Minor operations, miscellaneous travelling, field inspections etc	26	
Miscellaneous activities + 10%	25	
Total	277	

(iv) Weed Control by aerial spraying

3.3.2 Paddy Rice

The depression soils are probably best utilised for continuous rice growing. Paddy rice is currently being successfully cultivated at the Jowhar Experimental farm, by a Chinese Technical Aid team. It is also being cultivated at the Haawaaye Crash Programmes Farm.

(a) Varieties

Kendo and Shendo, both 120 day maturing varieties have been recommended by the Chinese Technical Aid Team. They have similar yield potential but Shendo is more prone to shattering. Vista is regarded as equally suitable, being physiologically adapted to either paddy or upland conditions and a high yielder. It has the additional advantage of being an earlier maturing variety allowing greater flexibility and scope for avoiding drought or bird damage. Any of the three varieties can be recommended; indeed a combination of Vista and either Shendo or Kendo would allow some scope for spreading the harvest period if necessary.

(b) Land Preparation and Planting

Primary cultivations would be similar to those for upland rice but greater emphasis would have to be placed on levelling (land planing) which would be required between successive crops.

Direct drilling of the crop is again recommended. There is no evidence which clearly indicates a yield advantage from transplanting and with the supply of family labour likely to be available the labour requirement for transplanting would be too high. About 90 kg of seed would be used for all three recommended varieties.

(c) Fertiliser

There is not enough local information available to make precise recommendations on levels of fertiliser use. These should not differ markedly from upland rice and 150 kg per hectare of urea and 50 kg per hectare of diammonium phosphate should be of the right order.

(d) Other Operations

Pest control and harvesting recommendations are similar to those made for upland rice. Since full flooding of crops is required from the 25 day onwards, water will provide an effective means of weed control after the application of the Propanil/Preforan spray.

The crop water requirements for paddy rice will be similar to upland. A greater field requirement will be necessary however, to maintain the required flood. The irrigation recommendations for paddy are as follows:

- regular irrigations at short intervals until 25 days after planting:
- maintenance of a flood depth of 10-15 cm water from 25 to 90 days after planting for Vista and 25 to 100 days after planting for the Chinese varieties.

(e) Yields

Paddy rice is expected to produce higher yields than upland. At Haawaaye average yields of 30 quintals per hectare have been achieved in successive years whilst at Jowhar experimental farm yields of up to 50 quintals per hectare of paddy have been obtained from a 40 hectare field. If recommended practices are followed the build up in yields is expected to be the following order:

	Year 1	Year 5	Year 10
Paddy rice (kg per hectare)	2,400	3,000	3,500

(f) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Note
Seed		90.0	Drilled
Seed dressing	Furadan granules	0.5	Control of cutworms
Fertiliser	Diammonium phosphate	50.0	Applied to seedbed
	Urea	140.0	Top dressing
Herbicide	Propanil(I)/Preforan (I)	12.0	Single application Post emergence
Pesticide	Carbicron (I)	2.5	Stem borer control
	Nuvacron (I)	2.5	

(ii) Mechanisation Requirements
As for upland rice.

(iii) Labour Requirements

Operation	Man Hrs/ha	Notes
Drilling - seed + basal fertiliser	2	Tractor drivers assistant
Pest control	2	Two applications
Top dressing N fertiliser	5	Broadcast
Weed control	40	Supplements use of herbicide
Irrigation	70	Basin irrigation
Carting inputs, grain and straw	6	
Minor operations - miscellaneous travelling, field inspections etc.	26	
Miscellaneous activities (+ 10%)	15	
Total	**166**	

(iv) Weed Control by Aerial Spraying

3.4 SESAME

Sesame is an important annual crop and is grown extensively throughout the Jubba and Shabeelle basins. Since imports of vegetable oils are rising and currently amount to about 14,000 tonnes per year, sesame production should be encouraged to offset the increasing levels of imports. Despite its traditional importance in the riverine areas, it has been the subject of relatively little research into improving varieties and production practices. Although it can be grown in either the 'gu' or 'der' seasons, it is much better suited to the 'der'. 'Gu' season plantings are more susceptible to 'footrot' and poor flower set and there is a risk of 'haggai' rains making harvesting conditions difficult.

(a) Varieties
The current local variety is the only one which can be recommended at this stage. Improvement is probably best achieved by the selection of pure lines within this variety. Introductions of new varieties, which originated mainly from Egypt have been tried, but they compared poorly with the local variety. Successful introduction of new varieties is likely to be difficult as sesame has fairly specific requirements and a narrow range of adaptability.

(b) Land Preparation and Planting
Sesame is recommended as a 'der' season crop only. If adequate weed control is maintained in the preceding 'gu' season crop (or fallow) then primary cultivation would probably only require disc harrowing followed by spike tooth harrowing to produce a medium to fine seed bed.

Hand planting is recommended with a row spacing of 75 cm and seed planted at 'hills' spaced 30 cm within the rows requiring a seed rate of 8-10 kg per hectare. Seed should be dressed with Fernasan D prior to planting. Planting can be carried out from mid-September to October allowing flowering to take place after the 'der' rains and thereby maximising pod set. Supplementary irrigation would be required in December.

(c) Fertilisers
Although two trials at Afgooye indicated significant yield increases at very high applications of N and P, in general sesame does not respond well to fertiliser application. It is likely therefore that only light applications of N and P in the order of 40 kg urea per hectare, and 25 kg per hectare of diammonium phosphate (DAP) need be applied. This could be applied in a single dressing prior to a pre-planting irrigation.

(d) Weed Control
Since sesame is likely to be sown mainly on a pre-planting flood irrigation, weeds will be most serious in the early stages. At least two hand weedings will be necessary within the first 35 days, thereafter weeding is unlikely to be necessary.

(e) Pests and Diseases
If sesame is planted at the times recommended, it is unlikely to be seriously affected by pests or diseases other than cutworm (*Agrotis*) and chafer bug. The cheapest and probably most effective control is to apply Furadan granules (1 per cent a.i. per 100 kg seed) with the seed at planting. Attacks by soil-borne pests can be expected in two out of every three years and consequently it is recommended that control measures are used with every planting.

(f) Irrigation
Since sesame is particularly susceptible to waterlogging in the seedling stage, irrigation during the early growth period should be avoided. If a heavy irrigation (160 mm) is applied prior to planting then irrigation will only be necessary during the flowering stage. In all three or four irrigations will be required.

(g) Harvesting
The local variety which is recommended is a dehiscent type prone to shattering. The traditional harvesting methods are recommended with the modification that stooks are placed on plastic sheeting to enable shattered seeds to be collected.

(h) Yields

Although smallholders' yields are probably between 2 and 3 quintals per hectare, higher yields have been obtained under field scale irrigation. About 4.8 quintals per hectare were obtained at Kurtun Waarey in the 1978 'der' season whilst elsewhere some of the better farmers claimed yields of 6-8 quintals per hectare. Under research conditions at Afgooye yields of between 8 and 8 quintals per hectare have been obtained. The highest yields obtained on the FAO Pilot Project exceeded 8 quintals per hectare. If recommended practices are followed it is considered that the yield potential of the local variety is fairly high and the following yield build-up could be expected:

	Year 1	Year 5	Year 10
Sesame (kg per hectare)	500	650	800

(i) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Notes
Seed	-	8.0	-
Seed dressing	Furadan	0.1	Cutworm control
Fertiliser	Diammonium phosphate	25.0	All applied to seed bed
	Urea	40.0	

(ii) Mechanisation Requirements

Operation	Machinery	Hrs/ha.
Land preparation	Tractor + plough	2.65
	3 x tractor + disc harrow	2.85
	Tractor + ridger	0.89
Inter-row cultivation	Tractor + inter-row cultivator	0.89
Transporting	Tractor + trailer	1.0

(iii) Labour Requirements

Operation	Man Hrs/ha.	Notes
Basal fertiliser appl.	5	Prior to ridging
Planting	20	
Weeding	100	2 x in first 35 days
Irrigation	67	4 x incl. 2 x whilst flowering
Harvesting	90	Cutting, tying stooking
Threshing	50	Beating and winnowing
Transporting	2	
Miscellaneous (10%)	33	
Total	**367**	

3.5 GROUNDNUTS

Although grown on a lesser scale than sesame, groundnuts are a traditional crop of the inter-riverine areas being cultivated under both rainfed and irrigated conditions. Ideally groundnuts prefer light textured well drained soils but successful production on heavy clays has been achieved in the Sudan. The problems with heavy soils, however, magnify the need for highly skilled management. These problems stem from the physical characteristics which alter markedly with the moisture content of the soil. When too wet or too dry pegging, pod development and harvesting can be adversely affected. Despite this groundnuts are a potentially suitable crop mainly because they are currently being grown in Somalia, fairly high yields have been achieved under research conditions and because production of groundnuts could lead to a reduction in imported vegetable oils.

The crop can be grown in the 'gu' or 'der' season with little seasonal variation. The 'gu' planted crops can be affected by the 'haggai' rains which can create difficulties at harvest and cause germination in mature pods, but this is not considered a serious problem.

(a) Varieties

Because of the production problems with heavy soils, only short season Spanish-Valencia types can be recommended. A number of varieties have been tried at Afgooye between 1966 and 1972. The two most promising are Florigiant and Sudan I. They are both 115-120 day varieties, and either can be recommended.

(b) Land Preparation and Planting

Land preparation requirements are similar to maize (Section 3.2.6) and should comprise a combination of ploughing and disc harrowing with land levelling after the third successive crop. Because of the heavy textured soils, the crop should be grown on ridges and a system of furrow irrigation used. The crop should be planted in single rows on 60 cm ridges or double rows on 80 cm ridges at a seed rate of 90-100 kg per hectare. The seed should be shelled and planted by hand to obtain an even stand.

'Gu' season planting should be between mid-April and mid-May and 'der' season between mid-August and mid-September. The latter would allow harvesting to take place in December after the 'der' rains when the soil moisture content can be controlled by the application of a light irrigation if necessary prior to harvest. The risks of 'gu' planting and isolated rain storms during harvest in the 'haggai' season have already been pointed out.

(c) Fertilisers

Trials at the FAO Pilot Project have indicated positive but inconsistent responses from groundnuts to fertilisers. Since heavy nodulation has been observed on groundnuts grown at Afgooye and since responses are mainly to phosphorus, it is expected that very little nitrogen will be necessary. A single dressing of 75 kg of DAP per hectare applied at planting would provide 37 kg P_2O_5 and 15 kg of N and should be adequate. As with all of the other crops precise recommendations will have to await the results of fertiliser trials in the area.

(d) Weed Control

Hand weeding is recommended as the most appropriate means of maintaining weed control. Pre-emergence herbicide sprays are possible (Gesagard 500 PW + Dual 500 EC at 2 litres + 2 litres per hectare respectively: Ciba Geigy 1977 recommendation) but given the availability of family labour it is not recommended that herbicides be used. If necessary mechanical cultivations could be used until flowering to supplement hand weeding. In total about four hand weedings would be required until about 60 days after planting when full crop cover is reached.

(e) Pests and Diseases

Apart from occasional cutworm damage no serious pests are expected. Fungicide sprays may be necessary to control 'leaf spot' (*Cercospora arachicola*).

(f) Irrigation

Groundnuts should receive regular irrigation at approximately two weekly intervals until 90 days after planting.

(g) Harvesting

Fully mechanised harvesting is not recommended. The most appropriate system would be a combination of partial lifting by a machine (by blades mounted on a tool bar) and final lifting and gleaning by hand. The harvested plants should then be stacked and air dried before stripping and storage.

(h) Yields

Yield information dating back to 1958-1959 (Selchozpromexport, 1965) indicate that up to 28 quintals per hectare of unshelled nuts have been obtained in the Jubba region. Recent yields at Fanoole, however, have been as low as 6 quintals per hectare but this probably resulted for a bad attack of leaf spot. Average yields are generally around 16 quintals per hectare. Since research trials at experimental plot and field level have yielded 49 and 24 quintals per hectare respectively it is believed that it should be possible to eventually achieve average yields of up to 20 quintals per hectare. The expected build-up in yields is as follows:

	Year 1	Year 5	Year 10
Unshelled groundnuts (kg per hectare)	1,500	1,800	2,500

(i) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Note
Seed	-	90.0	Shelled nuts
Seed dressing	Fernasan D	0.6	-
Fertiliser	Diammonium phosphate	75.0	All applied to seedbed

(ii) Mechanisation Requirement

Operation	Machinery	Hrs/ha.
Land preparation	Tractor + plough	2.65
	2 x tractor + disc harrow	1.90
	Tractor + ridger	0.89
Inter-row cultivation	Tractor + inter-row cultivation	0.89
Lifting	Tractor + groundnut blader	0.89
Transporting nuts haulms	Tractor + trailer	2.00

(iii) Labour Requirements

Operation	Man Hrs/ha.	Notes
Shelling seed	4	
Basal appl. of fertiliser	5	Prior to ridging
Planting	40	By hand
Weeding	200	4 x to 65 days after planting
Irrigation	134	8 x to 90-95 days after planting
Lifting/gleaming/stripping	150	
Transporting haulms and nuts	6	
Miscellaneous 10%	54	
Total	**593**	

3.6 COTTON

There is a high demand for cotton fabric in Somalia, and currently only about 20 per cent of this is met from the locally grown crops. The majority of the local cotton originates from peasant smallholdings where yields are low and highly variable. Production on larger schemes (Afgooye Mordile and Balcad Projects) under controlled irrigation is limited and has tended to decline. As soil and climatic conditions are suited to the production of cotton and as it represents an opportunity for import saving it is regarded as a potentially important crop for the Homboy scheme. Furthermore, it is well suited to production projects where family labour would be available for picking. The poor average yields (around 1 tonne seed cotton per hectare) obtained at Balcad (700 hectares) and in production trials at the FAO Pilot Project indicate that even with suitable soils and climate, a high standard of management is required particularly for the control of insect pests.

Because of the possibliity of rainfall in the 'haggai' season it should only be grown in the 'der' season. It matures in about 180 days and is harvested in the dry 'Jilal' season.

(a) Varieties

Medium staple upland cotton (*G.hirsutum*) is the most suitable type for the project and meets the requirements of the local market. Long staple cotton being more sensitive to salinity and having a high management required, has a lower yield potential. The varieties Acala S.J.1, Acala 4-42 and more recently Barac have been grown at Balcad, whilst Acala 4-42 has been grown at the FAO Pilot Project and is recommended for production in the Lower Jubba (Gitec Consult, 1977). Acala 4-42 is therefore recommended until further trials produce better varieties.

Growth Stage	Days from Planting
First square	40
First flower	50-55
Full crop cover	70
First boll open	110-115
First pick	130-135
Final (third) pick	170-180

(b) Land Preparation and Planting

Primary cultivations would be similar to those for maize and comprise either ploughing and discing (or heavy discing) followed by tined cultivation. Cotton would be grown on ridges and hand planting is recommended in rows 80 cm apart and at on the field scale. The existing information indicates widely varying yields and usually reflects poor pest control and indifferent management. The nearest crop to Jilib was at the Fanoole State Farm where an estimated yield of 5 quintals per hectare of poor seed cotton was obtained. About 10 quintals per hectare are being obtained at Balcad whilst 20 quintals per hectare are being achieved at the seed multiplication farm at Afgooye. With good management the yield potential is higher. Trials between 1966 and 1975 gave yields of over 30 quintals per hectare (CARS, 1966; FAO 1975) and at the FAO Pilot Project it is considered that average yields of 25 quintals per hectare of seed cotton should be obtainable. Given that the recommendations above are followed and that a fairly labour intensive system of production is practised by settlers, the following build-up in yield is expected.

	Year 1	Year 5	Year 10
Seed cotton (kg per hectare)	1,250	1,750	2,500

(i) Summary of Inputs

(i) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Notes
Seed	-	30.0	Undelinted
Seed dressing	Fernason D	0.2	
Fertilisers	Diammonium phosphate	35.0	Seed-bed application
	Urea	60.0	Top-dressing
Pesticide	Nuvacron Combi (l)	25.0	10 application with ULV sprayer

(ii) Mechanisation Requirements

Operation	Machinery	Hrs/ha.
Land preparation	Tractor + plough	2.65
	3 x tractor + disc harrow	2.85
	Tractor + ridger	0.89
Inter-row cultivation	Tractor + inter-row cultivator	0.89
Sprayer	ULV	10.00
Transporting	Tractor + trailer	5.00

(iii) Labour Requirements

Operation	Man Hrs/ha.	Notes
Application of basal fertiliser	5	Before ridging
Planting	25	Seed placement by hand
Top-dressing	25	Placed at 35-40 days
Weeding	200	4 x up to 65-70 days
Pest control	10	10 ULV sprays
Irrigation	116	Furrow irrigation 7 applications
Picking	390	In 3 picks
Carting	5	
Up-rooting and burning	95	By hand
Miscellaneous activities (+ 10%)	87	
Total	**958**	

3.7 OTHER CROPS

A number of other crops mainly vegetables, pulses and fruit will probably be grown by settlers. A wide range of crops within each group are likely to be grown and only the most common are mentioned here. In comparison with the main field crops described in the foregoing sections, they will be relatively less important and consequently discussion is brief. Of the vegetables, tomatoes and onions are likely to be of greatest importance, whilst green gram and cowpeas are the most common pulses. The fruits would almost certainly include mangoes, bananas and papaya and would probably be grown at the settlers homestead and along canals and watercourses rather than as field crops.

Tomatoes are likely to be the most important vegetable. The variety 'Roma' is recommended since it out yields other varieties and imported certified seed is fairly readily available. The seed should be planted in nurseries in July and August to be ready for transplanting into ridges during September. 250 gm of seed would be enough to provide seedlings for one transplanted hectare. Fertiliser requirements would be in the order of 35 kg per hectare of DAP and 100 kg of urea. Pest control measures would have to be rigorously applied and would probably amount to three or four sprays with a systemic insecticide. Yields of up to 20 tonnes of fruit per hectare should be obtained.

The recommended onion variety is 'Red and White Cariole' which should be hand planted in rows 30 cm apart at a seed rate of about 8 kg per hectare. To achieve reasonable yields, onions should receive about 50 kg of DAP at planting and a top dressing of 50 kg of urea. The main pest likely to affect the crop is thrips whilst white rot and downy mildew are likely to be the most important diseases. Between 8 - 10 tonnes of onions per hectare should be achieved.

Green gram and cowpeas are widely grown as inter-crops and are used mainly as a staple food, since prices are low and the market limited. Yield potential of pulses is low with yields of around 10 quintals per hectare being produced under research conditions. Widespread planting of pulses is not recommended; instead they should be limited to the areas required to meet the settlers needs.

Projected yields for tomatoes are:

Year following completion of construction	1	5	10
Yields of saleable fresh fruit kg/ha	7,000	15,000	20,000

3.7.1 Summary of Inputs for Tomatoes

(a) Physical Inputs

Item	Chemical or Trade Name	kg/ha	Note
Seed	-	0.25	Sown in nursery
Nursery fertiliser	10: 15: 10	2.00	
Nursery insecticide	Dimecron		Very small quantity required
Field fertiliser	Diammonium phosphate	35.0	
	Urea	100.0	
Insecticide	Carbofuron	3.6	Heliothis control
	Nogos (Dichlorros)	1.5	Fruitworm control

(b) Mechanisation Requirements

Operation	Machinery	Hrs/ha.
Land preparation	Tractor + plough	2.65
	Tractor + disc harrow	1.90
	Tractor + ridger	0.89
Inter-row cultivation	Tractor + inter-row cultivator	0.89
Transporting fruit	Tractor + trailer	10.0

(c) Labour Requirements

Operation	Man Hrs/ha.	Notes
Nursery preparation and care	30	Per transplanted hectare
Transplanting	65	
Gapping	16	
Application of fertilisers	30	Placement by hand
Pest control	7	ULV sprayer
Weeding	250	
Irrigation	120	Furrow irrigation
Harvesting	400	
Packing and loading	20	
Miscellaneous activities (+ 10%)	94	
Total	**1,032**	

3.8 CROPPING PATTERN

The cropping pattern, and cropping calendar that have been used for planning the Homboy Project are illustrated in Figure 3.1 and the proposed crop rotation and cropping intensity are shown in Table 3.1. The basis for crop selection has already been discussed. The cropping patterns have been determined taking into account rotational constraints, water availability, relative profitability of the selected crops, likely farmer preferences, and labour and mechanisation constraints.

3.9 ROTATIONAL CONSTRAINTS

Apart from some of the vegetables, rotational constraints do not impose any major limitation on cropping patterns. Rice, cotton and maize, three of the more important crops could all be monocropped successfully and the extent to which they are included in the cropping pattern is not determined solely by rotational considerations. Tomatoes, the most important of the vegetable crops, should not be grown more than one year in four if soil borne disease problems are to be avoided but since this crop will not occupy a significant land area it does not require special consideration. It is recommended that a crop rotation is followed as a routine agronomic process.

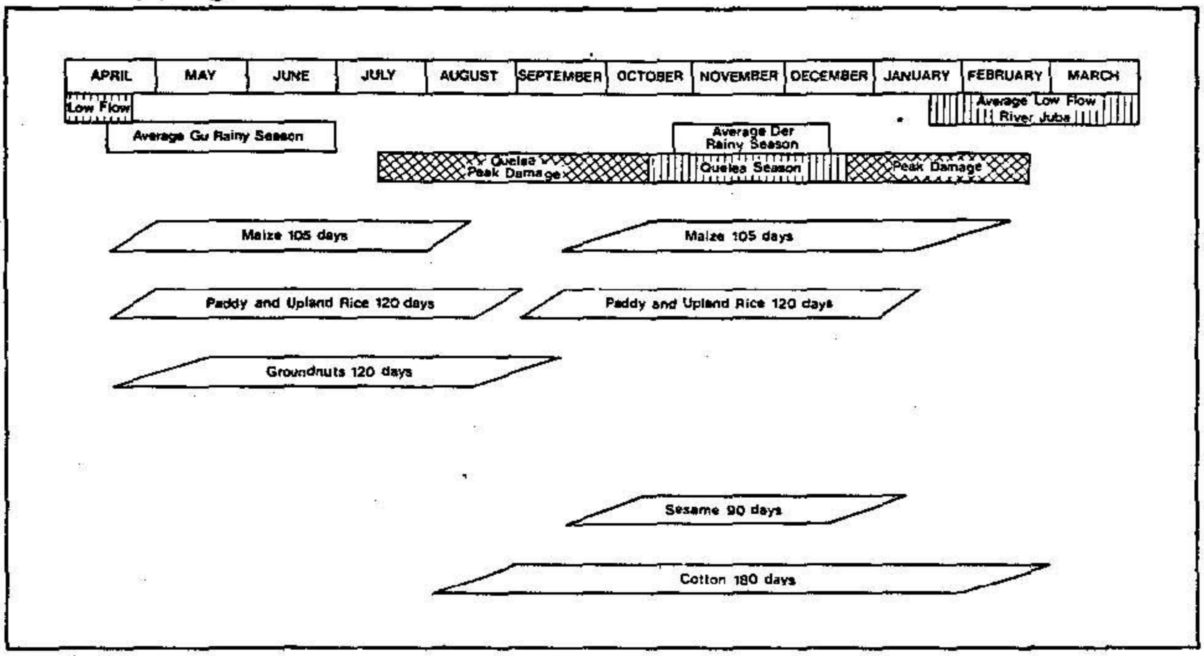
3.10 WATER AVAILABILITY AND THE CROPPING CALENDAR

The hydrological studies have shown that the low flows between mid-January and early April, effectively preclude irrigation in these months and confine the crop growing season to a period of around 260 days. Double cropping is possible within this period for most crops. Cotton has a growth period of 180 days and would therefore have to be preceded by a very short season crop such as green gram.

TABLE 3.1 PROPOSED CROP ROTATION AND CROPPING INTENSITY BY SEASONS

	Sequence of Crops		
Year	Gu	Der	Overall Area %
1	Vegetables	Vegetables	5
	Groundnuts	Sesame	15
2	Maize	Rice	20
3	Fallow	Cotton	20
4	Rice	Maize	20
5	Fallow	Cotton	20
Seasonal intensity	60%	100%	
Overall intensity	160%		

3.1 Cropping calendar



4

Water Requirements

4.1 GENERAL

In the Reconnaissance Report (HTS, 1978) gross irrigation requirements were calculated for an assumed cropping programme taken from the Inter-Riverine Study (HTS, 1977). Since the cropping pattern has now been finalised, it is possible to show the revised monthly requirements for the whole scheme.

There are several methods available for calculating crop water requirements. The guidelines laid down by Doorenbos and Pruitt (FAO, 1975 and 1977) are considered to be the most relevant for the Homboy Scheme, and of the methods which they discuss, that based on the Penman formula is considered to be the most suitable. The following sections describe how this methodology has been used to calculate crop water requirements for the Homboy Scheme.

4.2 RAINFALL

Although several measured meteorological parameters are used in the Penman formula, the contribution of rainfall has a major effect on the quantity of water which has to be provided throughout the irrigation system.

The closest source of rainfall data to the Homboy area is the research substation at Alessandra near Jilib. More recently daily rainfall records have been kept at Fanoole State Farm and at the Jubba Sugar Project at Mareerey. While it may be interesting to compare data from these sources, without doubt the long term records from Alessandra are regarded as the most appropriate for the Study Area, the Jilib data is used in the crop water requirement.

Not all rain that falls becomes available for plant growth. Factors such as surface run-off, deep percolation and soil physical properties affect availability. That proportion of the rainfall which is classified as 'effective' has been calculated using the USBR factors shown in Table 4.1. The 20 per cent dry year monthly actual and effective rainfall based on the Alessandra data are summarised in Table 4.2.

TABLE 4.1 EFFECTIVE RAINFALL

Monthly Rainfall mm	Percentage Effective
0-25	90.0
25-50	87.5
50-75	83.3
75-100	75.0
100-125	66.0
125-150	56.7

Source: USBR
Note: Rainfall over 150 mm per month is not considered.

TABLE 4.2 TWENTY PER CENT DRY YEAR RAINFALL DATA FOR ALESSANDRA

Month	Rainfall 1922-1960 mm	Percentage Effective	Effective Rainfall mm
January	0.0	90.0	0.0
February	0.0	90.0	0.0
March	0.0	90.0	0.0
April	69.0	83.3	57.5
May	56.0	83.3	46.6
June	23.0	83.3	20.7
July	17.0	83.3	15.3
August	5.0	90.0	4.5
September	0.0	90.0	0.0
October	1.0	83.3	0.9
November	20.0	83.3	18.0
December	11.0	87.5	9.9

Source: Fantoli (1965) - (Contributo Alla Climatologia Della Somalie) and Table 4.1.

4.3 CROP WATER REQUIREMENTS

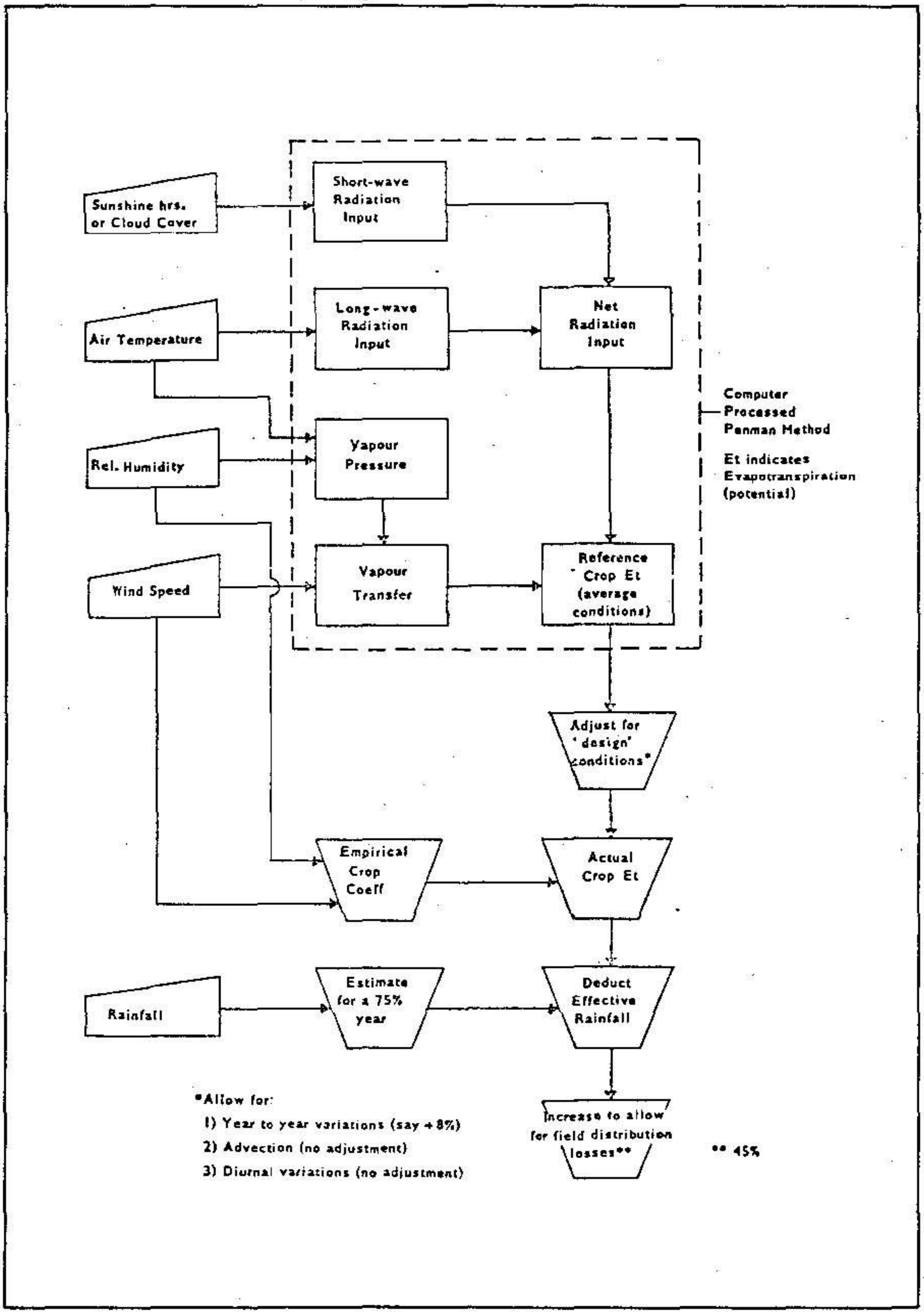
4.3.1 General

The Modified Penman Method as described by Doorenbos and Pruitt (FAO, 1977) requires the calculation of evapotranspiration of a reference crop (ETo). The reference crop is defined as an extensive surface of green grass of uniform height (8-15 cm), actively growing, completely shading the ground and not short of water. A crop coefficient related to the stage of growth and development of each crop is applied to the ETo to give the ET crop. Recent work in Egypt by Bentvelsen and Uttenbogaard (FAO, 1978) has further refined the calculation by introducing a factor 'P' when calculating the irrigation interval. This factor represents the fraction of available soil water permitting unrestricted evapotranspiration by the crop.

4.3.2 Reference Crop Evapotranspiration

The Penman Methodology for calculating ETo is based on a wide range of meteorological data. Essentially the ETo is determined primarily by the net energy supply from the sun and to a lesser extent by the prevailing aerodynamic conditions. A diagramatic representation of the process is given in Figure 4.1

4.1 Calculation of crop irrigation requirement



The meteorological data used in this Study were collected at the research substation at Alessandra near to Jilib (Fantoli, 1965). The basic data and the monthly estimates of both open water evaporation (Eo) and reference crop evapotranspiration (ETO) as calculated for the Inter-Riverine Study (HTS, 1977) are given in Table 4.3. The crop coefficients are given in Table 4.4, daily and monthly crop water requirements in Table 4.5 and gross water requirements in Table 4.6.

The high wind speeds prevailing in January, February and March are a major factor contributing to high ETo levels during that period. A similar situation in Egypt has been described by Bentvelsen and Uittenbogaard (FAO, 1978).

TABLE 4.3 METEOROLOGICAL DATA AND CALCULATED Eo AND ETo FIGURES FOR JILIB

Month	Temp °C	Humidity	Wind km/day	Sunshine hrs/day	Penman Eo mm/day	ETo mm/day
	1923-61 (15)	1931-63 (13)	1953-59 (5)	1934-58 (7)		
January	28.7	69	150	9.19	7.1	5.6
February	28.9	68	170	8.96	7.5	5.9
March	29.0	67	160	10.00	7.9	6.2
April	28.3	73	78	7.62	6.4	5.0
May	28.0	78	35	7.62	5.8	4.5
June	26.5	79	52	6.87	5.2	4.0
July	25.8	77	52	6.98	5.2	4.0
August	26.1	75	60	7.93	5.8	4.5
September	26.6	73	86	8.51	6.4	5.0
October	27.3	73	95	7.47	6.3	4.9
November	28.0	76	78	6.72	5.9	4.6
December	28.1	74	93	8.01	6.3	4.9

Source: Inter-Riverine Study (HTS, 1977)
Note: Jilib near Alessandra 00° 30'00"N, 42° 46'00"E, altitude 24 m.

TABLE 4.4 CROP COEFFICIENTS

Crop	Season	J	F	M	A	M	J	J	A	S	O	N	D
Vegetables[1]	Gu	-	-	-	0.19	0.51	0.93	0.69	0.15	-	-	-	-
Vegetables	Der	0.53	-	-	-	-	-	-	-	-	0.30	0.72	0.92
Groundnuts	Gu	-	-	-	0.42	0.81	1.01	0.83	0.09	-	-	-	-
Sesame	Der	-	-	-	-	-	-	-	-	0.15	0.73	0.99	0.45
Maize	Gu	-	-	-	0.13	0.55	1.02	0.97	0.26	-	-	-	-
Maize	Der	0.74	-	-	-	-	-	-	-	-	0.35	0.81	1.00
Upland rice[2]	Gu	-	-	-	0.35	0.82	1.00	0.94	0.37	-	-	-	-
Upland rice	Der	-	-	-	-	-	-	-	-	0.95	1.05	1.10	0.50
Cotton	Der	0.48	-	-	-	-	-	-	0.25	0.65	1.00	1.05	1.00

Source: Inter-Riverine Study (HTS, 1977) and Genale-Bulo Maresta Study (MMP/HTS, 1978).

Notes:

1 *Vegetables are assumed to be tomatoes in both seasons.*

2 *For paddy rice these coefficients should be increased by 30 per cent.*

TABLE 4.5 DAILY AND MONTHLY CROP WATER REQUIREMENTS

		J	F	M	A	M	J	J	A	S	O	N	D
Calculation example - gu season maize:													
(a) Daily ETo (Table 4.3)		5.60	5.90	6.20	5.00	4.50	4.00	4.00	4.50	5.00	4.90	4.60	4.90
(b) Crop coefficient (Table 4.4)		-	-	-	0.13	0.55	1.02	0.97	0.26	-	-	-	-
(c) Daily ET crop (a x b)		-	-	-	0.65	2.48	4.08	3.88	1.17	-	-	-	-
(d) Design monthly ET crop		-	-	-	0.70	2.67	4.41	4.19	1.26	-	-	-	-
(e) Design monthly ET crop (d x days - 15: 31: 30: 31: 7)		-	-	-	10.53	82.86	132.19	129.89	8.85	-	-	-	-
Vegetables -	gu daily design ET	-	-	-	1.03	2.48	4.02	2.98	0.73	-	-	-	-
	monthly design ET	-	-	-	15.45	76.88	120.60	92.38	10.95	-	-	-	-
Vegetables -	der daily design ET	3.21	-	-	-	-	-	-	-	-	1.59	3.58	4.87
	monthly design ET	99.51	-	-	-	-	-	-	-	-	49.29	107.40	150.97
Groundnuts -	gu daily design ET	-	-	-	2.27	3.94	4.36	3.59	0.44	-	-	-	-
	monthly design ET	-	-	-	34.05	122.14	130.80	111.29	6.60	-	-	-	-
Sesame -	der daily design ET	-	-	-	-	-	-	-	-	0.81	3.86	4.92	2.38
	monthly design ET	-	-	-	-	-	-	-	-	12.15	119.76	147.55	35.72
Maize -	gu daily design ET	-	-	-	0.70	2.67	4.41	4.19	1.26	-	-	-	-
	monthly design ET	-	-	-	10.53	82.86	132.19	129.90	8.85	-	-	-	-
Maize -	der daily design ET	4.48	-	-	-	-	-	-	-	-	1.85	4.02	5.29
	monthly design ET	67.20	-	-	-	-	-	-	-	-	57.35	120.60	163.99
Upland rice -	gu daily design ET	-	-	-	1.89	3.99	4.32	4.06	1.80	-	-	-	-
	monthly design ET	-	-	-	28.35	123.69	129.60	125.86	27.00	-	-	-	-
Upland rice -	der daily design ET	-	-	-	-	-	-	-	-	5.13	5.45	5.46	2.65
	monthly design ET	-	-	-	-	-	-	-	-	153.90	168.95	163.80	82.15
Cotton -	der design ET	2.90	-	-	-	-	-	-	1.22	3.51	5.29	5.22	5.29
	monthly design ET	89.90	-	-	-	-	-	-	18.30	105.30	163.99	156.60	163.99
Paddy rice -	der daily design ET	-	-	-	2.48	5.20	5.62	5.27	2.33	-	-	-	-
	monthly design ET	-	-	-	37.20	161.20	168.60	163.37	34.95	-	-	-	-
Paddy rice -	gu daily design ET	-	-	-	-	-	-	-	-	6.70	7.57	7.10	3.44
	monthly design ET	-	-	-	-	-	-	-	-	201.00	234.67	213.00	51.60

TABLE 4.6 GROSS CROP WATER REQUIREMENTS FOR THE SCHEME ('000 m^3)

Crop	Season	Area ha	J	F	M	A	M	J	J	A	S	O	N	D	Total
Vegetables	Gu	400	-	-	-	60	310	480	370	40	-	-	-	-	1,260
Vegetables	Der	400	400	-	-	-	-	-	-	-	-	200	430	600	1,630
Groundnuts	Gu	1,200	-	-	-	410	1,470	1,570	1,340	80	-	-	-	-	4,870
Sesame	Der	1,200	-	-	-	-	-	-	-	-	150	1,440	1,770	430	3,790
Maize	Gu	1,600	-	-	-	170	1,330	2,120	2,080	140	-	-	-	-	5,840
Maize	Der	1,600	1,080	-	-	-	-	-	-	-	-	920	1,930	2,620	6,550
Upland rice	Gu	1,600	-	-	-	450	1,980	2,070	2,010	430	-	-	-	-	6,940
Upland rice	Der	1,600	-	-	-	-	-	-	-	-	2,460	2,700	2,620	1,310	9,090
Cotton	Der	3,300	2,970	-	-	-	-	-	-	600	3,480	5,410	5,170	5,410	23,040
Paddy rice	Gu	400	-	-	-	150	640	680	660	140	-	-	-	-	2,270
Paddy rice	Der	700	-	-	-	-	-	-	-	-	1,410	1,640	1,490	360	4,900
Total	Gu	-	-	-	-	1,240	5,730	6,920	6,460	830	-	-	-	-	2,1180
Total	Der	-	4,450	-	-	-	-	-	-	600	7,500	12,310	13,410	10,730	49,000
Grand Total		-	4,450	-	-	1,240	5,730	6,920	6,460	1,430	7,500	12,310	13,410	1,230	70,180

5

Agricultural Inputs

5,1 GENERAL

This chapter describes and details the inputs required in order that the agricultural production targets can be achieved. It covers the interrelated factors of farm labour and mechanisation requirements, physical inputs such as seed, fertilizer and agrochemicals and buildings to cater for both the physical inputs and production.

One of the main stated objectives of the scheme is to utilize to the maximum the labour available from the settler families, and this has been done, bearing in mind the lack of familiarity with regular agricultural work and the unusual composition of families that will populate the scheme. Mechanisation has been used only for operations where limited time and the high cropping intensity proposed make this essential. Physical input requirements have been calculated on a block basis, but it must be realised that any changes in the development programme and cropping pattern will affect the input requirements accordingly and the actual requirements will need to be calculated annually, but sufficiently in advance to allow for ordering and delivery. Building requirements have allowed for this.

5.2 LABOUR REQUIREMENTS

5.2.1 Labour Availability

As previously mentioned, the settler families that will populate the Homboy scheme at a density of one family per hectare, are, because of the drift of mature adult males from Dujuuma during the past four years, of an unusual composition. In effect, this limits the amount of family labour available in the early years of development, although in time, the family composition will normalise. In Volume 2, Physical Planning, Part 2, a series of population projections have been made. Table 2.21 in that volume, summarises the availability of family labour over the critical period 1980 to 1985 when it is estimated that normality will be reached. This shows that an average of 1.7 labourers per family is available rising to 2.7 in 1985. Figures for a 50 ha cooperative unit, would therefore be 85 and 135 respectively. Assuming a six day working week, a total of 85 x 12, 1,020 man days are available per half month period.

5.2.2 Labour Requirements

Labour requirements have been calculated using the cropping pattern as a base (Chapter 3) and are expressed in half monthly means. Because of the problems of low output and lack of stamina associated with the introduction of nomads to regular agricultural work, it has been assumed that the norm will be a 4 hour working day. Labour requirements at full production in half monthly means for each block are shown at Appendix B, and these figures are converted to man/days per half month per 50 hectare cooperative unit in Table 5.1, in order that labour requirements can be compared with availability.

TABLE 5.1 CROP LABOUR REQUIREMENTS AND AVAILABILITY IN MAN/DAYS PER HALF MONTH FOR A 50ha COOPERATIVE UNIT

Crop	Season	j		F		M		A		M		J		J		A		S		O		N		D	
Vegetables	Gu	-	-	-	-	-	-	-	19	40	10	25	25	132	132	-	-	-	-	-	-	-	-	-	-
Vegetables	Der	132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	40	10	25	25	132
Groundnuts	Gu	-	-	-	-	-	-	-	112	159	113	129	129	97	65	50	163	157	12	-	-	-	-	-	
Sesame	Der	93	142	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	65	113	120	89	58	30
Maize	Gu	-	-	-	-	-	-	-	129	219	195	195	69	69	32	138	50	-	-	-	-	-	-	-	-
Maize	Der	32	138	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129	219	195	195	69	69
Upland rice	Gu	-	-	-	-	-	-	-	47	55	58	182	149	48	47	62	2	-	-	-	-	-	-	-	-
Upland rice	Der	–	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47	55	58	182	149	48	47	62
Cotton	Der	652	525	603	388										-	219	343	352	378	294	232	193	105	105	453
Total		909	805	711	388	-	-	-	307	473	376	531	372	346	276	469	558	556	468	565	786	667	462	304	746
Availability		1,020																							1020

It is evident from the table that there is adequate labour available, even during the peak month of January, to meet the requirements of the cropping pattern at full development, and that the settlers will have sufficient spare time to look after any associated rainfed agriculture and for social and community activities. During the first three cropping seasons on each block, a simplified cropping pattern is applied (section 2.7) which will reduce labour demand considerably during this period and allow settlers to partake in necessary construction work.

5.3 MECHANISATION

Although the Homboy Scheme will be a densley populated settlement scheme with a considerable pool of family labour available, it will be necessary because of the high intensity of cropping proposed and limited time available between the 'gu' and 'der' crop seasons, for a number of farm operations to be mechanized. A summary of these operations by crop is given in Table 5.2. Land preparation including ploughing, disc harrowing levelling and bunding would be mechanized for all crops. Apart from rice, planting would be by hand and weed control would be achieved mainly by a combination of hand weeding and tined cultivation. Harvesting of most crops would be by hand methods or mainly hand methods with limited assistance from machines (e.g. groundnuts). Rice however, would be mechanically harvested by self propelled combine because of the susceptibility of this crop to losses from shedding and bird damage if timely harvesting is not achieved.

TABLE 5.2 NUMBER OF MECHANISED FIELD OPERATIONS BY CROP

Field Operation	Ground-nuts	Vegetables	Maize	Sesame	Cotton	U.Rice	P.Rice
Ploughing	1	1	1	1	1	1	1
Disc harrowing	2	2	2	3	3	2	2
Levelling	-	-	-	-	-	2	2
Inter-row cultivation	1	1	1	1	1	-	-
Ridging	1	1	1	1	1	-	-
Drilling	-	-	-	-	-	1	1
Bund and minor canal formation.[1]	1	1	1	1	1	1	1
Combine harvesting	-	-	-	-	-	1	1
Transportation		All crops					

Note [1]: Establishment of minor bunds and canals for water distribution.

Wherever possible the mechanisation system proposed has been simplified with the emphasis on limiting the number of highly specialised machines which might be involved. The calculation of the number of tractors and implements required has been derived from the estimated output of each machine, the cropping pattern and time available to carry the operation. Table 5.3 illustrates the methodology used for a 1,000 hectare model with the proposed cropping pattern and provides the basis for determing the number of tractors and implements (Table 6.4) required on each development block.

The machinery replacement policy has been based on the expected working life of the machine in terms of total hours, and number of hours expected usage per year. The expected life in years is given in Table 5.5 whilst the expected purchasing and replacement schedule based on this and the proposed development programme is given in Table 5.4.

TABLE 5.3 CALCULATION OF MACHINERY REQUIREMENTS FOR 1,000 HECTARE MODEL WITH PROPOSED CROPPING PATTERN

Operation	Type of Tractor	Output (hrs/ha)	No. of hectares	Hours required	Time available (days)	Hours worked per day	The Critical implement requirement	Remarks
Ploughing	4WD 90 HP	2.65	1,600	4,240	90	8	6	One operation.
Disc harrowing	4WD 90 HP	0.95	3,750	3,562	90	8	5	2 operations for all crops except sesame and cotton which require 3.
Levelling	4WD 90 HP	0.75	800	600	40	8	2	Rice only.
Inter-row cultivation	65-70 HP	0.9	1,200	1,080	50	8	3	All crops except rice.
Ridging	65-70 HP	0.9	1,200	1,080	50	8	3	All crops except rice.
Drilling	65-70 HP	1.2	400	480	60	8	1	Rice only.
Combine harvesting		1.2	400	480	70	8	1	Rice only.
Bund and minor canal formation	4WD 90 HP	0.2	1,600	320	50	8	1	All crops.
Groundnut lifting	4WD 90 HP	2.5	150	375	25	8	2	
Transport (Trailers)	65-70 HP	-	-	5,000	-	-	5	
				Hours required/ annum		Hours worked/ annum		
Number of tractors	4WD 90 HP	-	-	9,097	-	1,200	8	
	65-70 HP	-	-	7,640	-	1,200	7	

TABLE 5.4 ESTIMATED MACHINERY REQUIREMENT BY BLOCK AT FULL DEVELOPMENT

	Block									
Machine	1	2	3	4	5	6	7	8	9[1]	10[2]
Tractors 4WD 90 HP	5	7	6	8	8	7	9	4	12	6
Tractors 65-70 HP	4	5	4	6	7	5	8	4	10	4
Ploughs	4	5	4	6	6	5	7	4	9	4
Disc-harrows	3	4	3	5	5	4	5	3	6	4
Land plane	1	2	2	2	2	2	2	1	4	2
Inter-row cultivators	2	3	2	3	3	3	3	2	3	2
Ridging bodies	2	3	2	3	3	3	3	2	3	2
Drills	1	1	1	2	2	1	2	1	3	2
Combine harvesters	1	1	1	1	1	1	1	1	3	2
Bund formers	1	1	1	1	1	1	1	1	2	1
Groundnut lifter	1	2	2	2	2	2	3	1	1	1
Trailers (5 tonne)	3	4	4	5	5	4	5	3	7	3

Notes:

1 *Allowance has been made for 500 hectares of paddy rice at 160 per cent intensity in addition to 1,000 hectares of mixed cropping.*

2 *Allowance has been made for 200 hectares of paddy rice at 160 per cent intensity.*

TABLE 5.5 EXPECTED LIFE OF AGRICULTURAL MACHINERY (YEARS)

Machine	Life (Years)
4WD 90 HP Tractor	6
65-70 HP Tractor	6
Disc plough	6
Disc harrow	6
Land plane	8
Inter row cultivator	8
Ridging bodies	8
Combine seed drill	4
Bunding equipment	8
Groundnut lifter	8
Combine harvester	5
Trailers	8

TABLE 5.6 MACHINERY PURCHASING AND REPLACEMENT SCHEDULE

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Tractor 4WD 90 HP	-	5	13	16	16	16	6	5	13	16	16	16	6	5	13	16	16	16	6	5	13	16	16	16	6	5	13	16	16	16
65-70 HP	-	4	9	13	13	14	4	4	9	13	13	14	4	4	9	13	13	14	4	4	9	13	13	14	4	4	9	13	13	14
Disc Plough	-	4	9	12	12	13	4	4	9	12	12	13	4	4	9	12	12	13	4	4	9	12	12	13	4	4	9	12	12	13
Disc Harrow	-	3	7	10	9	9	4	3	7	10	9	9	4	3	7	10	9	9	4	3	7	10	9	9	4	3	7	10	9	9
Land Plane	-	1	4	4	4	5	2			1	4	4	4	5	2			1	4	4	4	5	2			1	4	4	4	5
Inter-row cult	-	2	5	6	6	5	2			2	5	6	6	5	2			2	5	6	6	5	2			2	5	6	6	5
Ridging Bodies	-	2	5	6	6	5	2			2	5	6	6	5	2			2	5	6	6	5	2			2	5	6	6	5
Combine drill	-	1	2	4	3	5	4	4	3	5	4	4	3	5	4	4	3	5	4	4	3	5	4	4	3	5	4	4	3	5
Combine Harvester	-	1	2	2	2	4	3	2	2	2	4	3	2	2	2	4	3	2	2	2	4	3	2	2	2	4	3	2	2	2
Bund former	-	1	2	2	2	3	1			1	2	2	2	3	1			1	2	2	2	3	1			1	2	2	2	3
Groundnut lifter	-	1	4	4	5	2	1			1	4	4	5	2	1			1	4	4	5	2	1			1	4	4	5	2
Trailers	-	3	8	10	9	10	3			3	8	10	9	10	3			3	8	10	9	10	3			3	8	10	9	10

Table 5.7 summarises the requirement for drivers and machinery operators on each block. Provision has been made for absenteeism and training of replacement drivers by increasing the basic requirement as determined by the number of tractors by 25 per cent.

TABLE 5.7 REQUIREMENT FOR DRIVERS AND MACHINERY OPERATORS.

	Block									
	1	2	3	4	5	6	7	8	9	10
Number of Driver/Operators	12	15	13	18	19	15	21	10	28	13

	Year					
	1	2	3	4	5	6
Number of Driver/Operators	12	40	77	113	151	164

5.4 SEEDS, FERTILIZER AND AGROCHEMICALS

5.4.1 General

Difficulties are frequently experienced in Somalia in obtaining timely supplies of inputs, often leading to disappointing results on the various projects. If the production targets at Homboy are to be realised, it is essential that forward planning should take this into account. Although calculations can be made on the basis of the proposed cropping pattern and the agricultural development programme, such information is of limited value as any changes or delays will be directly reflected in the input requirements. With regard to cropping a flexible attitude is essential if new crops, better varieties and experience gained during the running of the scheme, are to be incorporated. The tables shown at Appendix C therefore, should be treated as a guide only, and show the detail of planning required for each block on an annual basis.

5.4.2 Seeds

The availability and supply of improved varieties of seeds in Somalia is a problem which is causing much concern in the Ministry of Agriculture who have recently established a committee to review the situation and make recommendations for an improved service. Formerly supplies were the responsibility of ONAT but more recently, this has been transferred to ADC. In practice the system has broken down due to a failure to keep separate the harvest from land planted to improved varieties. The resultant mixing of improved varieties with ordinary crops has led to a situation where pure stocks of seed are virtually unobtainable. In 1976 a project for Seed Production and Certification was started by FAO based at Afgooye (200 ha) and with sub-units at Bula Gedud (80 ha) and Bonka (130 ha). However, due to staffing difficulties, the project has not had any significant impact to date, total production in 1979 was limited to 55 tonnes of maize, 6 tonnes of sesame and 6 tonnes of upland rice seed. Because of the current desperate situation which is affecting all large agricultural developments, it is planned to extend and enlarge the project. Long term, therefore, the situation is reasonably optimistic, but the short term is still a problem with which the Homboy Scheme will have to contend. There are two possible solutions which should be considered by SDA.

(a) To obtain small quantities of pure seed from the FAO project for bulking on the scheme.

(b) To make selections and purify stocks on the existing settlement schemes with a view to meeting the Homboy requirements.

5.4.3 Fertilizer and Agrochemicals

It is the policy of the Somali Government to channel all fertilizer and agrochemical imports through one organisation, ONAT. All orders are approved by a National Purchase Committee. Although the administrative machinery exists, the system does not function effectively, causing long delays of up to one year in obtaining supplies. Because of these problems, the Banana Board obtained permission from government in 1979 to import it's own requirements, and in view of the importance of timely supply and the quantities required by SDA it is recommended that a similar dispensation be sought at an early date. Every effort has been made to simplify requirements and recommend brands known to be available but this does not preclude other manufacturers' products, and buying should always take price and availability into account.

5.4.4 Farm Buildings

With the decentralised system of management proposed for the Homboy Scheme, inputs and crops produced will be stored at each block village. This system has an added bonus of reducing double handling and economising on transport. Although some services, for reasons of efficiency will be handled centrally, such as the maintenance and operation of the main irrigation system, the overhaul and heavy maintenance of plant and agricultural machinery and the maintenance of the infrastructure buildings etc., provision for routine machinery maintenance, fuel supplies is made for each block.

All calculations are based on the proposed cropping pattern at full production, and actual building requirements calculated using certain basic assumptions which are outlined below.

(a) Seed and Agrochemicals will be stored separately in a secure lockable building of sufficient size to accommodate oneseason's total requirements. Floor space is calculated on the basis of 0.85 m^2 for seed and 2 m^2 for chemicals.

(b) No covered storage is provided for fertilizer as the polythene bags in which it is supplied is considered adequate protection. A hard standing for one seasons requirement is proposed allowing 0.8 m^2 per tonne.

(c) Similarly, no covered area is envisaged for machinery, and a hard standing only is recommended. Part of this should be set aside for routine maintenance purposes.

(d) The facilities recommended for crop storage (except cotton) are calculated on the basis of gross tonnage at full production less an allowance for home consumption which it is assumed each family will store in their own enclosures. It is also assumed that transport to ADC will be concurrent with harvesting, and the building allows for 1/3 of the crop to be in store at any one time. A covered, opensided building is recommended, with a large overhang to prevent rain damage,and an allowance of 0.85 m_2 of floor space per tonne has been used.

(e) Cotton, being a very bulky crop is expensive to store, and as it is unlikely that rain will fall during the picking season, infield storage and efficient transport direct to the ginnery is proposed. In the unlikely event of rain, sufficient tarpaulins should be on hand to cover the heaps of seed cotton.

(f) Due to the incidence of the "Haggai" rains, and the need for speedy harvesting, "gu" season rice will require drying. While it is not anticipated that all of the crop will require drying every year, nevertheless, provision has to be made for this. The installation of a continuous flow drier at each village is ruled out on the basis of high capital and operating costs, and a special hard standing is recommended. Assuming a depth of 5 cm of rice, and a drying period of 2 days, the entire crop could be dried in a period of 30 days by providing 1.6 m_2 of hardstanding per tonne. Spreading, turning and rebagging would be done by hand and allowance for this has been made in labour requirement calculations. The hard standing could be used for other crops and purposes when not required for rice.

6

Homboy - Livestock Annex

6.1 INTRODUCTION

6.1.1 General

The concept envisaged for this project involves the development of a net area of 8,850 ha irrigated cropping within a study area of 14,200 ha in which a resident population of about 1,450 families would be re-settled at a density of one hectare of irrigated land per family with the remaining irrigated area being taken up on the same basis by settlers from Dujuuma.

The resident population, of whom about 15 per cent are of nomadic origin, already exploit in excess of 20 per cent of the area for dryland and flood cropping and also graze significant numbers of resident livestock which are seasonally increased when nomadic animals move into the region.

The project lies within the lower Shabeelle floodplain where the deeper depressions are liable to flood and the area as a whole tends to be too wet during the rainy seasons for heavy concentrations of livestock. However, during the gelal season, the region is also of major importance to nomadic stock in search of dry season feed resources. In the case of the Homboy project, the major inflex would be associated with the settled nomadic minority community which probably already holds a major proportion of the resident animals.

In terms of the impact of this development on the livestock sector, the factors that require consideration are as follows:

(a) the curtailment of livestock access through engineering developments, the expansion and intensification of cropping and the overall increase of settler population.

(b) the loss of animal feed from natural resources and the compensatory effect of crop residues and stubble.

(c) the potential for improved livestock husbandry under the controlled project conditions and the consequent attraction for settlers to increase the resident livestock population.

In view of the importance of livestock to both the Somali economy and the Somali people it would be impractical to attempt to exclude livestock from the project. However, as it is intended to develop Homboy on a settler smallholding basis, the potential for organised livestock enterprises is not thought to be very encouraging. It is considered that the better approach would be to accept that a livestock presence will exist and that numbers will probably increase as development progresses. Subject to this acceptance, it will be necessary to provide essential facilities and services to ensure that the livestock sector thrives and that it contributes significantly towards the overall productivity of the project.

Such facilities and services should include animal health and production extension, organised marketing arrangements, adequate animal access throughout the irrigated area and limited storage facilities for crop residues. Some form of settler organisation may also be required to control the exploitation of available crop residues, stubble and opportunity grazing by itinerant nomadic animals and to ensure a reasonably equitable distribution of animal feed resouces between the settlements.

6.2 PRESENT SITUATION

6.2.1 Resident Population

In common with the remainderof the lower reaches of the Shabeelle and Jubba Rivers the resident farmers of the Homboy area, some of whom are settled nomads, keep a considerable number of domestic livestock. Unlike the more northern and inland areas, cattle are the dominant species and according to current estimates, some 40 per cent of the national cattle population may be found in the lower Shabeelle and Jubba regions.

The project area lies between Jilib and Jamama where livestock densities are statistically estimated to be between 25 and 11 cattle per square kilometer respectively, with camels at about 10, sheep at less than two and goats at about 8 per km^2. It is not clear whether these figures include nomadic animals or relate only to a permanent population. The project area of 14,200 ha may therefore carry between 1,500 and 3,000 head of cattle at some time during the year dependent on which density estimate is applied. A local estimate of 5,000 resident cattle is quoted for the Dhey Tubaako-Homboy area but, as there is no measure of the extent of this area, it is not possible to compare the figure with the official estimate. Whatever the numbers of resident cattle population, which is associated with the existing settlements, it is very unlikely that they would be totally dependent on the study area for the whole of their feed requirements due to the seasonal restrictions of both cropping activities and flooding, although it is probable that heavy concentrations may be found at certain times.

The present settled farmer population in the project area is estimated to be 1,275 families representing some 7,093 individuals. Unfortunately there is little information on the pattern of livestock ownership amongst these people and, while goats may be fairly evenly distributed throughout, it is unlikely that cattle are owned by a very high proportion of families.

Further population figures show that there is a separate group of people representing the settled and semi-settled nomads who also exploit the Homboy area. Numbers are estimated at 223 families, 1,130 individuals, who spend most of the year in the area but seasonal expansions occur when nomadic movement brings in other members of the clans. This sector of the resident population will inevitably own a relatively higher proportion of the resident animals.

If it is accepted that there are 5,000 head of resident cattle associated with the project area, then it is probable that the settled farmers own considerably less than half of that number and that the proportion kept by the group of nomadic origin would be augmented with influxes of nomadic animals mainly during the 'gelal' season.

6.2.2 Nomadic Population

No estimate is available on the numbers of nomadic livestock associated with the 'gelal' migration, although it is suggested that up to 400 families may move into the project area at this time. This could imply an additional 3,000 to 4,000 head of cattle and a significant number of camels moving with the people. However it is probable that the impact of this increase in livestock is not too great as their presence is largely due to family connections with the settled and semi-settled nomads and, although their animals may exploit considerable resources within the project area, their foraging activities will extend well beyond its boundaries as adjacent flooded areas become accessible.

6.2.3 Livestock Nutrition

Range grazing and browse remain the major source of animal feed in Somalia although the proportion provided by arable residues and stubbles may be higher in the lower Shabeelle and Jubba regions.

Current cropping activities in the Homboy area are estimated to cover a little over 20 per cent of the study area where some 2,360 ha of flood plain and 830 ha of depression cultivations are carried out in each of the growing seasons, 'gu. and 'der'. While some 60 per cent of the area shows little evidence of previous cultivations, the remainder, other than cropped, has been identified as recent or long term fallow.

The natural vegetation of the floodplains and shallower depressions varies from open shrubland to dense thicket of *Acacia* spp., mainly *A. nilotica,* and non thorny shrubs, e.g., *Dobera glabra* and *Combretum* sp., while deeper depressions are dominated by swamp grasses and sedges with little or no tree growth. The better grazing areas tend to be associated with the more open scrubland while little grass may be found under the dense thickets. Weed and pioneer grass species provide some grazing in the stubble and fallow areas but, in the latter case, there is a fairly rapid regeneration of shrub growth by the second or third year which probably militates strongly against the natural establishment of the more desirable perennial grasses.

Although no secific survey of the grass species has been carried out in the project area, it is probable that a mixture of species typical ofthe lower Shabeelle, occurs. This mixture may include *Agrostis schrimperiana, Cenchrus ciliaris, Dactyloctenium aegyptium, Echinochloa pyramidalis, Sporobolus* sp and *Tetropogon* sp. while areas with a more favourable soilmoisture regime, which may well occur, may support more productive grasses including *Bothriochloa insculpta, Eragrostis caespitosa, Brachiaria* sp., *Chloris* sp., and *Sorghum verticillifiorim.*

No specific estimate has been made of the forage production from natural vegetation for Homboy but, in 1973, the Hendrikson Planning Unit collated some original and derived work on this aspect which indicated a possible dry matter production of about 85 tonnes per square kilometer per year for this bioclimatic zone. On the basis of a daily dry matter intake of 2.5 per cent of bodyweight for grazing animals, an indicative estimate of carrying capacity can be calculated. Expressed in terms of adult bovines weighing 250 kg, then theoretically one square kilometer could support 37 animals of this class, i.e. between 2.5 and 3.0 ha per animal. In practice the whole of the dry matter production would not be available to the grazing animal and the competition between species would obviate the possibility of ascribing the available fodder to bovines only, an allowance of 50 per cent for cattle would be appropriate. Further in the case of Homboy only 60 per cent of the area can be classed as natural grazing to which these calculations may apply.

Under these circumstances the total cattle carrying capacity of the natural vegetation at Homboy may be in the order of 5 to 6 ha per adult beast, i.e. between 1,500 and 1,800 head.

The alternative sources of livestock nutrition include crop residues, stubble grazing, recent fallow and long term fallow.

In the latter two cases the grazing values will be extremely variable and difficult to assess but usually would be somewhat lower than for natural range. In the case of Homboy, where dense thickets and waterlogged areas are common, it is probable that, on average, these sources are of equal value to the natural range and can therefore be ascribed the same value on a unit area basis. In terms of adult cattle the 20 per cent fallow would have a total carrying capacity of between 500 and 600 head.

In the case of stubble grazing the assessment of an annual value is equally difficult to assess as it will vary according to the crop grown, the time that it is available, and the quality of the growing season. On the assumption that all crop stubbles would become available after each cropping and that average cropping success was achieved, then an arbitrary value of half of that for range may apply. In terms of adult cattle on the 20 per cent calculated area the stubble would have a total carrying capacity of between 250 and 300 head.

The remaining source of animal feed is found in the crop residues where the value can be calculated from the present estimated crop production as shown in Table 6.1. The nutritional values and production estimates for the relevant crop residues are shown in Table 6.2, but for the purposes of this calculation only the available dry matter is used.

TABLE 6.1 PRESENT ESTIMATED CROP PRODUCTION

Crop	Area[1] ha	Yield quintals/ha	Total Tonnes
Maize	2,910	2.0	582.0
Sorghum	2,358	3.0	707.4
Pulses	2,120	2.0	424.0
Sesame	1,104	1.5	165.6

Note: [1] *These areas are cumulative for the 'gu' and 'der' season and include an element of intercropping.*

Maize stover is therefore estimatedto yield 314 tonnes of dry matter, sorghum stover 302 tonnes, pulse straw 190 tonnes and sesame stalks 75 tonnes. The total available dry matter of 881 tonnes can be converted to adult bovine equivalents on the basis of daily dry matter intake at 2.5 per cent of liveweight to give an annual consumption of 2.28 tonnes of dry matter for an average liveweight of 250 kg. This would provide feed for between 350 and 400 head of adult cattle.

The current estimated carrying capacity for adult cattle of the full 14,200 ha of the Homboy Project may be summarised as follows:

Range	-	60 per cent of area	1,500	to	1,800 head
Fallow	-	20 per cent of area	500	to	600 head
Stubble	-	20 per cent of area	250	to	300 head
Residues	-	20 per cent of area	350	to	400 head
Total			2,600	to	3,100 head

It is considered that the above estimate allows sufficient flexibility to accommodate sheet, goats, camels and equines that are associated with the cattle but in much smaller numbers.

In that a net irrigated area of 8,850 ha is to be developed and that a further 2,675 ha of land suitable for rainfed cropping has been identified, there will be a balance of 2,675 remaining for engineering infrastructure, settlements and other necessary reserves. This will include only very small areas of natural vegetation many of which will be heavily waterlogged. In effect the scheme will reduce the natural range to insignificant proportions.

6.2.4 Livestock Services

There are currently no staff from the Department of Animal Health at Homboy and the nearest clinic is sited at Jilib in the charge of a junior member of staff. The nearest Veterinary Officer is based at Kismaaya.

The Livestock Development Authority (LDA) is active in the region in that they operate the Jilib Ranch and are further responsible for the development of the irrigated fodder scheme as part of the Trans Juuba Project. They also maintain a regional office at Kismaayo which controls buying teams operating throughout the southern parts of Somalia.

6.3. LIVESTOCK POTENTIAL AND POLICY

6.3.1 General

It has been indicated above that the natural range will provide very little animal feed when the scheme is fully developed. In that this resource is estimated to provide over half of the present carrying capacity ofthe study area, it would be necessary for the irrigated area to replace this capacity if estimated numbers are to be maintained.

Under the present situation, 3,186 ha of land is cropped, but once irrigation is introduced the area under rainfed cropping would fall to 2,675 ha of which possibly no more than 60 per cent would be in use at any one time. Feed resources would thus be reduced by half, and this would have to be replaced by production from the irrigated area. Fallow grazing would be similarly affected.

An estimate of this reduced carrying capacity for adult cattle may be summarised as follows:

Range	-	10 per cent of present capacity	150	to	180 head
Fallow	-	1,000 ha at 5/6 ha head	160	to	200 head
Stubble	-	50 per cent of present	120	to	150 head
Residues	-	50 per cent of present	170	to	200 head
			600	**to**	**730 head**

Therefore to maintain the same numbers of cattle, based on carrying capacity, the irrigated sector would be required to provide sufficient animal feed for between 2,000 and 2,400 head of adult cattle. This would represent between 4,500 and 5,500 tonnes of dry matter to be gained from crop residues, stubble and 'opportunity' grazing. Any surplus to this level of production could be regarded as potential for increasing livestock numbers.

The effect that this situation would have on nomadic animals, which normally use Homboy area, is difficult to assess as it is not known what proportions of estimated population and use of carrying capacity that they represent. If they fall within these categories then, with adequate access and reasonable organisation, they could probably, fit into the scheme to a considerable degree. On the other hand, if they are significantly in excess of these estimates then they would be required to exploit any potential surplus in competition with the settlers. In this case the effects could be quite serious in that they would also be in competition with other groups of nomads at alternative sites.

In order to develop a policy for livestock it is therefore necessary to estimate the level of contribution to animal feed that may be anticipated from the irrigated area.

6.3.2 Potential

The irrigated area may offer four sources of animal feed which would include the following:

(a) Crop residues - e.g. maize stover, rice straw.

(b) Crop processing by-products - e.g. cottonseed, groundnut haulm.

(c) Stubble grazing.

(d) 'Opportunity' grazing - e.g. roadsides, canal banks and drains.

In the case of Homboy, where the domestic animals will be the property of smallholding settlers and kept mainly in a traditional manner, the calculations for carrying capacity do not include class (b), crop by-products, as this assumes a financial input which would not necessarily be acceptable to the owners.

An estimate for the feed values of 'opportunity' grazing can only be made on an arbitrary basis related to the area of that part of the scheme which is not cultivated and cropped. At Homboy this area is roughly an additional 20 per cent of the net irrigated area. This would represent about 1,800 ha which can be rounded to 2,000 ha to allow for infrastructure in the dryland cropping sector. It is unlikely that more than 30 per cent of this area would provide any viable animal feed but in view of its general association with the irrigation system it may be of higher value than natural range and an annual dry matter production of 1.5 Tonnes/ha is used. In terms of adult cattle this represents btween 260 and 270 head.

The crop residues and stubble grazing values are based on the recommended cropping pattern and the anticipated production at full development as shown in Table 6.3. This table also shows the anticipated available dry matter from residues. Table 6.2 shows the feed values for the chosen crops.

TABLE 6.2 NUTRITIONAL VALUES OF LIVESTOCK FEEDS, ESTIMATES OF PRODUCTION AND PROBABLE AVAILABILITY TO LIVESTOCK

Feed	Per cent Dry matter	Per cent	per cent	Production per cent of	Probable availability percent of Production
Groundnuts	DM	TDN[1]	DP[1]		
Tops	90	40	4.7	100 nut yield	50
Hulls	92	19	1.6	11 nut yield	60
Cake	94	85	42.4	55 nut yield	90
Maize					
Stover	90	50	2.0	100 grain yield	60
Cobs (stripped)	90	46	0.0	20 grain yield	60
Grain	88	69	9.0	100 grain yield	95
Rice					
Straw	93	41	0.6	50 paddy yield	60
Hulls	92	10	0.1	17 paddy yield	50
Bran	91	67	8.4	12 paddy yield	80
Cotton					
Stalks[2]	90	40	-	75 seed cotton	50
Hulls	91	44	0.0	10 seed cotton	60
Oil cake	93	72	34.0	40 seed cotton	95
Sesame					
stalks2	90	40	-	100 seed yield	50
Cake	94	71	39.4	58 seed yield	95

Notes: [1] *TDN - Total Digestible Nutrients, DP-Digestible Protein, these values are not used in the overall carrying capacity calculations but are significant in considerations of nutritional balance and serve to emphasise the high nutritional values of many by-products.*

notes: [2] *The values and production levels of cotton and sesame stalks are not well recorded and the figures used in this table are not technically confirmed.*

In terms of adult cattle requiring some 2.28 tonnes of dry matter per year, the carrying capacity of the residues may be in the order of 6,500 head.

The stubble value can be calculated in similar manner to dryland crops but allowance must be made for more critical timing of planting and harvest which may offset the probable higher nutritional value resulting from improved management and higher yields to some degree. Nevertheless, it is anticipated that stubble values would easily achieve a 50 per cent improvement over the higher estimate for dryland crops and, in terms of adult cattle should support an estimated 1,350 head.

The estimated carrying capacity of the irrigation development at Homboy in terms of adult cattle overaging 250 kg liveweight, can be summarised as follows:

Crop residues	-	6,500 head
Stubble grazing	-	1,350 head
'Opportunity. grazing	-	270 head
		8,120 head

TABLE 6.3 CROPPING PATTERN AND ESTIMATED PRODUCTION OF LIVESTOCK FOODS AT FINAL DEVELOPMENT

	Area[1] ha	Primary Yield Tonnes/ha	Residues Yield Tonnes/ha	Total DM available to licestock Tonnes
Paddy rice	1,160	3.50	1.75	1,130
Upland rice	3,260	3.00	1.50	2,730
Maize[2]	3,260	3.75	3.75	6,600
Cotton	3,260	2.50	1.88	2,760
Groundnuts	1,219	2.50	2.50	1,370
Sesame	1,219	0.80	0.80	440
Vegetables[3]	406	'stubble value'		
Total				**14,930**

Notes: [1] *Areas are cumulative where crops are grown in both 'gu' and 'der' seasons.*
[2] *1,630 ha of maize are grown in each season with yields of 4 tonnes and 3.5 tonnes in 'gu' and 'der' respectively - an average of these yields is used above.*
[3] *No residue value can be ascribed to vegetables but the area is included in stubble calculations.*

In terms of potential, beyond maintenance of numbers estimated for the present carrying, there could be an apparent increase of about 6,000 head. To exploit this potential it would be necessary to ensure that maximum use was made of all the available feed resource which could involve a massive storage programme for residues and an unacceptably complex system of access to grazing. It would therefore seem unlikely that the maximum potential could be achieved although it should not be too difficult to accommodate at least double the present estimate of carrying capacity.

6.3.3 Access

In order to exploit the feed resource within the irrigated area and to allow animals to move to grazings outside the scheme, it is logical to pre-plan their points of access over various structures. Such a plan not only leads to protection of these structures but also offers the management of the scheme considerable control over livestock movement. It further demonstrates to livestock owners that the authority has considered their situation and has taken action in their interests.

The following suggestions for access are based on the final engineering design drawings. In view of the level topography of the scheme and the opportunity for animals to spoil earth roads in wet weather, it is recommended that livestock should be directed to special trekking routes alongside roads and in some cases canals and drains.

Village 1. Crossing of collector drain - D2 - to north of village.

Village 2. Crossing of distributor canal - H1/D2 - to east of the village.

Village 3. Crossing collector drain - D16 - to east of the village and a strengthened crossing over the flood bund.

Village 4. Crossing over the flood bund to the east of the village.

Village 5. (Homboy/Aminow) crossing distributor canal - H4/D4 to the east of the village.

Village 6. crossing over collector drain D2 and distributor canal H5/D2 to the north of the village, crossing collector drain D2, 2-2½ km, north of the village east from the main road.

Village 7. Crossing over collector drain D12 to the north of the village and crossing over distributor canal H5/D1 and collector drain D16 to the north of the village also strengthened crossing of the flood bund.

Village 8. Crossing over branch canal HB/2, 2-2½ km south of the village and east of the main road, crossing collector drain D2/1 and distributor canal HB1/D2.

Village 9. Crossing over the Lower Outfall Drain to the east of the village between collector drain D10 and south east corner, crossing over distributor canal HB1/D6 to the west of the village; crossing collector drain D8 and distributor canal HB1/D4 for access to undeveloped areas in block 8.

Village 10. Share crossings over HB2, D2/1 and HB1/D2 with village 8; crossing over collector drain D2 (or D2/1, between junction of D2 and crossing of HB2) and distributor canal HB2/D2 to the south of the village; possible crossing of Lower Outfall Drain into southern reserve area.

Burgaan Village - access may be required over the Lower Outfall Drain into the scheme to the north of the village.

6.3.4 Storage and Facilities

In view of the seasonal fluctuations in the supplies of crop residues it is seen as necessary to provide limited storage facilities at village sites. Detailed requirements cannot be predicted at this stage as the eventual distribution and concentration of livestock cannot be forecast. However an open sided dutch barn type structure on a raised floor at each village would allow for initial requirements and could be added to as required.

Approximately 100 tonnes of well compressed dry material can be contained in a 3 bay barn with an eave height of 7 m and each bay 7 x 7 m.

Livestock owners should be responsible for their animal housing and penning requirements but the planners must ensure that adequate space is reserved near to the village sites to accommodate these facilities.

6.3.5 Services

In the longer term, as evidence of an increasing livestock population is identified, the establishment of a specialist livestock extension worker may be justified. His main objective would be to encourage improved management and better nutritional practices with the aim of increasing the levels of productivity amongst resident animals.

However, negotiations should take place immediately with the Ministry of Livestock and the LDA to ensure that members of their local staff are aware of the project. They should visit the area regularly during the development stages and assist in the re-organisation of livestock where possible. These organisations could also assist in providing some basic livestock training for selected members of project field staff in order that some monitoring of the situation can be on going and minimal advisory activities are available.

In the longer term a small dispensary/store for livestock materials may be justified but, in the meantime, it should be the responsibility of the existing veterinary services to provide essential drugs and medicines from their nearest centre.

6.4 CONCLUSIONS

On the understanding that the majority of the resident farmer and settled nomad population of the study area will take up options for irrigated holdings, it must be anticipated that the existing resident livestock population must be accommodated.

It has been demonstrated that the introduction of the irrigation scheme should increase overall carrying capacity by at least 100 per cent which should offer an opportunity for increasing production levels. A major question may arise in how this potential should be used in relation to the requirements of nomadic animals that appear seasonally in the area.

In the short term and before new settlers begin to build up their own livestock sector, there would appear to be adequate opportunity for nomadic animals to enter the project and exploit available surpluses.

In the longer term as the resident livestock population increases, this surplus may be taken up to the exclusion of nomadic stock. In anticipation of this situation arising it would appear logical for the resident settlers and the regular nomadic owners to set up a joint committee which would liaise with the scheme management and the Ministry of Livestock. This group should monitor the ongoing situation and attempt to plan ahead with the aim of avoiding conflict while protecting the interests of both sides.

The question of more sophisticated livestock enterprises may also arise in the long term but it is not considered worthwile to attempt to plan for this aspect at this stage. It may be anticipated that a sufficient number of problems will arise in organising the cropping sector without adding complex livestock development.

Appendices

APPENDIX A

DAILY RAINFALL STATISTICS 1978

Meteorological Stations

Jilib (Alessandra)	0°30'N	42°46'E	Altitude 24m.
Jilib State Farms	0°29'N	42°46'E	Altitude 19m. (approx.)
Jubba Sugar Project	0°25'N	42°42'E	Altitude 20m.*

*Permanent Meteorological Station. Figures from January to July recorded at 'Temporary Office Site'.

Daily Rainfall Statistics 1978

Month: January

Day	Alessandra	State Farm	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	trace
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
Total	0.0	0.0	0.0

Month: February

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	trace
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	trace
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	1.1
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
Total	0.0	0.0	1.1

Daily Rainfall Statistics 1978

Month: March

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	2	6.5
4	6.7	4	18.2
5	20.0	14	6.0
6	45.0	50	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	5	1.7
14	0.0	0.0	trace
15	0.0	0.0	0.0
16	2.0	13	trace
17	5.0	0.0	3.0
18	6.0	15	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	trace
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	trace
Total	84.7	103	35.4

Month: April

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.7
4	0.0	0.0	0.0
5	5.0	13	1.7
6	0.0	0.0	0.0
7	2.0	14	30.0
8	11.0	18	28.8
9	7.0	10	2.0
10	7.0	6	0.0
11	6.0	30	0.8
12	1.0	3	1.0
13	55.0	165	53.2
14	0.0	0.0	0.0
15	8.0	39	1.6
16	0.0	0.0	0.0
17	0.0	10	0.0
18	7.0	0.0	0.0
19	0.0	0.0	2.0
20	0.0	9	13.0
21	10.2	30	28.4
22	21.5	0.0	0.0
23	0.0	0.0	trace
24	0.0	0.0	0.0
25	2.1	0.0	0.0
26	0.0	0.0	0.0
27	0.0	7	4.0
28	0.5	8	15.3
29	8.1	11	1.6
30	2.3	17	14.1
31	0.0	0.0	0.0
Total	153.7	390	198.2

Daily Rainfall Statistics 1978

Day	Alessandra	State Farms	JSP	Day	Alessandra	State Farms	JSP
Month: May				Month: June			
1	18.2	6	7.5	1	0.5	0.0	0.0
2	2.5	0.0	0.0	2	0.0	0.0	0.0
3	1.5	31	64.6	3	0.0	0.0	0.0
4	13.6	3	0.0	4	0.0	0.0	0.0
5	0.0	22	44.8	5	0.0	0.0	0.0
6	48.3	0.0	0.0	6	0.0	0.0	0.0
7	1.3	31	2.4	7	0.0	0.0	0.0
8	9.8	0.0	0.0	8	0.0	0.0	0.0
9	0.0	18	7.2	9	0.0	0.0	0.0
10	78.0	29	23.5	10	0.0	0.0	0.6
11	16.3	10	4.7	11	0.0	0.0	0.1
12	9.0	8	4.6	12	0.0	0.0	0.0
13	0.0	8	0.0	13	0.0	0.0	1.6
14	0.0	0.0	0.4	14	0.2	0.0	0.0
15	0.0	0.0	0.5	15	2.7	0.0	3.8
16	0.0	0.0	0.0	16	0.4	0.0	2.3
17	0.0	0.0	0.4	17	1.1	0.0	0.0
18	0.0	0.0	0.7	18	0.8	0.0	0.0
19	1.1	0.0	0.2	19	0.0	0.0	0.0
20	0.0	0.0	7.0	20	0.0	0.0	0.0
21	1.7	0.0	0.0	21	0.0	0.0	0.0
22	1.4	0.0	1.9	22	0.0	12	10.6
23	5.6	0.0	0.2	23	2.8	10	5.7
24	5.4	27	44.1	24	5.5	11	5.8
25	10.6	0.0	1.1	25	14.5	7	1.0
26	0.0	0.0	0.0	26	2.1	0.0	2.2
27	1.0	0.0	0.0	27	1.9	15	0.5
28	0.0	10	5.9	28	2.8	2	2.4
29	2.6	0.0	0.2	29	1.5	0.0	1.2
30	1.0	0.0	0.0	30	2.0	0.0	1.8
31	0.0	0.0	0.5	31	0.0	0.0	
Total	228.9	203	222.3	Total	38.8	57	39.6

Daily Rainfall Statistics 1978

Month: July				Month: August			
Day	Alessandra	State Farms	JSP	Day	Alessandra	State Farms	JSP *
1	0.0	0.0	1.8	1	0.0	0.0	0.0
2	2.8	0.0	0.0	2	0.0	0.0	0.0
3	0.0	6	1.4	3	0.0	0.0	0.0
4	0.5	0.0	0.0	4	0.0	0.0	0.0
5	0.0	5	0.0	5	0.0	0.0	0.0
6	0.0	0.0	0.0	6	0.0	0.0	0.0
7	0.0	0.0	0.2	7	0.0	0.0	0.0
8	1.0	0.0	0.5	8	0.5	0.0	0.0
9	0.8	4	0.6	9	0.0	0.0	0.0
10	15.0	18	1.9	10	0.0	0.0	0.0
11	6.0	7	6.3	11	0.0	0.0	0.0
12	0.3	5	13.2	12	0.0	0.0	0.0
13	0.0	0.0	0.0	13	0.0	0.0	0.6
14	0.0	0.0	0.5	14	0.0	0.0	0.0
15	0.0	0.0	0.0	15	0.0	0.0	0.0
16	0.0	0.0	0.2	16	0.0	0.0	0.5
17	0.0	0.0	0.0	17	0.7	0.0	0.5
18	0.0	0.0	0.0	18	0.5	0.0	0.0
19	0.0	0.0	2.0	19	0.0	0.0	0.0
20	0.0	3	1.9	20	0.0	0.0	0.0
21	2.5	4	2.0	21	0.0	0.0	0.0
22	2.0	4	0.0	22	0.0	0.0	0.0
23	0.3	0.0	0.0	23	0.0	0.0	0.0
24	0.0	0.0	0.0	24	0.0	0.0	0.0
25	0.0	0.0	0.0	25	0.0	0.0	0.0
26	0.0	0.0	0.0	26	0.0	8	2.7
27	0.0	0.0	0.0	27	1.5	0.0	0.0
28	0.0	0.0	0.0	28	0.0	0.0	0.0
29	0.0	0.0	0.0	29	0.0	0.0	0.0
30	0.0	0.0	0.0	30	0.0	0.0	0.0
31	0.0	0.0	0.0	31	0.0	0.0	0.0
Total	32.1	56	32.5	Total	3.2	8	4.3

* Transfer to 'Permanent Meteorological Station'.

Daily Rainfall Statistics 1978

Month: September

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.2	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
Total	0.2	0.0	0.0

Month: October

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.5
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	7.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	8.5
24	0.0	0.0	5.1
25	3.0	0.0	5.0
26	0.0	0.0	2.7
27	6.6	5	46.4
28	4.4	0.0	0.0
29	0.0	0.0	3.0
30	20.3	10	3.8
31	2.8	24	19.1
Total	37.1	39	101.4

Daily Rainfall Statistics 1978

Month: November

Day	Alessandra	State Farms	JSP
1	41.5	8	10.0
2	1.0	11	0.0
3	14.2	0.0	0.0
4	0.0	18	13.8
5	2.0	22	3.5
6	47.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	8.4
9	22.5	0.0	0.0
10	0.0	77	13.2
11	2.0	10	0.0
12	35.5	0.0	0.0
13	0.0	18	14.8
14	0.0	15	1.3
15	1.1	20	28.5
16	0.0	0.0	0.0
17	2.3	0.0	0.6
18	0.0	0.0	0.0
19	0.0	0.0	1.1
20	0.0	0.0	1.9
21	11.3	0.0	7.3
22	5.5	25	3.2
23	8.5	5	37.4
24	0.2	34	18.5
25	17.6	10	0.0
26	12.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	1.4	0.0	0.0
31	0.0	0.0	0.0
Total	225.6	273	163.5

Month: December

Day	Alessandra	State Farms	JSP
1	0.0	0.0	0.0
2	0.0	28	37.1
3	6.0	25	42.1
4	15.5	0.0	0.0
5	13.5	0.0	1.2
6	10.4	0.0	0.0
7	0.0	0.0	0.0
8	0.5	15	9.7
9	6.0	15	7.9
10	0.9	8	7.5
11	0.4	15	20.4
12	0.4	30	37.0
13	10.3	5	0.0
14	0.0	0.0	10.6
15	19.5	0.0	0.6
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	0.0	0.0	0.0
24	0.0	0.0	0.0
25	0.0	0.0	0.0
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.6
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
Total	83.4	141	174.1

APPENDIX B

DAILY LABOUR REQUIREMENTS BY BLOCKS IN HALF MONTHLY MEANS

APPENDIX B BLOCK 1 - 600 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	90	15th Apr-15th May	-	-	-	-	--	-	-	89	127	90	103	103	77	52	40	130	125	9	-	-	-	-	-	-
Sesame	90	1st Oct-15th Oct	74	113	46	-	--	-	-	-	-	-	-	-	-	-	-	-	-	18	52	90	96	71	46	24
Maize Gu	120	15th Apr-30th Apr	-	-	-	-	--	-	-	103	175	156	156	55	55	25	110	40	-	-	-	-	-	-	-	-
Maize Der	120	1st Oct-15th Oct	25	110	40	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	103	175	156	156	55	55
Rice Gu	120	15th Apr-30th Apr	-	-	-	-	--	-	-	37	44	46	145	119	38	37	49	1	-	-	-	-	-	-	-	-
Rice Der	120	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37	44	46	145	119	38	37	49
Cotton	240	1st Aug-15th Aug	521	420	482	310	--	-	-	-	-	-	-	-	-	-	175	274	281	302	235	185	154	84	84	362
Vegetables																										
Gu	30	15th Apr-30th Apr	-	-	-	-	--	-	-	15	32	8	20	20	105	105	-	-	-	-	-	-	-	-	-	-
Vegetables																										
Der	30	1st Oct-15th Oct	105	-	-	-	--	-	-	-	-	-	-	-	-	-	-	-	-	-	15	32	8	20	20	105
Totals			**725**	**643**	**568**	**310**	--	-	-	**244**	**278**	**300**	**424**	**297**	**275**	**219**	**374**	**445**	**443**	**373**	**451**	**627**	**533**	**369**	**242**	**595**

Source: *The Study and Genale-Bulo Marerta Project (MMP/HTS 1978).*

BLOCK 2 - 825 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	A Area (ha)	Planting Dates	Jan		Feb		Mar	Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	124	15th Apr-15th May	-	-	-	-	- -	-	123	175	124	141	141	107	72	54	178	172	12	-	-	-	-	-	-
Sesame	124	1st Oct-15th Oct	102	156	63	-	- -	-	-	-	-	-	-	-	-	-	-	-	25	72	124	133	98	63	33
Maize Gu	170	15th Apr-30th Apr	-	-	-	-	- -	-	146	248	221	221	78	78	36	194	58	-	-	-	-	-	-	-	-
Maize Der	170	1st Oct-15th Oct	36	194	58	-	- -	-	-	-	-	-	-	-	-	-	-	-	-	146	248	221	221	78	78
Rice Gu	170	15th Apr-30th Apr	-	-	-	-	- -	-	53	63	65	206	168	54	53	70	2	-	-	-	-	-	-	-	-
Rice Der	170	1st Sept-15th Sept	-	-	-	-	- -	-	-	-	-	-	-	-	-	-	-	53	63	65	206	168	54	53	70
Cotton	340	1st Aug-15th Aug	738	595	683	439	- -	-	-	-	-	-	-	-	-	248	388	398	428	333	262	218	119	119	513
Vegetables Gu	41	15th Apr-30th Apr	-	-	-	-	- -	-	20	44	11	27	27	143	143	-	-	-	-	-	-	-	-	-	-
Vegetables Der	41	1st Oct-15th Oct	143	-	-	-	- -	-	-	-	-	-	-	-	-	-	-	-	-	20	44	11	27	27	143
Totals			1,019	945	804	439	- -	-	342	530	421	595	414	382	304	566	626	623	528	636	884	751	519	340	837

BLOCK 3 - 700 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	105	15th Apr-15th May	-	-	-	-	-	-	-	104	148	105	120	120	90	61	46	151	146	10	-	-	-	-	-	-
Sesame	105	1st Oct-15th Oct	86	132	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	61	105	112	83	54	28
Maize Gu	140	15th Apr-30th Apr	-	-	-	-	-	-	-	120	204	182	182	64	64	29	150	46	-	-	-	-	-	-	-	-
Maize Der	140	1st Oct-15th Oct	29	158	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	204	182	182	64	64
Rice Gu	140	15th Apr-30th Apr	-	-	-	-	-	-	-	43	52	53	169	139	45	43	57	2	-	-	-	-	-	-	-	-
Rice Der	140	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	52	53	169	139	45	43	57
Cotton	280	1st Aug-15th Aug	608	490	563	361	-	-	-	-	-	-	-	-	-	-	204	319	328	353	274	215	179	98	98	423
Vegetables																										
Gu	35	15th Apr-30th Apr	-	-	-	-	-	-	-	17	38	9	23	23	122	122	-	-	-	-	-	-	-	-	-	-
Vegetables																										
Der	35	1st Oct-15th Oct	122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	38	9	23	23	122
Totals			845	780	663	361	-	-	-	284	442	349	494	346	321	255	465	518	517	436	525	731	621	431	282	694

BLOCK 4 - 925 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	139	15th Apr-15th May	-	-	-	-	-	-	-	138	196	139	158	158	119	81	61	200	193	14	-	-	-	-	-	-
Sesame	139	1st Oct-15th Oct	114	175	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	81	139	149	110	71	38
Maize Gu	185	15th Apr-30th Apr	-	-	-	-	-	-	-	159	270	240	240	85	85	39	209	61	-	-	-	-	-	-	-	-
Maize Der	185	1st Oct-15th Oct	39	209	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159	270	240	240	85	85
Rice Gu	185	15th Apr-30th Apr	-	-	-	-	-	-	-	57	68	70	224	183	59	57	76	2	-	-	-	-	-	-	-	-
Rice Der	185	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57	68	70	224	183	59	57	76
Cotton	370	1st Aug-15th Aug	803	647	743	477	-	-	-	-	-	-	-	-	-	-	270	422	433	466	363	285	237	129	129	559
Vegetables Gu	46	15th Apr-30th Apr	-	-	-	-	-	-	-	23	50	12	31	31	161	161	-	-	-	-	-	-	-	-	-	-
Vegetables Der	46	1st Oct-15th Oct	161	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	50	12	31	31	161
Totals			1,117	1,031	875	477	-	-	-	377	584	461	653	457	424	338	616	685	683	576	696	968	821	569	373	919

BLOCK 5 - 1,025 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	154	15th Apr-15th May	-	-	-	-	-	-	-	152	217	154	176	176	132	89	68	222	214	15	-	-	-	-	-	-
Sesame	154	1st Oct-15th Oct	126	194	79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	89	154	165	122	79	42
Maize Gu	205	15th Apr-30th Apr	-	-	-	-	-	-	-	176	299	266	266	94	94	43	231	67	-	-	-	-	-	-	-	-
Maize Der	205	1st Oct-15th Oct	43	231	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	176	299	266	266	94	94
Rice Gu	205	15th Apr-30th Apr	-	-	-	-	-	-	-	64	76	78	248	203	66	64	84	2	-	-	-	-	-	-	-	-
Rice Der	205	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	76	78	248	203	66	64	84
Cotton	410	1st Aug-15th Aug	890	717	824	528	-	-	-	-	-	-	-	-	-	-	299	467	480	517	402	316	262	143	143	619
Vegetables Gu	51	15th Apr-30th Apr	-	-	-	-	-	-	-	25	55	14	34	34	178	178	-	-	-	-	-	-	-	-	-	-
Vegetables Der	51	1st Oct-15th Oct	178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	55	14	34	34	178
Totals			1,237	1,142	970	528	-	-	-	417	647	512	724	507	470	374	682	758	758	639	770	1,072	910	631	414	1,017

BLOCK 6 - 800 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	120	15th Apr-15th May	-	-	-	-	-	-	-	119	169	120	137	137	103	70	53	173	167	12	-	-	-	-	-	-
Sesame	120	1st Oct-15th Oct	98	151	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	70	120	128	95	61	32
Maize Gu	160	15th Apr-30th Apr	-	-	-	-	-	-	-	138	234	208	208	74	74	34	181	53	-	-	-	-	-	-	-	-
Maize Der	160	1st Oct-15th Oct	34	181	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	138	234	208	208	74	74
Rice Gu	160	15th Apr-30th Apr	-	-	-	-	-	-	-	50	59	61	194	158	51	50	66	2	-	-	-	-	-	-	-	-
Rice Der	160	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	59	61	194	158	51	50	66
Cotton	320	1st Aug-15th Aug	694	560	643	413	-	-	-	-	-	-	-	-	-	-	234	365	374	403	314	246	205	112	112	483
Vegetables																										
Gu	40	15th Apr-30th Apr	-	-	-	-	-	-	-	20	43	11	27	27	140	140	-	-	-	-	-	-	-	-	-	-
Vegetables																										
Der	40	1st Oct-15th Oct	140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	43	11	27	27	140
Totals			966	892	757	413	-	-	-	327	505	400	566	396	368	294	534	593	591	498	603	837	710	493	324	795

BLOCK 7 - 1,125 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	169	15th Apr-15th May	-	-	-	-	-	-	-	167	238	169	193	193	145	98	74	243	235	17	-	-	-	-	-	-
Sesame	169	1st Oct-15th Oct	139	213	86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	98	169	181	134	86	46
Maize Gu	225	15th Apr-30th Apr	-	-	-	-	-	-	-	193	328	292	292	103	103	47	254	74	-	-	-	-	-	-	-	-
Maize Der	225	1st Oct-15th Oct	47	254	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	193	328	292	292	103	103
Rice Gu	225	15th Apr-30th Apr	-	-	-	-	-	-	-	70	83	85	272	223	72	70	92	2	-	-	-	-	-	-	-	-
Rice Der	225	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	83	85	272	223	72	70	92
Cotton	450	1st Aug-15th Aug	976	787	904	580	-	-	-	-	-	-	-	-	-	-	328	513	526	567	441	346	288	157	157	679
Vegetables																										
Gu	56	15th Apr-30th Apr	-	-	-	-	-	-	-	28	60	15	38	38	196	196	-	-	-	-	-	-	-	-	-	-
Vegetables																										
Der	56	1st Oct-15th Oct	196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	60	15	38	38	196
Totals			1,358	1,254	1,064	580	-	-	-	458	709	561	795	557	516	411	748	832	831	701	845	1,175	999	693	454	1,116

BLOCK 8 - 575 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar	Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	86	15th Apr-15th May	-	-	-	-	- -	-	85	121	86	98	98	74	50	38	124	120	9	-	-	-	-	-	-
Sesame	86	1st Oct-15th Oct	71	108	44	-	- -	-	-	-	-	-	-	-	-	-	-	-	17	50	86	92	68	44	23
Maize Gu	115	15th Apr-30th Apr	-	-	-	-	- -	-	99	168	149	149	53	53	24	130	38	-	-	-	-	-	-	-	-
Maize Der	115	1st Oct-15th Oct	24	130	38	-	- -	-	-	-	-	-	-	-	-	-	-	-	-	99	168	149	149	53	53
Rice Gu	115	15th Apr-30th Apr	-	-	-	-	- -	-	36	43	44	139	114	37	36	47	1	-	-	-	-	-	-	-	-
Rice Der	115	1st Sept-15th Sept	-	-	-	-	- -	-	-	-	-	-	-	-	-	-	-	36	43	44	139	114	37	36	47
Cotton	230	1st Aug-15th Aug	499	402	462	296	- -	-	-	-	-	-	-	-	-	168	262	269	290	225	177	147	80	80	347
Vegetables																									
Gu	29	15th Apr-30th Apr	-	-	-	-	- -	-	14	31	8	19	19	101	101	-	-	-	-	-	-	-	-	-	-
Vegetables																									
Der	29	1st Oct-15th Oct	101	-	-	-	- -	-	-	-	-	-	-	-	-	-	-	-	-	14	31	8	19	19	101
Totals			695	640	544	296	- -	-	234	363	287	405	284	265	211	383	425	425	359	432	601	510	353	232	571

BLOCK 10 - 750 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	82	15th Apr-15th May	-	-	-	-	-	-	-	81	116	82	93	93	71	48	36	118	114	8	-	-	-	-	-	-
Sesame	82	1st Oct-15th Oct	67	103	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	48	82	88	65	42	22
Maize Gu	110	15th Apr-30th Apr	-	-	-	-	-	-	-	95	161	143	143	51	51	23	124	36	-	-	-	-	-	-	-	-
Maize Der	110	1st Oct-15th Oct	23	124	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	95	161	143	143	51	51
Rice Gu	110	15th Apr-30th Apr	-	-	-	-	-	-	-	34	41	42	133	109	35	34	45	1	-	-	-	-	-	-	-	-
Rice Der	110	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	41	42	133	109	35	34	45
Cotton	220	1st Aug-15th Aug	477	385	442	284	-	-	-	-	-	-	-	-	-	-	161	251	257	277	216	169	141	77	77	332
Vegetables																										
Gu	28	15th Apr-30th Apr	-	-	-	-	-	-	-	14	30	8	19	19	98	98	-	-	-	-	-	-	-	-	-	-
Vegetables																										
Der	28	1st Oct-15th Oct	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	30	8	19	19	98
Paddy Gu	120		-	-	-	-	-	-	-	41	79	79	32	36	32	10	10	13	-	-	-	-	-	-	-	-
Paddy Der	200		22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68	132	132	54	60	54	16	16
Totals			687	612	520	284	-	-	-	265	427	354	420	308	287	213	376	419	473	474	547	629	549	393	239	564

BLOCK 9 - 1,525 HA NET CULTIVABLE AREA. DAILY LABOUR REQUIREMENT IN HALF MONTHLY MEANS ASSUMING A 4 HOUR WORKING DAY

Crop	Area (ha)	Planting Dates	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec	
Groundnuts	150	15th Apr-15th May	-	-	-	-	-	-	-	148	211	150	171	171	129	87	66	216	208	15	-	-	-	-	-	-
Sesame	150	1st Oct-15th Oct	123	189	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	87	150	160	118	76	40
Maize Gu	200	15th Apr-30th Apr	-	-	-	-	-	-	-	172	292	260	260	92	92	42	226	66	-	-	-	-	-	-	-	-
Maize Der	200	1st Oct-15th Oct	42	226	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	172	292	260	260	92	92
Rice Gu	200	15th Apr-30th Apr	-	-	-	-	-	-	-	62	74	76	242	198	64	62	82	2	-	-	-	-	-	-	-	-
Rice Der	200	1st Sept-15th Sept	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	74	76	242	198	64	62	82
Cotton	400	1st Aug-15th Aug	868	700	804	516	-	-	-	-	-	-	-	-	-	-	292	456	468	504	392	308	356	140	140	604
Vegetables Gu	50	15th Apr-30th Apr	-	-	-	-	-	-	-	25	54	13	33	33	175	175	-	-	-	-	-	-	-	-	-	-
Vegetables Der	50	1st Oct-15th Oct	175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	54	13	33	33	175
Paddy Gu	315		-	-	-	-	-	-	-	107	208	208	85	94	85	25	25	35	-	-	-	-	-	-	-	-
Paddy Der	525		58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	178	346	346	142	157	142	42	42
Totals			1266	1115	946	516	-	-	-	514	839	707	791	588	545	391	691	775	916	969	1098	1188	1044	757	445	1035

APPENDIX C

INPUT REQUIREMENTS BY BLOCKS AND AGGREGATED FOR WHOLE SCHEME

WHOLE SCHEME AGGREGATED INPUT REQUIREMENTS - QUINTALS

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
: Groundnuts	-	-	-	-	81	-	287	-	550	-	811	-	1097	-
Sesame	-	-	-	-	-	26	-	37	-	72	-	91	-	121
Maize	-	60	128	212	171	281	319	418	374	454	368	359	326	326
Upland rice	-	300	638	1062	856	1384	1574	2069	1850	2248	1822	1775	1610	1610
Cotton	-	-	-	-	-	258	-	369	-	723	-	912	-	978
Paddy rice	-	-	-	-	-	-	-	-	284	653	392	653	392	653
Vegetables (kg)	-	-	-	-	15	74	74	97	122	170	170	210	224	224
lizers:														
Diammonium phosphate	-	300	638	1062	934	1822	1870	2688	2558	3804	2827	3638	2891	3580
Urea 46%	-	870	1850	3080	2512	4821	4729	7131	6347	9574	6530	8185	5742	7900
10:15:10	-	-	-	-	0.6	2	2	3	4	6	6	8	8	8
hemicals:														
Fernasan D	-	1.5	3.2	5.3	4.8	8.7	9.9	12.9	14.6	19.3	16.2	14.2	15.5	13.8
Furadan	-	0.6	1.3	2.1	1.7	3.1	3.2	4.6	5.3	9.6	5.9	8.3	5.9	8.1
Nuvacron	-	7.5	16.0	26.6	21.4	35.1	39.9	52.2	54.6	74.8	56.9	63.0	51.6	58.9
Nuvacron Combi	-	15.0	31.9	53.1	42.8	285.2	79.7	412.0	93.5	716.0	89.6	849.7	81.5	896.5
Propanil/Preforan	-	36.0	76.6	127.4	102.7	168.5	191.3	250.7	262.2	359.2	273.2	302.4	247.8	282.6
Carbicron	-	7.5	16.0	26.6	21.4	35.1	39.9	52.2	54.6	73.3	56.9	63.0	51.6	58.9
Carbofuran	-	7.5	16.0	26.6	19.5	35.9	40.7	44.7	58.9	81.1	64.7	73.6	64.6	74.6
Nogos	-	-	-	-	0.5	1.6	1.6	2.3	3.0	4.5	4.5	5.7	6.1	6.1

INPUT REQUIREMENT BY SEASONS - BLOCK 1

IN Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ɜds:														
Groundnuts	-	-	-	-	8100	-	8100	-	8100	-	8100	-	8100	-
Sesame	-	-	-	-	-	720	-	720	-	720	-	720	-	720
Maize	-	6000	3600	6000	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
Upland Rice	-	30000	18000	30000	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
Cotton	-	-	-	-	-	7200	-	7200	-	7200	-	7200	-	7200
Paddy rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	15	15	15	15	15	15	15	15	15	15
'tilizers:														
Diammonium phosphate	-	30000	18000	30000	19800	23700	19800	23700	19800	23700	19800	23700	19800	23700
Urea 46%	-	87000	52200	87000	37800	55800	37800	55800	37800	55800	37800	55800	37800	55800
10:15:10	-	-	-	-	60	60	60	60	60	60	60	60	60	60
ichemicals:														
Fernasan D	-	150	90	150	114	108	114	108	114	108	114	108	114	108
Furadan	-	60	36	60	24	33	24	33	24	33	24	33	24	33
Nuvacron	-	750	450	750	300	300	300	300	300	300	300	300	300	300
Nuvacron Combi	-	1500	900	1500	600	6600	600	6600	600	6600	600	6600	600	6600
Propanil/Preforan	-	3600	2160	3600	1440	1440	1440	1440	1400	1440	1440	1440	1440	1440
Carbicron	-	750	450	750	300	300	300	300	300	300	300	300	300	300
Carbofuran	-	750	450	750	108	108	108	108	108	108	108	108	108	108
Nogos	-	-	-	-	45	45	45	45	45	45	45	45	45	45

INPUT REQUIREMENTS BY SEASONS BLOCK 2 - IN Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	11160	-	11160	-	11160	-	11160	-
Sesame	-	-	-	-	-	992	-	992	-	992	-	992	-	992
Maize	-	-	4960	8240	4960	3400	3400	3400	3400	3400	3400	3400	3400	3400
Upland rice	-	-	24800	41200	24800	17000	17000	17000	17000	17000	17000	17000	17000	17000
Cotton	-	-	-	-	-	10200	-	10200	-	10200	-	10200	-	10200
Paddy rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	41	41	41	41	41	41	41	41	41
tilizers:														
Diammonium phosphate	-	-	24800	41200	24800	33435	27735	33435	27735	33435	27735	33435	27735	33435
Urea 46%	-	-	71920	119480	71920	78760	53400	78760	53400	78760	53400	78760	53400	78760
10:15:10	-	-	-	-	-	82	82	82	82	82	82	82	82	82
ichemicals:														
Fernasan D	-	-	124	206	124	153	159	153	159	153	159	153	159	153
Furadan	-	-	50	82	50	46	34	46	34	46	34	46	34	46
Nuvacron	-	-	620	1030	620	425	425	425	425	425	425	425	425	425
Nuvacron Combi	-	-	1240	2060	1240	9350	850	9350	850	9350	850	9350	850	9350
Propanil/Preforan	-	-	2976	4944	2976	2040	2040	2040	2040	2040	2040	2040	2040	2040
Carbicron	-	-	620	1030	620	425	425	425	425	425	425	425	425	425
Carbofuran	-	-	620	1030	620	573	573	573	573	573	573	573	573	573
Nogos	-	-	-	-		61	61	61	61	61	61	61	61	61

INPUT REQUIREMENTS BY SEASONS BLOCK 3 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	9450	-	9450	-	9450	-	9450	-
Sesame	-	-	-	-	-	840	-	840	-	840	-	840	-	840
Maize	-	-	4200	7000	4200	2800	2800	2800	2800	2800	2800	2800	2800	2800
Upland Rice	-	-	21000	35000	21000	12000	12000	12000	12000	12000	12000	12000	12000	12000
Cotton	-	-	-	-	-	8400	-	8400	-	8400	-	8400	-	8400
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	18	18	18	18	18	18	18	18	18
tilizers:														
Diammonium phosphate	-	-	21000	35000	21000	27650	23100	27650	23100	27650	23100	27650	23100	27650
Urea 46%	-	-	60900	101500	60900	65100	44100	65100	44100	65100	44100	65100	44100	65100
10:15:10	-	-	-	-	-	70	70	70	70	70	70	70	70	70
ichemicals:														
Fernasan D	-	-	105	175	105	126	133	126	133	126	133	126	133	126
Furadan	-	-	42	70	42	38	28	38	28	38	28	38	28	38
Nuvacron	-	-	525	875	525	350	350	350	350	350	350	350	350	350
Nuvacron Combi	-	-	1050	1750	1050	7700	700	7700	700	7700	700	7700	700	7700
Propanil/Preforan	-	-	2520	4200	2520	1680	1680	1680	1680	1680	1680	1680	1680	1680
Carbicron	-	-	525	875	525	350	350	350	350	350	350	350	350	350
Carbofuran	-	-	525	875	525	476	476	476	476	476	476	476	476	476
Nogos	-	-	-	-	-	52	52	52	52	52	52	52	52	52

INPUT REQUIREMENTS BY SEASONS BLOCK 4 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	-	-	12510	-	12510	-	12510	-
Sesame	-	-	-	-	-	-	-	1112	-	1112	-	1112	-	1112
Maize	-	-	-	-	5560	9240	5560	3700	3700	3700	3700	3700	3700	3700
Upland Rice	-	-	-	-	27800	46200	27800	18500	18500	18500	18500	18500	18500	18500
Cotton	-	-	-	-	-	-	-	11100	-	11100	-	11100	-	11100
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-	23	23	23	23	23	23	23
tilizers:														
Diammonium phosphate	-	-	-	-	27800	46200	27800	36535	30535	36535	30535	36535	30535	36535
Urea 46%	-	-	-	-	80620	133980	80620	86010	58250	86010	58250	86010	58250	86010
10:15:10	-	-	-	-	-	-	-	92	92	92	92	92	92	92
ichemicals:														
Fernasan D	-	-	-	-	139	231	139	166	176	166	176	166	176	166
Furadan	-	-	-	-	55	92	55	51	37	51	37	51	37	51
Nuvacron	-	-	-	-	695	1155	695	462	462	462	462	462	462	462
Nuvacron Combi	-	-	-	-	1390	2310	1390	10175	925	10175	925	10175	925	10175
Propanil/Preforan	-	-	-	-	3336	5544	3336	2220	2220	2220	2220	2220	2220	2220
Carbicron	-	-	-	-	695	1155	695	462	462	462	462	462	462	462
Carbofuran	-	-	-	-	695	1155	695	628	628	628	628	628	628	628
Nogos	-	-	-	-	-	-	-	69	69	69	69	69	69	69

INPUT REQUIREMENTS BY SEASONS BLOCK 5 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	-	-	13860	-	13860	-	13860	-
Sesame	-	-	-	-	-	-	-	-	-	1232	-	1232	-	1232
Maize	-	-	-	-	-	10240	6160	10240	4100	4100	4100	4100	4100	4100
Upland Rice	-	-	-	-	-	51200	30800	51200	20500	20500	20500	20500	20500	20500
Cotton	-	-	-	-	-	-	-	-	-	12300	-	12300	-	12300
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-	-	25	25	25	25	25	25
tilizers:														
Diammonium phosphate	-	-	-	-	-	51200	30800	51200	33835	40485	33835	40485	33835	40485
Urea 46%	-	-	-	-	-	148480	89320	148480	64550	95310	64550	95310	64550	95310
10:15:10	-	-	-	-	-	-	-	-	102	102	102	102	102	102
ichemicals:														
Fernasan D	-	-	-	-	-	256	154	256	195	102	195	102	195	102
Furadan	-	-	-	-	-	102	62	102	41	56	41	56	41	56
Nuvacron	-	-	-	-	-	1280	770	1280	512	512	512	512	512	512
Nuvacron Combi	-	-	-	-	-	2560	1540	2560	1025	11275	1025	11275	1025	11275
Propanil/Preforan	-	-	-	-	-	6144	3696	6144	2460	2460	2460	2460	2460	2460
Carbicron	-	-	-	-	-	1280	770	1280	512	512	512	512	512	512
Carbofuran	-	-	-	-	-	1280	770	1280	696	696	696	696	696	696
Nogos	-	-	-	-	-	-	-	-	76	76	76	76	76	76

INPUT REQUIREMENTS BY SEASONS BLOCK 6 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
·ds:														
Groundnuts	-	-	-	-	-	-	-	-	-	-	10800	-	10800	-
Sesame	-	-	-	-	-	-	-	-	-	960	-	960	-	960
Maize	-	-	-	-	-	-	4800	8000	4800	3200	3200	3200	3200	3200
Upland Rice	-	-	-	-	-	-	24000	40000	24000	16000	16000	16000	16000	16000
Cotton	-	-	-	-	-	-	-	-	-	9600	-	9600	-	9600
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-	-	-	20	20	20	20	20
:tilizers:														
Diammonium phosphate	-	-	-	-	-	-	24000	40000	24000	31600	25075	31600	25075	31600
Urea 46%	-	-	-	-	-	-	69600	116000	69600	74400	50400	74400	50400	74400
10:15:10	-	-	-	-	-	-	-	-	-	80	80	80	80	80
·ichemicals:														
Fernasan D	-	-	-	-	-	-	120	200	120	144	152	144	152	164
Furadan	-	-	-	-	-	-	48	80	48	44	32	44	32	44
Nuvacron	-	-	-	-	-	-	600	1000	600	400	400	400	400	400
Nuvacron Combi	-	-	-	-	-	-	1200	2000	1200	8800	800	8800	800	8800
Propanil/Preforan	-	-	-	-	-	-	2880	4800	2880	1920	1920	1920	1920	1920
Carbicron	-	-	-	-	-	-	600	1000	600	400	400	400	400	400
Carbofuran	-	-	-	-	-	-	600	1000	600	544	544	544	544	544
Nogos	-	-	-	-	-	-	-	-	-	60	60	60	60	60

INPUT REQUIREMENTS BY SEASONS BLOCK 7 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
eds:														
Groundnuts	-	-	-	-	-	-	-	-	-	-	15210	-	15210	-
Sesame	-	-	-	-	-	-	-	-	-	1352	-	1352	-	1352
Maize	-	-	-	-	-	-	6760	11240	6760	4500	4500	4500	4500	4500
Upland Rice	-	-	-	-	-	-	33800	56200	33800	22500	22500	22500	22500	22500
Cotton	-	-	-	-	-	-	-	-	-	13500	-	13500	-	13500
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-	-	-		28	28	28	28
rtilizers:														
Diammonium phosphate	-	-	-	-	-	-	33800	56250	33800	44435	37135	44435	37135	44435
Urea 46%	-	-	-	-	-	-	98020	162980	98020	93360	70850	93360	70850	93360
10:15:10	-	-	-	-	-	-	-	-	-	112	112	112	112	112
richemicals:														
Fernasan D	-	-	-	-	-	-	169	281	169	202	214	202	214	202
Furadan	-	-	-	-	-	-	68	112	68	62	45	62	45	62
Nuvacron	-	-	-	-	-	-	845	1405	845	562	562	562	562	562
Nuvacron Combi	-	-	-	-	-	-	1690	2810	1690	12375	1125	12375	1125	12375
Propanil/Preforan	-	-	-	-	-	-	4056	6744	4056	2700	2700	2700	2700	2700
Carbicron	-	-	-	-	-	-	845	1405	845	562	562	562	562	562
Carbofuran	-	-	-	-	-	-	845	1405	845	764	764	764	764	764
Nogos	-	-	-	-	-	-	-	-	-	84	84	84	84	84

INPUT REQUIREMENTS BY SEASONS BLOCK 8 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Du	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	-	-	-	-	-	-	7740	-
Sesame	-	-	-	-	-	-	-	-	-	-	-	688	-	688
Maize	-	-	-	-	-	-	-	-	3440	5760	3440	2300	2300	2300
Upland Rice	-	-	-	-	-	-	-	-	17200	28800	17200	11500	11500	11500
Cotton	-	-	-	-	-	-	-	-	-	-	-	6900	-	6900
Paddy Rice	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-	-	-	-	-	15	15	15
tilizers:														
Diammonium phosphate	-	-	-	-	-	-	-	-	17200	28800	17200	22715	18965	22715
Urea 46%	-	-	-	-	-	-	-	-	49880	82400	49880	53490	36250	53490
10:15:10	-	-	-	-	-	-	-	-	-	-	-	58	58	58
ichemicals:														
Fernasan D	-	-	-	-	-	-	-	-	86	281	86	103	109	103
Furadan	-	-	-	-	-	-	-	-	34	112	34	32	23	32
Nuvacron	-	-	-	-	-	-	-	-	430	720	430	288	288	288
Nuvacron Combi	-	-	-	-	-	-	-	-	860	1440	860	6324	574	6324
Propanil/Preforan	-	-	-	-	-	-	-	-	2064	3456	2064	1380	1380	1380
Carbicron	-	-	-	-	-	-	-	-	430	570	430	287	287	287
Carbofuran	-	-	-	-	-	-	-	-	430	570	430	392	392	392
Nogos	-	-	-	-	-	-	-	-	-	-	-	44	44	44

INPUT REQUIREMENTS BY SEASONS BLOCK 9 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	-	-	-	-	-	-	13500	-
Sesame	-	-	-	-	-	-	-	-	-	-	-	1200	-	1200
Maize	-	-	-	-	-	-	-	-	6000	10000	6000	4000	4000	4000
Upland Rice	-	-	-	-	-	-	-	-	30000	50000	30000	20000	20000	20000
Cotton	-	-	-	-	-	-	-	-		-	-	12000	-	12000
Paddy Rice	-	-	-	-	-	-	-	-	28350	47250	28350	47250	28350	47250
Vegetables	-	-	-	-	-	-	-	-	-	-	-	25	25	25
tilizers:														
Diammonium phosphate	-	-	-	-	-	-	-	-	45750	76250	45750	65750	48750	65750
Urea 46%	-	-	-	-	-	-	-	-	159100	218500	159100	108500	107100	108500
10:15:10	-	-	-	-	-	-	-	-	-	-	-	100	100	100
ichemicals:														
Fernasan D	-	-	-	-	-	-	-	-	307	512	307	180	190	180
Furadan	-	-	-	-	-	-	-	-	217	362	217	317	197	317
Nuvacron	-	-	-	-	-	-	-	-	1538	2562	1538	1812	1287	1812
Nuvacron Combi	-	-	-		-	-	-	-	1499	2500	1499	11000	1000	11000
Propanil/Preforan	-	-	-	-	-	-	-	-	7380	12300	7380	8700	6180	8700
Carbicron	-	-	-	-	-	-	-	-	1537	2562	1537	1812	1287	1812
Carbofuran	-	-	-	-	-	-	-	-	1537	2562	1537	1992	1467	1992
Nogos	-	-	-	-	-	-	-	-	-	-	-	75	75	75

INPUT REQUIREMENTS BY SEASONS BLOCK 10 - In Kg

Item	1982		1983		1984		1985		1986		1987		1988	
	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der	Gu	Der
ds:														
Groundnuts	-	-	-	-	-	-	-	-	-	-	-	-	7380	-
Sesame	-	-	-	-	-	-	-	-	-	-	-	-	-	656
Maize	-	-	-	-	-	-	-	-	-	5500	3300	5500	2200	2200
Upland Rice	-	-	-	-	-	-	-	-	-	27500	16500	27500	11000	11000
Cotton	-	-	-	-	-	-	-	-	-	-	-	-	-	6600
Paddy Rice	-	-	-	-	-	-	-	-	-	18000	10800	18000	10800	18000
Vegetables	-	-	-	-	-	-	-	-	-	-	-	-	14	14
tilizers:														
Diammonium phosphate	-	-	-	-	-	-	-	-	-	37500	22500	37500	24130	31730
Urea 46%	-	-	-	-	-	-	-	-	-	107750	64650	107750	51500	79180
10:15:10	-	-	-	-	-	-	-	-	-	-	-	-	56	56
ichemicals:														
Fernasan D	-	-	-	-	-	-	-	-	-	137	82	137	104	99
Furadan	-	-	-	-	-	-	-	-	-	155	93	155	82	130
Nuvacron	-	-	-	-	-	-	-	-	-	1187	712	1187	575	775
Nuvacron Combi	-	-	-	-	-	-	-	-	-	1375	580	1375	550	6050
Propanil/Preforan	-	-	-	-	-	-	-	-	-	5700	3420	5700	2760	3720
Carbicron	-	-	-	-	-	-	-	-	-	1187	712	1187	575	775
Carbofuran	-	-	-	-	-	-	-	-	-	1187	712	1187	813	1288
Nogos	-	-	-	-	-	-	-	-	-	-	-	-	42	42

Part 2

Organisation, Management and Implementation

1

Organisation

1.1 INTRODUCTION

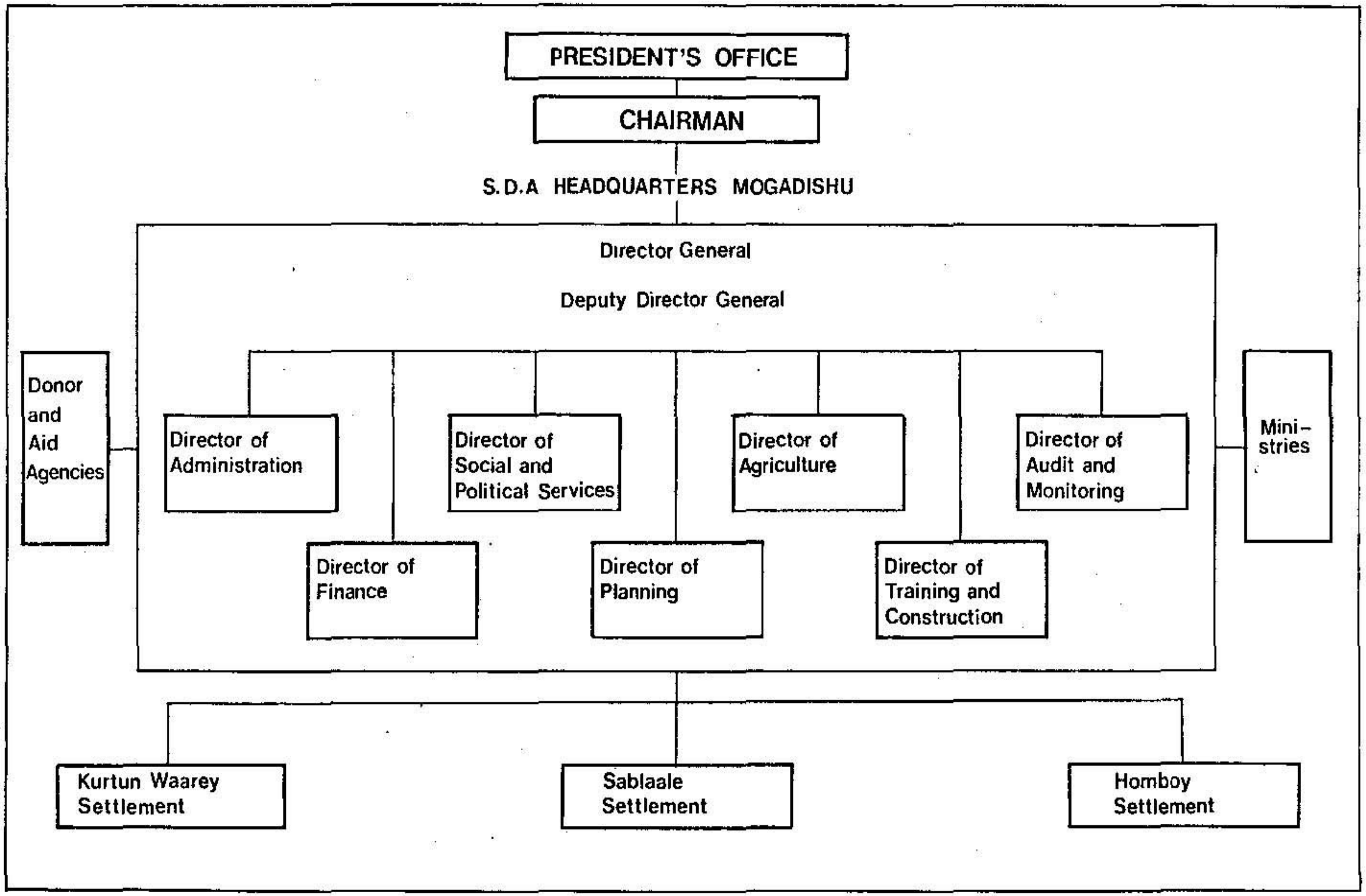
The principal objective of the project is to establish a settlement scheme with a stable community participating in and benefiting from the agricultural and social activities of the scheme.

There is no doubt that success in achieving this on the Homboy Scheme will depend to a large extent on an effective management structure which must be established at the start of the project. There is no substitute for good management and previous experience on large schemes has shown failure often results from lack of experience in this field. In Somalia there is a shortage of people with the relevant experience and, with the proposed development of other irrigated agricultural projects (Mogambo, Sablaale, Kurtun Waarey, Janaale) in the country, this situation is unlikely to improve in the near future.

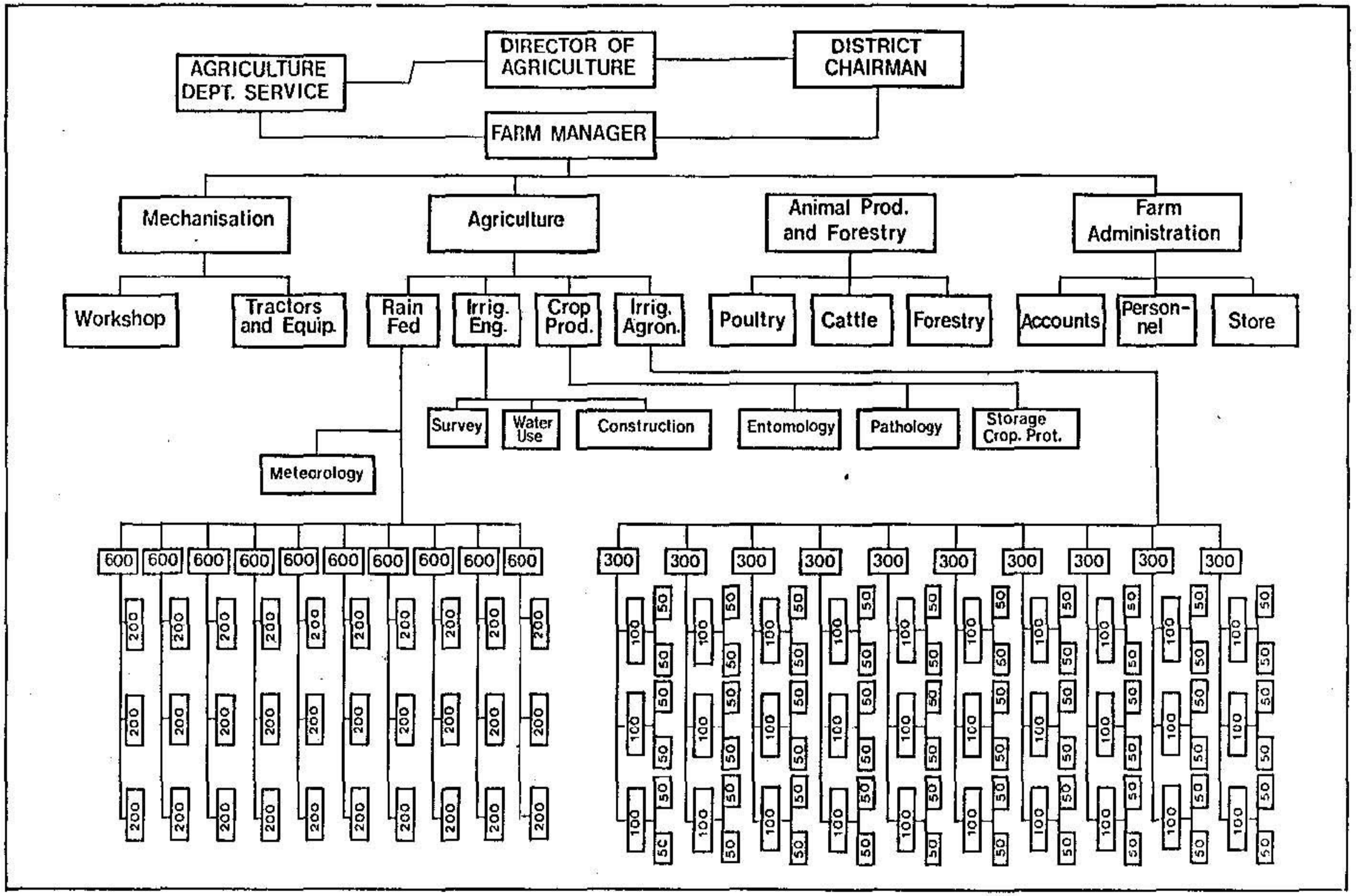
Before making proposals for a management structure for Homboy, it is essential to examine the existing structure of SDA, management and socio-political structures on the other two settlements, and problems experienced during the past few years. Any changes in the structure which are considered essential to the successful development of Homboy are discussed in detail. Emphasis must also be placed on the quality of management, so that the destabilising and demoralising effects of the move from Dujuuma may be minimised. Given the existing demands for experienced managerial staff on projects throughout Somalia and the need for rapid development at Homboy, it is anticipated that assistance from expatriates with appropriate experience will be necessary.

Two distinct phases with differing needs and objectives are evident during the development of an irrigation scheme such as Homboy, a transitional implementation stage and an operational stage, and these are discussed in the following sections. Initially a structure providing tight central control is anticipated to ensure adequate coordination and this will gradually give way to a much more devolved system with many decisions being made at the 50 ha. cooperative unit level.

1.1 Framework of the Provincial administration



1.2 Organisational chart - Agricultural Settlement Scheme



2

Proposed Organisation Structure

1.2.1 GENERAL

The existing organisation is established at three levels. The Settlement Development Agency headquarters in Mogadishu, the scheme farm management organisation and a socio-political structure within the overall framework of the Provincial administration. Figure 1.1 illustrates the relationship between SDA the Presidents' Office, other government ministries, donor and aid agencies and the settlement schemes including Homboy.

1.2.2 THE SDA HEADQUARTERS

The SDA was established in 1975 on the recommendations of a World Bank Mission. A Chairman responsible for the whole drought rehabilitation programme heads the orgainsation, and provides a direct link with the Presidents' Office. The SDA is seperate from the Ministry of Agriculture, and is staffed by a General Manager, a deputy and seven Directors representing the various departments. See Figure 1.1. These are supported by junior staff in the conventional way. In general the SDA has suffered from shortages of suitably qualified staff, and changes at senior level have been all too frequent, affecting both coninuity and capability. The headquarters organisation is supported by a team of management consultants financed under the loan agreement with the Arab Fund for Social and Economic Development which also supports the development of irrigated agricultural development on the three settlement schemes. Under a separate agreement, the IDA support rainfed agriculture associated with the settlement schemes.

The SDA is responsible for the direction and coordination of the settlement programme, liaison with other ministries and donor and aid agencies. In addition they provide technical supervision, procure all plant, agricultural machinery and other physical inputs and are closely involved in detailed planning.

1.2.3 SETTLEMENT SCHEME ORGANISATION

Each of the three settlement schemes has its own management structure, headed by a Farm Manager, responsible for the day to day running. He is supported by a team of professional officers, heading up the four departments. Because of the recent nomadic background of the settlers, a high level of supervision is essential and this is reflected in the large number of junior staff supporting the senior management structure. Figure 1.2 illustrates the overall organisation.

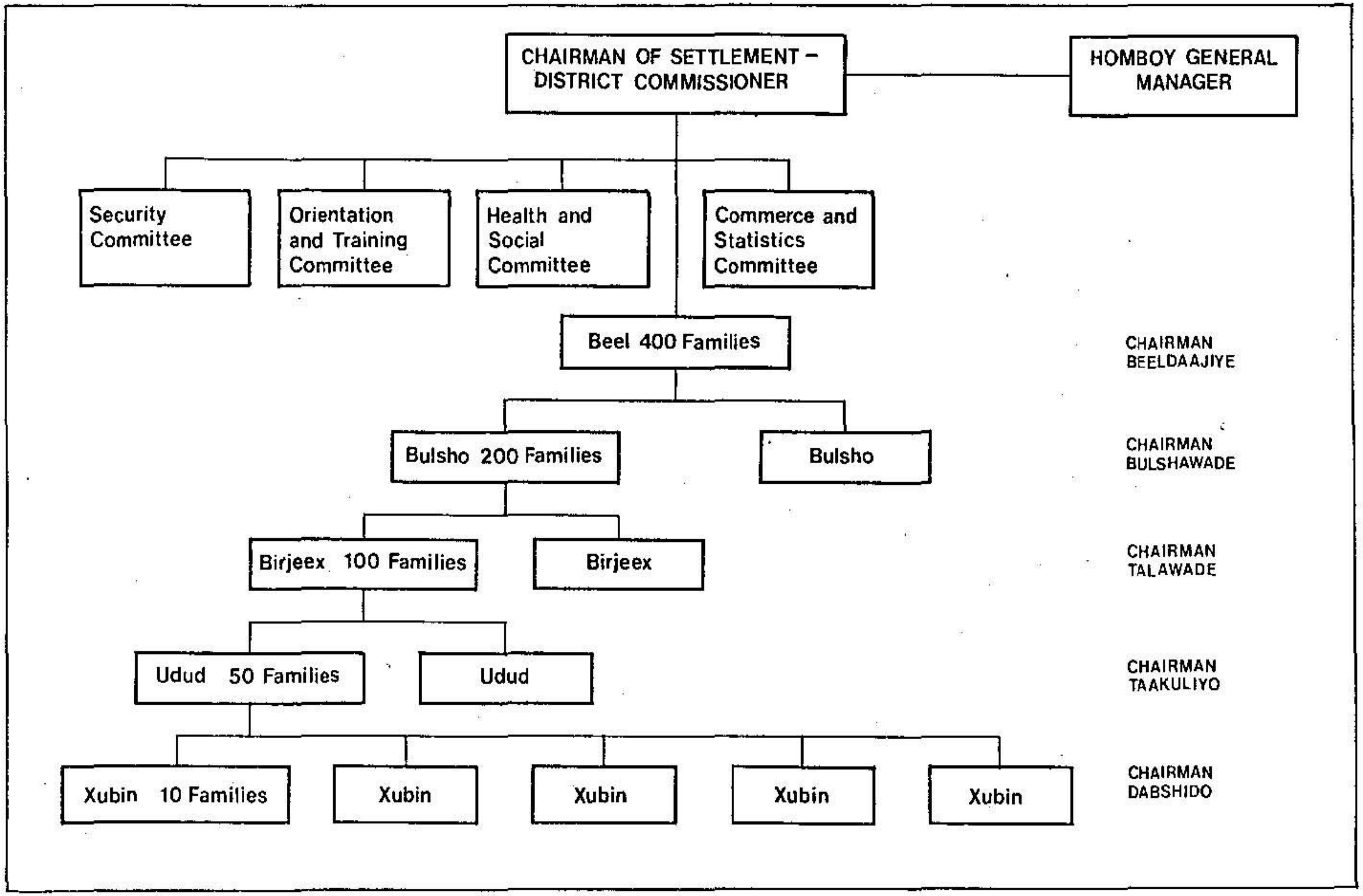
Staffing problems have also been encountered at scheme level. Total establishments for the three settlements are; Kurtun Waarey and Sablaale 392, Dujuuma/Homboy 818 and figures produced by SDA in December 1979 showed that staffing overall was

63 per cent, 73 per cent and 7.5 per cent respectively. The management consultants which support the SDA headquarters organisation (see Section 1.2.2) also support the settlement schemes, but even here many posts remain unfilled. A new contract has recently been agreed with the consultants to provide a larger team of four experts at each settlement.

1.2.4 SOCIO/POLITAL STRUCTURE

It is the policy of the government of Somalia to establish an administrative district for each settlement scheme, and the same is proposed for Homboy. As there is no area other than the settlement involved, the District Chairman or District Commissioner becomes chairman of the settlement. In addition to the usual complement of staff associated with an administrative district, the settlement chairman has a special important function to perform. With the social disturbances associated with the resettling of a group of nomads on a permanent site with regular and a very different pattern of life, in mind, a series of committees based upon traditional family groupings has been established at the settlements. Through this structure, settlers views are represented at all levels, thus inducing a sense of community. The District Chairman chairs the most senior committee. Figure 1.3 illustrates this structure from the smallest unit of 10 families (Xubin) to the largest 400 family unit (Beel). The six committees are repeated at each social unit level. In practice at Kurtun Waarey, experience has shown that strict adherence to this structure in too much duplication and the committees at 'Bulsho' and 'Birjeex' levels have been exlcuded. Apart from the stabilising effect already mentioned, the committees are used extensively by the farm management to disseminate orders and organise production. The chairman of the committees receive a small remuneration from the SDA for their services.

1.3 Organisational chart - Resettlement Committees



3

Implementation

1.3.1 GENERAL

The Homboy scheme has several distinct advantages over its sister schemes, one of which is the experience gained during the past few years. This section evaluates existing management under three main headings; staff, rate of development and devolution of the management structure.

1.3.2 STAFF

As previously mentioned, shortages of staff occur right through the SDA structure, and with many planned and ongoing developments competing for staff, this problem is unlikely to be solved in the near future. The recently approved Agricultural Extension and Farm Management Training Programme is unlikely to ease the situation until 1985 onwards. Not only is there a short fall in numbers, but often quality of staff has suffered and these two factors combined, seriously limit the capacity to plan and implement the settlement schemes.

1.3.3 RATE OF DEVELOPMENT

Both Kurtun Waarey and Sablaale settlements were scheduled to complete development by December 1979, after a five year implementation stage. In both cases, the development targets have not been met, and only 30 per cent development had been achieved by December 1979. Delays in delivery of construction plant are partly to blame, but the main factor remains poor management due to shortfalls in establishment and lack of suitably qualified and experienced staff. The SDA settlement schemes are by no means alone in this slow development, all large development schemes in Somalia suffer from the same malaise which suggests that the SDA structure is not to blame.

1.3.4 DEVOLUTION OF THE MANAGEMENT STRUCTURE

Although SDA policy is to establish a devolved system of mangement, with farmer cooperatives managing their own production on their allocated land within an overall framework providing services, advice and coordination, this has not come to pass on any of the settlements. The existing situation shows a much closer resemblance to a state farm than a settlement scheme. There are several possible reasons for this:

(a) more efficient utilisation of scarce management staff resources is possible with a state system.

(b) at both Kurtun Waarey and Sablaale, the transitional implementation stage has been unduly prolonged due primarily to failure to achieve development targets. This in turn has been affected by shortages of staff at SDA headquarters resulting in inadequate detailed implementation planning.

(c) failure to establish workable administrative procedures and record keeping sufficient to facilitate proper monitoring and evaluation. An inherent danger in this situation is that the state farm management model becomes the norm, and it becomes increasingly difficult to change and adapt. This lack of progression and devolution is causing the SDA some concern.

4

The Homboy Settlement

1.4.1 THE HOMBOY SETTLEMENT

Before making proposals for the organisation and management of Homboy, it is necessary to examine the scheme, particularly as to how it differs from the other two settlements.

The first and most obvious is the difference in size. At 8,850 ha. of net irrigated land, Homboy is three times larger than Kurtun Waarey and Sablaale and is in fact the largest planned irrigated development in the whole of Somalia.

Secondly the Homboy Scheme has two important features: the project is supplied by a 16 km long main canal offtaking from the Fanoole canal and flowing parallel to the new Jilib - Golweyn road; comprehensive flood protection works have been incorporated necessitating the construction of long lengths of flood bund. Both these features considerably increase the volume of earthworks associated with the irrigation scheme. Neither Sablaale nor Kurtun Waarey have similar [illegible]

The shape of the project area is also significant, whereas the other settlements are more or less rectangular and can be served by one central village, Homboy is long and narrow and would be logistically difficult to manage without sub-division.

A further difference which should not be overlooked is that the settlers who will populate the scheme have, through no fault of their own, been associated with the failure of agricultural production at Dujuuma, and are being asked to cope with another major social upheaval. With their present low morale, this situation calls for tactful and sympathetic handling, strong effiecient management and above all every effort must be made to ensure the successfull implementation of their new scheme at Homboy.

With the background outlined above very much in mind, the Homboy project area has been subdivided into 10 blocks, each having a village sized in accordance with a density of one family per hectare of irrigated land. The design of the irrigation system is such that each block is self contained, and in field works have been designed around the social structure as illustrated in Figure 1.3. Every attempt has been made to build in maximum flexibility, to suit both the implementation stage and the longer term and more important cooperative structure desired.

5

Homboy Project Headquarters

1.5.1 GENERAL DESCRIPTION

An organisational structure with the capability of operating the project will have to be established shortly after construction of the project commences. Its functions and responsiblities will grow as land is developed, and by the sixth year after the start of construction it should have stabilised in size and have residual capability of operating and maintaining the project effectively. The final form of the proposed organisational structure is described in Section 1.5.2 whilst the assistance and supporting services considered necessary during the implementation stage, to enable the project area to be developed is described in Section 1.5.3. The organisational structure recommended for operation, maintenance and agricultural management is illustrated in Figure 1.4. It comprises four functional departments Agriculture, Engineering, Administration and Finance, and Settlement and Training. The Head of each department would report directly to a Project General Manager, who in turn would be responsible to the General Manager of the SDA. He would also be responsible for maintaining close liaison with the Settlement Chairman as head of the settlement committee structure and ensuring that liaison was maintained at all levels. The project offices and headquarters for the major departments would be located at New Aminow, adjacent to Homboy village.

Each block would have its own management structure (figure 1.4) and levels of responsibility are discussed and defined.

1.5.2 THE HOMBOY PROJECT HEADQUARTERS

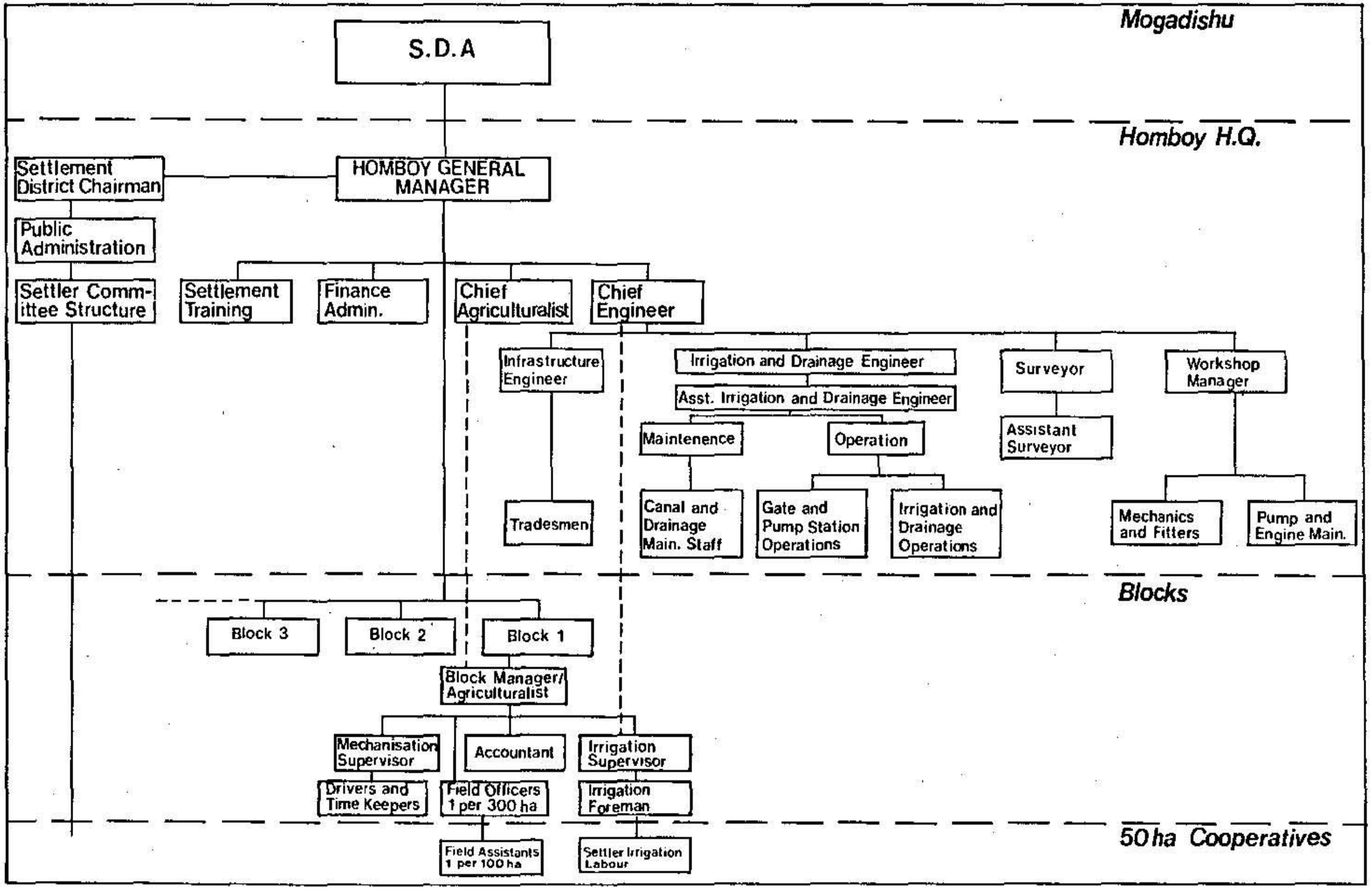
(a) The Engineering Department

The engineering department would be headed by the Chief Engineer. It would have three sub-sections; irrigation and drainage, workshops and infrastructure. Together they would ensure that irrigation works and drains were maintained and operating correctly, vehicles, plant and, agricultural machinery were repaired and maintained; and that all buildings and civil works were kept in an adequate state of repair. The Chief Engineer would be an experienced Irrigation and Drainage Engineer.

This section would have overall responsibility for the operation of the system from the offtake from the Fanoole canal to field level. However routine work at Block level would be the responsibility of the Block Manager. Details of the operation and maintenance of the irrigation and drainage System are given in Part 3 of this Volume.

The Chief Engineer would be assisted at Project Headquarters by an Irrigation

1.4 Homboy Irrigation Settlement Scheme - Organisation/Operational stage



and Drainage Engineer and two assistant irrigation engineers, responsible for irrigation and drainage operation and maintenance.

A rigid hierarchy of management is proposed for the irrigation and drainage network so that wastage of water is reduced to an absolute minimum. The irrigation and Drainage Engineers will supervise the operation and maintenance of the supply canal and irrigation and drainage systems together with the works associated with flood protection including the storage reservoirs and the four drainage pump stations. It is essential for the efficient running of the Project that all these items are carefully operated and maintained.

Under the irrigation engineers will be a team of operators and maintenance personnel with appropriate equipment and vehicles to enable them to undertake the daily running and repair of the systems. Operators are provided at all the major structures in addition to the canal operators responsible for special reaches of Main and distributary canals together with the drainage system and associated storage reservoirs. The canal operators will come under the direct supervision of the Irrigation Engineer. Only the operators responsible for the major structures have been provided with operators quarters.

The irrigation programme will be coordinated by the Chief Engineer and should not only be modified with the season and the cropping pattern but also as a result of experience gained at field trials in the block farms. The release and allocation of water to individual blocks will be centrally managed but within the block, the block manager and irrigation supervisor will arrange the distribution of supplies and any rotation required. This information will be passed to the project headquarters and the canal operators to enable any necessary adjustments to be made.

The main workshop would be located at New Aminow and would operate under the supervision of a Workshop Manager. It would be staffed by a complement of skilled mechanics, fitters, and electricians and other tradesmen. The workshop would have the capability to carry out major repairs and overhauls to all plant, vehicles and machinery and maintain an adequate supply of spare parts. Daily maintenance and minor repairs of agricultural machinery would be carried out at the Block villages. Facilities at the main workshop would include fuel stores, mechanical and electrical workshops, body and paintwork repair shops and a machine shop for making some spare parts where necessary. Provision is also made for mobile workshops.

The infrastructure section of the engineering department would be responsible for the maintenance of all buildings and services throughout the project. It would be located at the project headquarters at New Aminow and would be staffed by an engineer, skilled tradesmen and machine operators.

(b) The Agricultural Department

This department would be staffed by a Chief Agriculturalist, who would be responsible for coordinating the management of all agricultural activities. He will provide the main link with SDA headquarters and in addition liaise with research institutions, evaluate new crops and varieties and disseminate information to Block Managers. Because detailed planning and the day to day organisation of production will take place at Block level, it is not anticipated that he will require an assistant.

The Chief Agriculturalist will however, in his role as coordinator, be available to Block Managers, offering technical advice and assisting as required in detailed annual planning sessions.

(c) The Administration and Finance Department

The administration and finance department would be responsible for opertating the accounting and administrative system for the project, preparation of annual budgets, maintaining budgetary control and would carry out all functions connected with hiring of permanent staff at Headquarters and Block level. This department would also be responsible for aggregating requisitions for agricultural inputs from the blocks and for their eventual procurement and distribution. It would be responsible for supervision and monitoring of Block level accounting and book-keeping and would be staffed by a Financial Controller and Administrative Manager, supported by book-keeping, clerical and secretarial staff.

(d) The Settlement and Training Department

This department, staffed by a Settlement Officer and Training Manager, would be responsible for attending to the community needs of the settlers and organising appropriate training to equip them for an increasingly responsible role in the organisation of the scheme, particularly at the Block level.

The department would also have responsibility for organising the logistical arrangements for transportation of settlers from Dujuuma to Homboy, organising housing, supply food stuffs and ensuring that sites and materials were available for the housing and village construction programme.

1.5.3 THE BLOCK HEADQUARTERS

Each of the ten blocks would have a management team, based in the block village. The Block Manager would be an agriculturalist, and he would be supported by a Mechanisation Supervisor, an Accountant/Bookeeper and an Irrigation Supervisor (See Figure 1.4). As outlined in Part 2 Chapter 2 of this volume, the village would not be simply sources of labour but would be designed as complete communities. The sense of identity would be reinforced by giving the blocks a high degree of autonomy, and by involving settlers through the committee structure.

Each block manager would be responsible for the irrigation and general agricultural management within his area. Each farm would be sub-divided into areas of about 300 ha. served by a Field Officer, and 3 Field Assistants. The 300 ha. areas, would generally be sub-divided into 50 hectare/50 family units. In addition to the normal duties of agricultural management, emphasis would be placed on providing extension and advice to the families attached to each village. Every effort would be made to ensure that the village communities contribute increasingly to the organisation of activities on each block and assume a positive decision making role. The Udud committees are seen as becoming increasingly important as the 50 ha. cooperative units develop.

The daily operation of the irrigation system will be directed by the irrigation supervisor working for the block managers in conjunction with the irrigation engineer. Assisting the irrigation supervisor in each block will be a team of irrigation foreman each responsible for the field irrigation of two watercourse units (one 50 ha. cooperative). On average each supervisor will have 8 foremen under his charge. The foremen will assist, advise and organise the irrigation labourers of two Udud cooperative units (100 ha). The foremen irrigators will be farmers (settlers) with the benefit of a series of short training sessions in the simple routines necessary for field irrigation, operation and maintenance.

The irrigation teams would vary in respect of numbers and operations depending upon the size of the block and the crops under cultivation.

Maintenance of canals and drains within blocks will be organised on a day to day basis by the operation staff when they are not fully involved in operation. Associated with a 12 hour irrigation period larger inputs will be required for operation at the beginning and end of a day. Much of the maintenance work, including minor bank repairs to field channels and weed clearance of large channels can be done by hand. When irrigation requirements are low in the dry or 'closed season' (February and March) maintenance can be carried out on a large scale using the irrigation labour, plant and machinery from both the maintenance section and the agricultural sector.

The Mechanisation Supervisor would be responsible for the village vehicle park and the inspection of the farm vehicles (tractors, harvesters and the ancillary equipment, trailers, etc.). The Mechanisation Supervisor's particular duty would be to maintain accurate records of the performance of each vehicle - hours worked, tasks accomplished, fuel consumption, breakdowns, maintenance, etc. These records would be used to monitor the efficiency of the mechanisation service and to enable charging levels to be adjusted so that replacement and operating costs could be recovered. The appropriate records of hours used on each 50 ha units would be passed on to the accountant/book-keeper to enable charges to be made to individual units.

The principle function of the Accountant book-keeper would be to maintain accurate accounts for each unit in the Block. In effect this would mean keeping an account of all charges for operations carried out, inputs (including labour) used and produce sold from each of the individual 50 ha. units, in order that surpluses over direct costs could be estimated and bonuses calculated for each unit.

6

Homboy Scheme Management Proposed Structure

1.6.1 GENERAL

The implementation stage of the Homboy Project covers that period between the initiation of construction and full development and normal operation of the project. The aim during this period will be to bring land into production as rapidly as possible and to ensure that the entire area is under cultivation and all available families settled in their respective villages in as short a time as possible after completion of the engineering works. Three major activities are involved:

(a) the construction of the supply, irrigation and drainage systems and associated engineering works.

(b) the gradual establishment of an effective organisation and management structure (i.e. project authority).

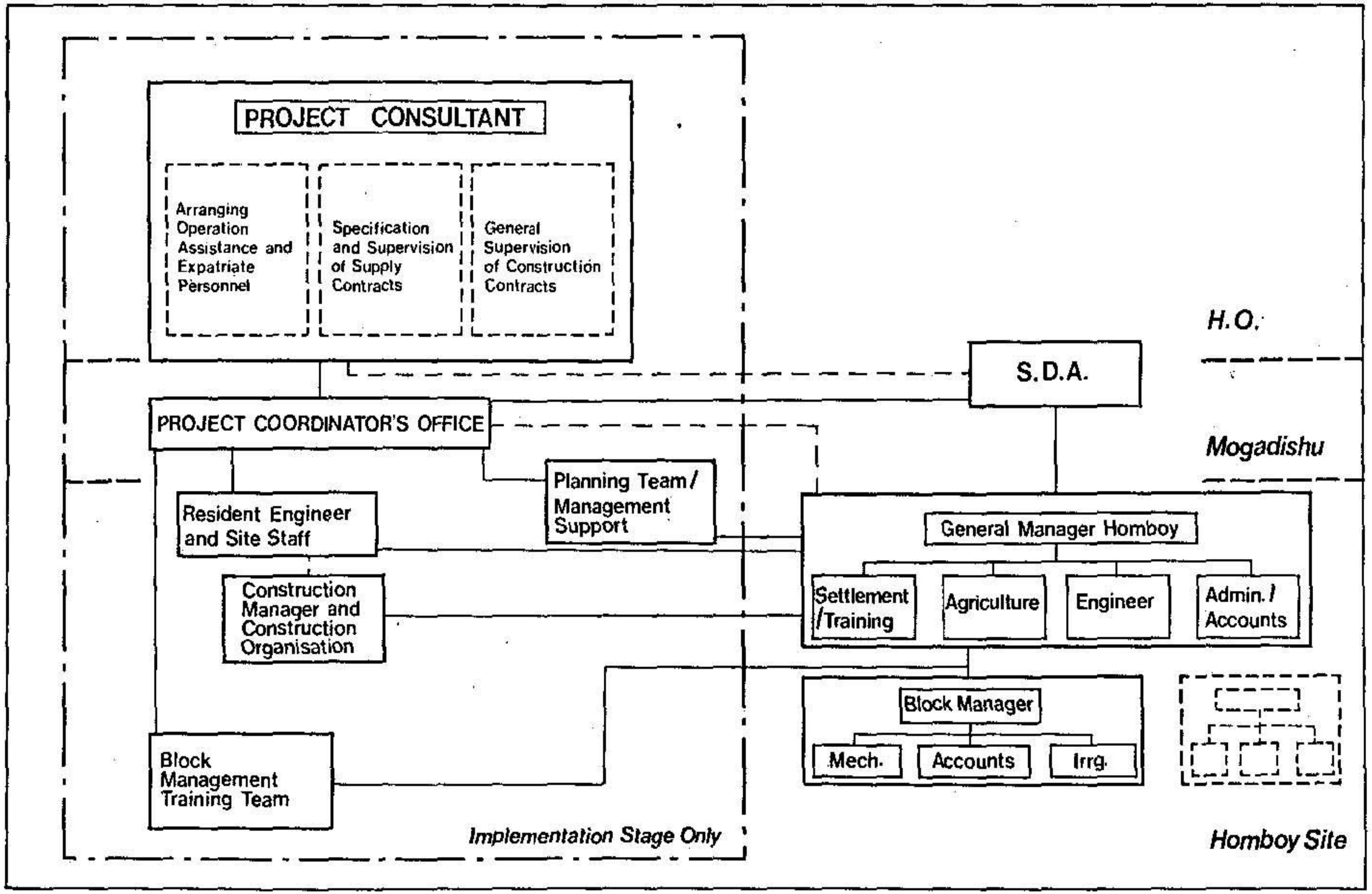
(c) the organisation of agricultural production as irrigation works are commisioned and land developed brought into cultivation.

In Section 1.3, an evaluation of existing management performance was made. This was done in order to see clearly the weaknesses that had resulted in poor performance on the other settlement schemes and in an endeavour to avoid a similar situation developing at Homboy. It concluded that support by expatriates would be required in the implementation stage, when the overall demands for managerial, technical and skilled staff will be at their greatest. Although some agricultural staff would be coming available from the Agricultural Extension and Farm Management Project towards the end of the implementation stage, the simultaneous development of a number of other projects in Somalia and particularly in the Jubba and Shabeelle valleys will accentuate the shortage of staff. Whilst expatriate assistance is allowed for in the following proposal, it is emphasised that an underlying aim would be the replacement of expatriates with Somali staff as soon as adequately trained and experienced Somali staff become available.

Implementation of a complete project normally involves three seperate parties, the Project Authorities, in this case the SDA, the Project Consultant and the Contractor executing the works. The Project Consultant may be assisted by sub-consultants and other specialists whilst there may be more than one contractor and also sub-contractors involved. Although this arrangement would be the most satisfactory method of implementing the Homboy Project, it is understood that the policy of the SDA is for them to be involved in as much of the construction works as possible and proposals for construction take this into account.

7.2

1.5 Homboy Irrigated Settlement Scheme - Organisation/Implementation stage



The development of a complex project such as the Homboy Irrigated Settlement Scheme involves the participation of many disciplines and organisations and it is essential these are adequately coordinated. It is therefore proposed that a Project Consultant be appointed, who would provide assistance and technical back-up as illustrated in figure 1.5.

The Project Consultant at their Head Office would make arrangements for construction of the works, procurement of vehicles and equipment as required and provide back up services for agricultural and other developments.

One of the reasons for slow rates of development is the shortage of staff at SDA Headquarters to undertake the detailed final planning necessary for successful implementation. It is proposed that a Project Coordinator's Office be established in Mogadishu to work with the SDA and undertake final planning and programming of the engineering, agricultural and other inputs necessary for implementation of the project including evaluation of anticipated requirements for the fist two years. It would also provide liaison between the SDA and the Project Consultant. Initially, the Project Coordinator's Office would comprise the following expatriate staff.

(a) The Project Consultant's representative and an assistant, both of whom would have an appropriate engineering background.

(b) Other staff who would form the detailed planning team would undertake appointments within the SDA organisation at HQ and would transfer to Homboy at an appropriate stage in the programme for implementation where they would become the management support team. The staff initially concerned would be:

   (i) General Manager

   (ii) Chief Agriculturalist

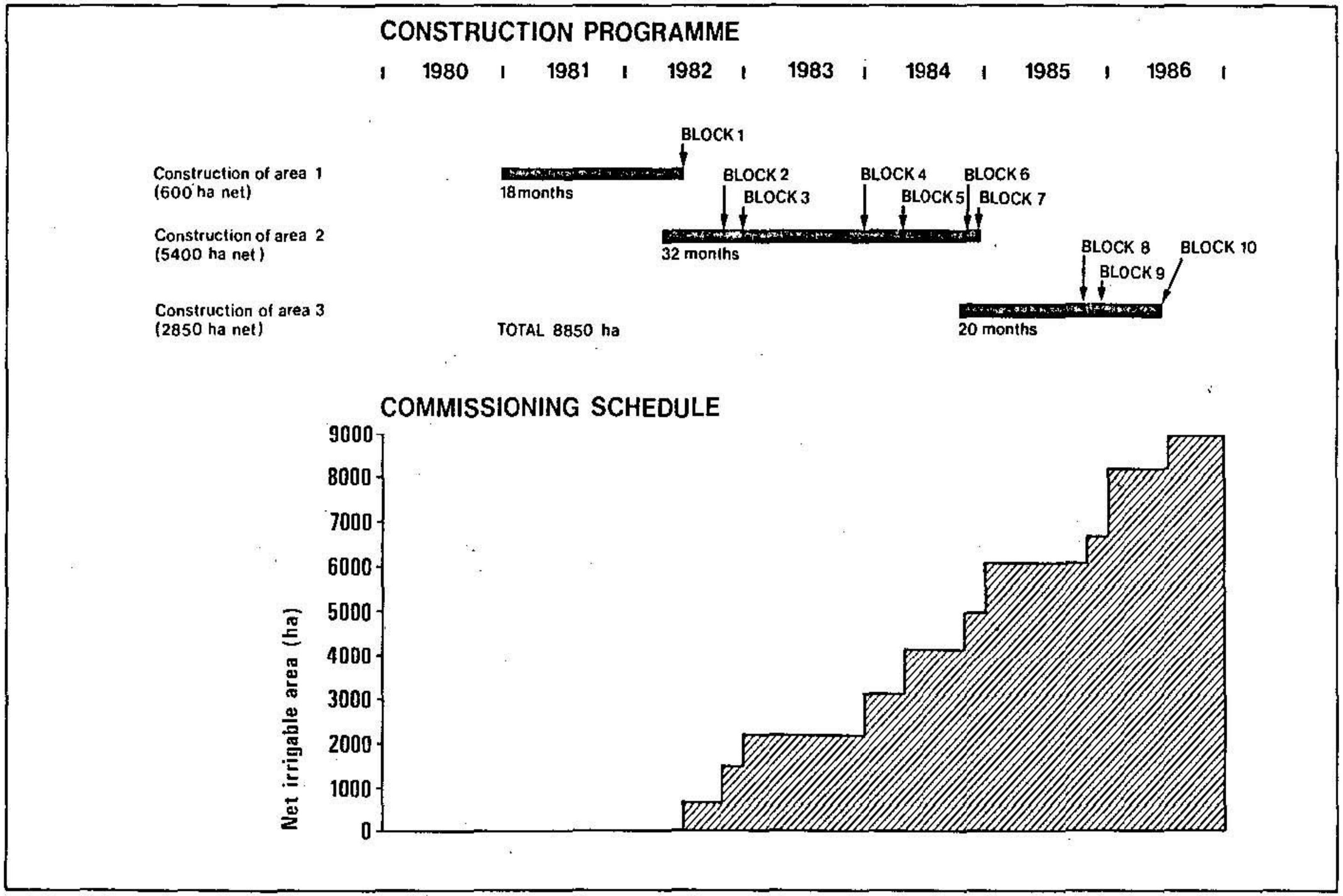
   (iii) Financial Controller and Administrative Manager

1.6.2 THE ESTABLISHMENT OF THE HOMBOY SCHEME MANAGEMENT

The proposed structure of the Homboy Scheme Management has been described in section 5.2. One of the primary activities of the implementation stage will be to establish this organisation so that it is operating effectively as soon as possible after construction commences. This will be effected by supplementing the three expatriates who provide the core of the implementation planning team at Headquarters (section 6.1) by the appointment of a Training Manager, a Chief Engineer, an Infrastructure Engineer and a Workshop Manager. There would be a distinct advantage if the Mechanisation Supervisor from the Block Planning Team (section 6.4) joined at this stage. Emphasis would be given to training qualified local staff as replacements and it is envisaged that a system of counterparts would be operated. Not all counterpart staff would be required at the start.

The General Manager should be a highly experienced person preferably having undertaken a similar role on a large irrigation project. He would be responsible for coordination of all project activities, project plans and would ultimately be responsible to the SDA for ensuring that established targets were met. He should be in position shortly after construction commences and consequently would be involved in selection and recruitment of the other key senior posts.

1.6 Construction programme and commissioning schedule



The Financial Controller and Administrative Manager post would also be filled initially by an expatriate who should be in position as soon as possible after construction commences. The wide range of responsibilities involved would include designing and installing the most appropriate accounting and financial control system, establishment of proper administrative systems, recruitment of secretarial and clerical staff, and management of the main Headquarters Office. He would also be responsible for liaison with the District Administration and the various local Government offices involved.

Provided that suitably qualified and experienced candidates are available, the post of Settlement Officer should be filled by a local person and should be established in time to allow the detailed planning of arrangements to transport and resettle families from Dujuuma to be carried out.

The Training Manager's post should be filled by an expatriate recruited by the Project Consultant. He too would be recruited when construction commences in order that training programmes can be planned and introduced when required.

The Workshop Manager and Mechanisation supervisor should also be in post at an early stage. This would allow time for all agricultural machinery arriving to be cleared, transported to Homboy and checked over before the first cultivation on Block 1 was due to start.

1.6.3 CONSTRUCTION OF IRRIGATION AND CIVIL ENGINEERING WORKS

The construction porgramme as outlined in Volume 2, Annex and illustrated in Figure 1.6 is designed to yield a complete irrigation scheme of approximately 9,000 hectares in a period of six years.

The other settlement schemes at Kurtun Waarey and Sablaale are both currently under construction, this work being organised and supervised by the staff of SDA with the aid of a management consultant team. Each project will eventually extend to 3,000 hectares of irrigated land. The irrigation works are being constructed by equipment recieved under loan agreements with staff provided by the SDA. The housing and infrastructural components are being assisted by seperate aid organisations.

The construction of works of the scale planned at Homboy are often undertaken by International Contractors but this does not accord with SDA policy. The only Somali Government contracting organisation with appropriate experience is the Water Development Agency. This agency does not have sufficient resources at present to undertake additional projects. If implementation of the Homboy Scheme is to go ahead quickly, it does not appear feasible for the Water Development Agency to be involved.

In order to complete the construction of the works in phase with the agricultural programme, direct labour alone under the direction of SDA is not considered viable. Private organisations such as NATCO exist in Somalia but is is doubtful whether the resources exist to undertake large sections of the Homboy Scheme.

It is evident that a seperate organisation is required to assist the SDA in undertaking construction of the works associated with the irrigation scheme. This organisation would use the majority of the equipment supplied by the Arab Fund for construction. It is therefore proposed that SDA supply labour together with some supervisory staff and plant and materials and undertake construction of the works with the assistance of an expatriate management construction team provided form an International Contractor or other suitable organisation.

Duties of the management construction team would include the supervision and training of Somali staff and operators in construction of the works and liaison with the Project Consultant's site staff.

The Project Consultant would arrange the procurement of the expatriate management construction team and it is envisaged that a minimum compliment would comprise:-

Construction Manager	1
Agents	2
Senior Engineers	4
Senior Measurement Engineer	1
Section Engineers	4
Office Manager	1
Plant Manager	1
Plant Supervisors	2
Stores Supervisor	1
Foreman Fitters	2
Construction Foreman	3
	22

The actual complement of the expatriate management construction team will depend on the number and capability of the Somali engineers, trades foreman, mechanics and others that can be made available.

In addition to the construction team the Project Consultant would provide site staff whose duties would include technical supervision to ensure the works are constructed in accordance with the designs and specifications, to undertake and approve design or other adjustments which may become necessary on site, to certify the amount of work completed each month according to the requirements of the SDA and the Loan Agents, to report on progress, and to liaise with the Project Consultant's Head Office through their representative in Mogadishu, the General Manager Homboy Project and the management construction team. It is envisaged that the expatriate site staff would comprise a Resident Engineer, four assistant engineers and one inspector and would be assisted by Somali engineers, surveyors and supporting staff.

1.6.4 ORGANISATION OF AGRICULTURAL PRODUCTION

The management of agricultural production, will, as has already been explained, be organised by the ten Block Managers. In order to ensure that this vital area is not neglected, and that land is brought into production as soon as it is commissioned, a Block Management Training Team, comprising three expatriates is proposed as part of the overall consultant's package. The team would comprise, a Block Manager, and Administrator/Accountant and a Mechanisation Supervisor. However, as the first block of 600 ha. is expected to be commissioned 18 months after construction, it is not considered necessary that the Block Manager and the Administrator/Accountant be in post until six months before production is scheduled to start. The Mechanisation Supervisor will of course become available as his duties at the Project Headquarters are phased out. The detailed planning for Block one would be done by the Project Headquarters staff and would include; planning the first year's cropping in detail, determining quantities of inputs required and making sure that orders were placed in good time, recruiting and training staff of all levels. The team would concentrate in particular on setting up the recording and book keeping systems, machinery operation and maintenance procedures and instructing their counterparts in their use.

When subsequent blocks come into production, this team would carry out the same function but in addition would provide some advice and supervision to blocks already established. As the permanent block management become more experienced, the intensity of supervision would decrease. At full development the team would no longer be required.

7

Staffing

1.7.1 STAFFING

The requirement for expatriate staff during the implementation stage is shown in Table 1.1 This does not include the requirement for staff to manage the construction of engineering works. A peak of ten expatriates would be required from year 2 reducing to four in year 6. No provision is made for expatriates beyond the sixth year. The decision for retention of a nucleus of expatriate staff for an additional period would be made then. Phase staffing for the whole scheme is shown at Table 1.2 and Table 1.3 shows recommended vehicle requirements.

TABLE 1.1 ORGANISATION FOR OPERATION - REQUIREMENT FOR EXPATRIATE PERSONNEL DURING THE PROJECT IMPLEMENTATION STAGE

Designation	Year										Total
	1	2	3	4	5	6	7	8	9	10	
General Manager	1	1	1	1	1						5
Chief Agriculturalist	1	1	1	1	1						5
Financial Controller/ Administrative Manager	1	1	1	1							4
Training Manager	1	1	1	1	1						5
Chief Engineer	1	1	1	1							4
Irrigation and Drainage Engineer	1	1	1	1							4
Infrastructure Engineer		1	1								2
Workshop Manager	1	1	1	1	1	1					6
Agriculturalist[1] Block Manager		1	1	1	1	1					5
Accountant[1]		1	1	1	1	1					5
Mechanisation[1] Supervisor	1	1	1	1	1	1					6

Notes: [1] *Block management training team.*

TABLE 1.2 PHASED STAFFING REQUIREMENTS - WHOLE SCHEME

Staffing - Homboy Project Headquarters

Designation	No.	Grade	Year 1	2	3	4	5	6	7	8
Homboy General Manager	1	EXP	1	1	1	1	1	-	-	-
Chief Agriculturalist	1	EXP	1	1	1	1	1	-	-	-
Financial Controller/Administrative Mngr.	1	EXP	1	1	1	1	-	-	-	-
Training Manager	1	EXP	1	1	1	1	1	-	-	-
Chief Engineer	1	EXP	1	1	1	1	-	-	-	-
Irrigation & Drainage Engineer	1	EXP	1	1	1	1	1	-	-	-
Infrastructure Engineer	1	EXP	-	1	1	-	-	-	-	-
Workshop Manager	1	EXP	1	1	1	1	1	1	-	-
Homboy General Manager	1	SE	1	1	1	1	1	1	1	1
Chief Agriculturalist	1	SE	1	1	1	1	1	1	1	1
Financial Controller/Accountant	1	SE	1	1	1	1	1	1	1	1
Administrative Manager	1	SE	1	1	1	1	1	1	1	1
Training Manager	1	SE	1	1	1	1	1	1	1	1
Chief Engineer	1	SE	1	1	1	1	1	1	1	1
Irrigation & Drainage Engineer	1	SE	1	1	1	1	1	1	1	1
Assistant Irrigation & Drainage Engineer	2	JE	1	2	2	2	2	2	2	2
Infrastructure Engineer	1	SE	-	1	1	1	1	1	1	1
Workshop Manager	1	SE	1	1	1	1	1	1	1	1
Settlement Officer	1	SE	1	1	1	1	1	1	1	-
Assistant Settlement Officer	4	JE	1	2	3	4	4	4	2	1
Assistant Accountant	3	JE	1	1	2	2	2	2	2	2
Office Manager	1	JE	-	1	1	1	1	1	1	1
Surveyor	1	JE	-	1	1	1	1	1	1	1
Assistant Surveyor	2	T	-	1	1	2	2	2	2	2
Storemen	6	T	2	4	6	6	6	6	6	6
Mechanics, Fitters & Electricians	10	T	5	5	10	10	10	10	10	10
Workshop Assistants	20	L	5	10	15	20	20	20	20	20
Secretary/Typist	6	PA	1	2	4	6	6	6	6	6
Accounts Clerks	6	C	1	2	4	6	6	6	6	6
General Clerks	6	C	1	2	4	6	6	6	6	6
Building & Service Operation and Maintenance	20	SL	-	4	8	16	20	20	20	20
Building & Services Maintenance Labour	20	L	-	4	8	16	20	20	20	20
Irrigation & Drainage Operators	112	SL	-	14	28	56	84	112	112	112
Irrigation Maintenance Foremen	5	SL	-	1	2	3	5	5	5	5
Maintenance Plant Operators	17	SL	-	3	6	9	17	17	17	17
Irrigation System Maintenance Labour	30	L	-	6	12	15	30	30	30	30
Drivers	25	SL	10	20	25	25	25	25	25	25
Cleaners/Messengers	6	L	-	2	4	6	6	6	6	6
Watchman	4	L	-	2	4	4	4	4	4	4

TABLE 1.2 (Continued)

Homboy Project Field Staff

Designation	No.	Grade	Year 1	2	3	4	5	6	7	8
Agriculturalist	1	EXP	-	1	1	1	1	1	-	-
Accountant	1	EXP	-	1	1	1	1	1	-	-
Mechanisation Supervisor	1	EXP	1	1	1	1	1	1	-	-
Block Manager	10	SE	1	3	5	7	9	10	10	10
Accountants	10	SE	1	3	5	7	9	10	10	10
Mechanisation Supervisor	10	SE	1	3	5	7	9	10	10	10
Irrigation Supervisors	11	SE	1	3	5	7	10	11	11	11
Field Officers (Agriculture)	30	T	2	7	14	21	28	30	30	30
Field Assistants (Agriculture)	90	JT	6	21	42	63	84	90	90	90
Irrigation Foremen	176	JT	12	41	82	123	164	176	176	176
Tractor Drivers	164	SL	12	40	77	113	151	164	164	164
Vehicle Drivers	25	SL	1	8	14	21	25	25	25	25
Secretary/Typist	20	C	-	2	6	14	18	20	20	20
Clerks/Storemen	80	C	-	8	24	56	72	80	80	80
Cleaner/Watchmen	30	L	-	3	9	21	27	30	30	30

TABLE 1.3 SUGGESTED TRANSPORT REQUIREMENTS

Location	Designation	Type	Number
HQ	Homboy General Manager	Landrover S/W	1
HQ	Chief Agriculturalist	Landrover	1
HQ	Chief Engineer	Landrover	1
HQ	Irrigation & Drainage Engineer	Landrover	1
HQ	Assistant Irrigation & Drainage Engineers	Motor Cycle	2
HQ	Infrastructure Engineer	Landrover	1
HQ	Workshop Manager	Landrover	1
HQ	Mechanics	Motor Cycle	1
HQ	Settlement Officer	Landrover	2
HQ	Assistant Settlement Officers	Motor Cycle	4
HQ	Surveyor	Pick-up	1
HQ	Building & Services Maintenance	FWD Pick-up	2
HQ	Irrigation Maintenance Foremen	Pick-up	5
HQ	General Duties	5 Ton Truck	1
Field	Block Management Training Team	Landrover	3
Field	Block Managers	Landrover	10
Field	Mechanisation Supervisors	Pick-up	10
Field	Field Officers (Agriculture)	Motor Cycle	30
Field	Irrigation Supervisors	Motor Cycle	11
Field	Irrigation Foremen	Bicycle	176

8

Training

1.8.1 TRAINING

Attention has already been drawn to the shortage of suitably qualified staff in Somalia and this is reflected in the short falls on establishments at SDA headquarters and at all three settlements. The need for a training programme is thus both obvious and urgent. A wide variety of training needs is posed by the project, ranging from settlers to top management. These needs can be categorised as follows:

(a) Pre-service training prior to undertaking a formal training course or appointment to a post following a qualification obtained at an institution.

(b) In-service training for otherwise unqualified personnel leading to appointment to a post.

(c) In-service training for qualified staff for purposes of upgrading or general improvement of capability or of a refresher nature.

(d) Formal institution training for otherwise unqualified or underqualified staff, leading to a basic qualification.

(e) Settler training in basic farming or other skills relevant to them.

In Somalia all methods of training are undertaken and it is noted that all staff employed on the Homboy project will require to have some qualification whether obtained by formal or informal training systems. Because there is strong competition for graduates from institutions in the country it is very likely that a large proportion, of at least the more junior grades of staff, will have to be trained by the less formal methods. Recruits for more senior posts will preferably have had experience on other projects following a formal qualification. The needs for this category will fall into the in-service type of training to improve their capability. It may for instance be possible to recruit agricultural graduates without experience of irrigation and provide specialised short programmes at institutions and on operational projects to cover this aspect. While every use must be made of training facilities available within Somalia, the possibility of short overseas courses should not be ruled out.

Overall staffing requirements are summarised in Chapter 1.7 of this annex, and other requirements are detailed in the relocation study (Volume 2, Part 2). The first task of the Training Officer will be to examine these sections and consider the training procedures required.

Key to Grades:

Grade		Somali Salary Scale
EXP	Expatriate	A Scale
SE	Senior Executive	B Scale
JE	Junior Executive	C Scale
PA	Personal Assistant	C Scale
C	Clerical	B Scale
T	Technical	C Scale
JT	Junior Technical	C Scale
SL	Skilled Labour - Artisian	C Scale
L	Labour - Semi Skilled	

Part 3

Operation and Maintenance of the Irrigation System

1
Introduction

2.1 INTRODUCTION

The importance of good operation and maintenance cannot be overemphasised. Without closely controlled operation of the irrigation system, it becomes impossible to get sufficient water on to the fields in the time available. The resulting delays cannot easily be made up and the effect becomes cumulative causing overall loss of yield, increased costs and reduced income. Likewise poor maintenance of the drainage system over a period can cause waterlogging and a build-up of salinity which can also have a serious effect on crop yields.

With particular importance in the case of the Homboy Scheme is the correct operation of the flood protection system, this is vital to the safety of the settlers and the protection of the works.

2

Operation of the Irrigation and Drainage System

2.2.1 GENERAL

Operation of the surface irrigation system basically involves conveying water from the Supply Canal head works to the fields in the most efficient and economic manner. The quantity of flow required at the head works is based on the crop water requirements with allowances for seepage losses, wastage and uneven distribution. With well constructed canals and efficient landlevelling, losses due to seepage and uneven distribution can be kept to a minimum, but it is the operation of the system which will determine the losses due to wastage. It is important to realise that there are time lags between the various stages in the distribution system, from the head works through the supply and Main Canal, storage reservoirs, distributary canals and watercourses. If sequential operations are not well timed, there is a danger not only that water will be lost but also that time will be wasted for water levels to reach the required value.

For example, at the end of the day, it is important to reduce the flow through the distributary head regulator in the storage reservoir before shutting off all the outlets to the watercourses. Otherwise, the excess flow will pass to the end of the distributary canal to discharge through the tail escape to waste.

2.2.2 OPERATION OF THE SUPPLY CANAL HEAD WORKS

The Homboy Supply Canal offtakes from the Fanoole Main Canal via a structure with undershot gates. The discharge through the structure can be controlled by raising or lowering the gates. Once the required weekly flow is set the gates should need little attention although small adjustments may have to be made for changes in the water level of the Fanoole Main Canal. Three operators (3 shifts) will be provided and to ensure their presence at all times, an operator's quarters will be provided at the regulator site. The Supply Canal Head Regulator should have a radio link to the project headquarters so that in the event of a breach in the canal system the gates can be quickly closed.

In the unlikely event of the Fanoole Canal not being completed in time, an alternative supply system for the Homboy Project has been proposed. This would include a temporary pump station on the River Jubba near the village of Limoole.

2.2.3 OPERATION OF THE MAIN CANAL AND BRANCH CANALS

The Main and branch canals are designed to run continuously for 10 months of the year, with an operating discharge which is adjusted no more often than once each week unless demand is influenced by heavy rainfall. Each group of night storage reservoirs has a movable weir cross regulator just downstream on the Main Canal with a similar structure on the inlet to the storage reservoir. Once set for the required flow, these weirs should need little attention, but clearly small adjustments will have to be made to compensate for minor changes in the Main Canal flow. The two branch canals are controlled by movable weir head regulators at the tail of the Main Canal. Each has a night storage reservoir at its tail.

Three operators will be provided for each group of offtakes to work in three equal shifts and to ensure the presence of the operators at all times, a small operator's quarters will be constructed near each group.

The operator will set the offtaking weir to give the required offtake flow based on a constant upstream water level (canal design water level) and will adjust the cross regulator weir where applicable to maintain this level.

Two Main Canal escapes have been provided, one near the head of the Main Canal and one near the tail. These structures are to be used for the emergency draw down of the Main or Supply Canal in the event of a breach and for draining the system for maintenance purposes.

2.2.4 OPERATION OF THE DISTRIBUTARY CANALS

Distributary canals are to be operational for a period sufficient to provide a maximum of 12 hours field irrigation per day. At the start of the day, the canal operator will open the head regulator in the storage reservoir and will then proceed down the canal setting the distributary cross regulators to predetermined openings and at the same time, opening the outlets to the watercourses. Having opened all the outlets, the operator will return up the canal readjusting all the gates where necessary. It is estimated that the first operator should commence filling the distributary canal at least one hour before irrigation is due to begin. The gate opening of the head regulator must be adjusted several times throughout the day as the water level in the reservoir falls. This should be no more than four times per twelve hours but must be determined by the irrigation engineer.

Two shifts of canal operators are provided, each of eight hours, enabling full operation of the distributary canals to be covered and allowing an overlap between shifts for briefing. The gate adjustment described must be repeated at the beginning and end of each shift thus necessitating a minimum of four checks be carried out of each gate setting per day. More adjustments may be necessary if supplies to watercourses are found to be excessive or deficient. At the end of the twelve hour day the operator will work along the canal from the head closing down the regulators and outlets to a half closed position and then return from the tail closing the system down completely in order to retain as much water as possible in storage. From the lengths of reaches between regulators and the associated channel slopes, no problem should exist owing to the water level rise due to storage in each reach. It is essential that this closing-off operation should be carried out without any delays otherwise overtopping could occur. If due to bad weather conditions or any other reason the operator is likely to be delayed, he should close off the regulators and outlets completely when starting from the head.

Each canal operator will be supplied with a bicycle and will be responsible for one distributary, unless that distributary is longer than four kilometres, in which case two canal operators will operate the canal in two sections. The outlets to the watercourses which offtake directly from the Main Canal, branch canals or night storage reservoirs should be assigned to the canal operator in charge of the nearest distributary canal.

A twelve hour irrigation day will only be necessary over large areas of the project in the months of October to December. Some distributaries will need to supply water for the maximum interval in other months but the majority of the area can be supplied with irrigation water in a much shorter time interval.

The number of canal operators have been estimated on the peak requirement of all canals operating for the twelve hour period. For part of the year, it is envisaged that only a single shift will be required for the canal operators, surplus staff will exist and will at the direction of the Irrigation Engineer be assigned other duties such as assisting in the maintenance of the system.

All the gates on the distributary canal structures are screw operated vertical sliding gates, and as such, can be set at any opening. Calibration tests should be carried out and the required gate openings determined by the Irrigation Engineer.

Tail escapes have been provided at the tails of all distributaries to prevent overtopping in the event of excessive discharge being passed down the canal or incorrect outlet operation.

In the event of heavy rainfall occurring in all or part of the project area, it will necessary to reduce flows in the canal(s) affected including the Main Canal. This must be a centrally controlled operation under the control of the Irrigation Engineer in response to information provided from the blocks by the Block Managers and the Irrigation Supervisors.

2.2.5 OPERATION OF NIGHT STORAGE RESERVOIRS

The night storage reservoirs will be filled from the Main or branch canals at night and then discharged into the distributary canals during the day. Thus the outflow along the distributaries should be twice the inflow from the Main or branch canals but this is dependent on the operational schedule for the distributaries. The operation of the inlet structure to the reservoirs is controlled by the operators at the regulator groups and the operation of the outlet structure (distributary canal head regulator) is controlled by the canal operators.

2.2.6 OPERATION OF THE INFIELD WORKS

The three methods of irrigation to be used are furrow, border strip and basin. Furrow and border strip methods will be for mixed crops and the capacity of the watercourse supplying each unit will be 60 l/s. The basin method will be used for growing paddy rice and the capacity of the watercourse supplying each unit will be 100 l/s.

Water is transmitted from the watercourse to the field via a small field channel called 'kontro kanale', which runs parallel to the watercourse. The traditional method of conveying the water from the Kontro Kanale to the furrow, border strip or basin is to make a small breach in the bank; this is usually done manually. An alternative method which could be used is to pass the water directly from the watercourse to the field through plastic siphon tubes.

These siphons are normally primed simply by immersing them in the channel, filling them up with water and holding the ends closed until they are placed in position with one end in the channel and the other discharging in the furrow, border strip or basin.

An irrigation cycle of ten days is recommended thus approximately 1/10 th of each 25 ha net watercourse unit will be irrigated every day. The ten day cycle is based on the easily available water content (EAWC) relating to the normal Homboy Soils (see Table 2.10 of Volume 1) and the monthly water requirements of the various crops. The maximum monthly requirement of 171.3 mm for Upland Rice will require three irrigations per month adopting the average water holding capacity of the soils. This is equivalent to a ten day cycle which was also found suitable for shallow rooted crops and the initial growth period of other crops, although a shorter interval may occasionally be warranted.

The ponding of water in the watercourse and Kontro Kanale for the section of the unit to be irrigated is traditionally carried out by forming small earth bunds. An alternative method is to use portable canvas check structures.

The flow into the watercourse is adjusted by using the screw vertical sliding gate on the outlet structure. It is recommended that the watercourses flow to their capacity and the time for each irrigation is changed as the monthly crop water requirements change. It would be possible to keep the time for each irrigation constant and to vary the flow in the watercourses, however, it is thought that this would be more difficult to operate.

One irrigation foreman will be responsible for four watercourse units (100 ha net). [illegible], as the farmers become experienced, the intensity of supervision can be reduced such that after a period of about a year one foreman could supervise up to 8 units (200 ha). The settlers will be responsible for getting the water into the fields, and for carrying out minor repairs to channels and bunds. The settlers required for each unit are to be selected from the 25 families forming each unit. It is thought that three settlers will be needed for the irrigation of watercourse units growing mixed crops and slightly fewer for units growing paddy rice.

Two eight hour shifts of the irrigation foremen are required for the twelve hour irrigation period giving an overlap which can be used for maintenance. This will be a seasonal staffing requirement as discussed in the case of canal operators. The peak requirement is when the full 8,850 ha is being irrigated. This gives a peak labour requirement of 176 irrigation foremen.

In the case of paddy rice, a watercourse discharge of 100 l/s has been incorporated into the design. If it is found to be too large for a single settler to handle, then two or three settlers can pass the flow simultaneously into their individual holdings.

2.2.7 OPERATION OF THE DRAINAGE SYSTEM

Approximately 70 per cent of the area is drained by a gravity system of surface drains, and requires little operation as such, no gates being involved. Drainage water for the remaining 30 per cent must be pumped into the Lower Outfall Drain. This is achieved by means of four small drainage pump stations which will be operated as required according to the instructions of the Irrigation Engineer.

As this operation will only be intermittent, one operator plus two relief operators per station has been allowed. Operation of the pump stations should follow promptly after heavy rainfall so that flooding of the cropped area is minimised.

During and shortly after a period of heavy rainfall, the pump stations will need to be operated continuously necessitating a three shift system at each pump station. There will also be periods where the pump stations will be inoperative for some weeks during which time servicing will be carried out. Stages between those two extremes will require one or two operators only. It will be the responsibility of the Irrigation and Drainage Engineer to assign the operators not required to other duties.

This will be done in conjunction with the Agriculturalist, Irrigation Supervisor and Block Manager associated with each block.

TABLE 2.1 STAFF REQUIREMENTS FOR THE OPERATION OF THE IRRIGATION AND DRAINAGE SYSTEM

Name	Number of Shifts	Total	Location
Irrigation and Drainage Engineer	1 x 1	1	Project headquarters
Assistant Irrigation Engineer	1 x 1	1	Project headquarters
Irrigation Supervisor	11 x 1	11	Block villages
PHQ Base			
Operator	4 x 2	8	Drainage pump stations
Operator	8 x 3	24	Regulator groups
Operator	1 x 3	3	Supply Canal Head Regulator
Operator	1 x 3	3	Northern Reservoir
Operator	1 x 3	3	Eastern Reservoir
Operator	1 x 3	3	Lower Outfall Drain
Canal Operator	34 x 2	68	Distributary canals
Irrigation foreman	88 x 2	176	Watercourse units

Gravity flow from the Lower Outfall Drain into the River Jubba will only be possible when the river levels are low. The outlet structure has been provided with flap gates to ensure that no river water flows back into the project area when river levels are high. As an extra safeguard (in the event of the flap gates becoming jammed), the penstocks can be closed manually. Two operators (two shifts) and operator's quarters have been provided for the Lower Outfall Drain Outlet Structure.

2.2.8 OPERATION OF THE FLOOD PROTECTION WORKS

The operation of the flood protection work entails the operation of the Northern Reservoir Outlet Structure and the Eastern Reservoir Outlet Structure.

A simplified summary of the required operational procedure is as follows:-

(a) The Eastern Reservoir should normally be maintained at a maximum level of 17.5 m to facilitate emptying of the Northern Reservoir. If the water level in the Northern Reservoir exceeds 22.5 m, water must be released to the Eastern Reservoir until its maximum level of 18.5 m is reached. The maximum design water level in the Northern Reservoir is 22.5 m, although this may rise to 22.8 m under the 1 in 1000 year storm conditions. The maximum design capacity of the Northern Reservoir Outlet Structure is 330 cumecs.

(b) The Eastern Reservoir Outlet Structure is to be open whenever discharge into the Jubba River is possible. Historical simulation has shown that the outlet capacity of this structure need only be 10 cumecs.

Three operators (three shifts) will be provided for each structure and to ensure their presence at all times, a small operator's quarters will be constructed near each structure. Both structures should have a radio link to the project headquarters.

2.2.9 OPERATIONAL STAFF REQUIREMENTS

The total operational staff requirements for the irrigation and drainage system are given in Table 2.1. Overall control will be the responsibility of the Irrigation and Drainage Engineer; he will draw up the irrigation requirements schedule for each period and determine the operational needs of the regulators on the Main Canal and storage reservoirs.

3

Maintenance of the Irrigation and Drainage System

2.3.1 DRAINAGE PUMP STATIONS

The drainage pump stations are only operated intermittently and can be serviced and repaired when not in operation. Two mechanics will be responsible for the maintenance of the drainage pump stations but will also assume other duties under the direction of the Workshop Manager.

All pump intakes should be kept free of debris and will from time to time have to be cleared of sediment. The pumps and engines should be strictly maintained in accordance with the manufacturers' service schedule.

2.3.2 NIGHT STORAGE RESERVOIRS

The deposition of sediment in the storage reservoirs is unavoidable. However, the magnitude of the problem is not considered sufficient to warrant the provision of a floating dredger in the initial years of the project. The reasons for this are as follows:-

(a) the reservoirs have a minimum dead storage depth of 0.5 m;

(b) to provide fill material for canal and reservoir embankments, all night storage reservoirs will be overexcavated on average to a depth of 2.5 m;

(c) the length of the canal system supplying water to the project from the River Jubba is approximately 55 km, Fanoole Main Canal (40 km) and Homboy Supply Canal (15 km). Therefore, it is considered that the majority of the suspended sediment load will be deposited upstream of the storage reservoirs.

After a number of years operation, it will probably be necessary to provide a floating dredger. This has been accounted for in the running costs.

Clearing sediment in the vicinity of the inlet and outlet structure can be carried out, when necessary, by dragline.

Clearance of weeds in the storage reservoirs is required and can be carried out by boat as described in Section 3.4.

2.3.3 SUPPLY, MAIN AND DISTRIBUTARY CANALS

Silt deposition will, for the most part, take place in the night storage reservoirs. Deposition will also occur in the Supply and Main Canals. The distributary canals will also experience some deposition as part of the day-time supplies will pass directly through the reservoirs and will be ponded in the distributaries overnight. In addition the distributaries will be the most affected by weed growth.

It is proposed to employ draglines in clearing the Main and Supply Canals and hydraulic excavators will be used on the distributary canals as necessary. Care must be taken when desilting not to tear any membrane lining at certain structures, and buried warning netting has been provided to help prevent this.

All materials should be deposited outside the canal banks so that the inspection roads are not rendered impassable. Clearance should generally start from upstream so that silt and weeds are not carried back into recently cleared areas.

Frequent maintenance will be required on banks and side slopes to repair gulleying caused by rain. Repairs to the horizontal and outside slopes to canal banks can be achieved by grader. The inside banks will have to be repaired by hand as far as possible in the dry season when there is a surplus of labour. This also applies to the flood banks but here maintenance can be carried out most of the year mainly by grader.

Extensive gulleying can be avoided if the banks are properly graded. The bank top should be sloped away from the canal and no low spots or lips should be left which would cause ponding of the water or the outflow to be concentrated at one point. If the rain water runs off evenly over the whole bank length, there should be little gulleying.

After the canals and reservoirs have been operating for some time, weed growth will establish itself on the banks. This helps to reduce rain damage but must be kept in control. This is discussed in detail in the following section.

Regular inspection should be carried out of all canals, embankments and structures and any defects reported to the Irrigation Engineer who will arrange any necessary repairs at the most appropriate time. Suitable forms should be drawn up for this purpose.

2.3.4 WEED CLEARANCE

Some of the consequences of uncontrolled weed growth in irrigation schemes are as follows:-

(a) obstruction to flow in channels, causing variation from design conditions;

(b) blockage of structures;

(c) harbouring of pests.

For these reasons, it is important to keep the growth of aquatic weeds and bank vegetation in the canals, drains and reservoirs under firm control.

There are two broad classes of weed likely to cause the most trouble:-

(i) Emergent weeds, which are those rooted in the soil with most or all of their leaves in the air. These grow on banks or through shallow water and include grass, sedge, reeds and herbs.

(ii) Free floating weeds, which are not rooted in the soil, including 'water hyacinth' and 'water lettuce'.

The four basic methods of weed control are burning, chemical, biological and mechanical. These are discussed briefly below:-

(i) Burning
Burning can be used quite effectively where canals and drains can be dried out. This will be a possibility for the Homboy Project where a closure for a period of two months can be expected. However, the method will require careful control to ensure success and cannot be relied upon as the sole means of clearance.

(ii) Chemical Methods
Many chemicals are available for controlling aquatic weeds. Some of these are harmful to people, fish and crops and have to be used carefully under strict control. Other chemicals are relatively safe.

Herbicides must be selected specifically to suit the weed species and therefore expert advice is required.

Chemical methods are generally cheaper than the alternatives and therefore should be considered; although it must be borne in mind that water from the canal system will be used for domestic purposes.

(iii) Biological Methods
Under certain circumstances weed growth can be controlled by the introduction of a natural predator. These include snails, fish, insect and animals which feed on the weeds; diseases which attack and kill weeds; and other plants which compete with and overcome the weeds.

These methods can be successful but can also have undesirable side effects. Much more research is necessary before any firm recommendation can be made.

(iv) Mechanical Methods
Until such time as sufficient information is available to justify any of the other methods, mechanical clearance is proposed for Homboy.

A variety of floating and land-based machines are available for the control of aquatic weeds. Two operations can be distinguished, cutting and collection, though some devices do both at once. The main methods proposed for Homboy are described below:-

(a) Underwater Cutters Mounted on Boats
Several machines have been developed which use reciprocating cutter bars suspended from boats. Most types have a horizontal bar at a depth down to about 2.5 m and one or two vertical bars (inverted-T or U types). They are suitable for submerged weeds or bottom-rooted emergent weeds. The cut material floats downstream in channels to collection points, but in storage reservoirs would have to be collected by raking from This method has a low running cost and is suitable for Supply and Main canals and storage reservoirs.

(b) Hydraulic Excavators and Draglines
These machines can be fitted with special buckets for the cutting and collection of weed growths. The special buckets are fitted with a sharp serrated edge on the front

edge of the bucket so that the cut weed is collected and the water and mud drain out. Widths up to 4 m are available.

Both excavators and draglines can be used on canals and drains, clearing silt and weeds at the same time with standard buckets, or just clearing weeds with the above mentioned special buckets. This special bucket method has a higher running cost for clearing weeds than the boat method and cannot be used for the majority of the area of the storage reservoirs; however, the rate of clearing is higher than that for the boat method.

(c) Tractor Mounted Flail Mowers
These machines can be used to cut emergent species on canal banks but not under water. Cutting should if possible take place before the weeds have seeded to avoid reinfestation downstream and in the fields. Flail mowers can be used to clear the whole channel in the dry season.

(d) Hand Cutting
Hand cutting and clearing is cheap but slower than the other methods described. It is only practical for small channels because of the depth of water in the larger canals and reservoirs. However, it must be stated that hand cutting in partially full or wet channels, though cheap, has the severe disadvantage that it will inevitably favour the spread of water-borne diseases such as schistosomiasis. When the canals and drains are dry then hand clearing is recommended especially as the majority of labour will be underemployed during this period.

2.3.5 DRAINS

Drains will also require periodic desilting and weed clearance. The methods discussed above for canals are appropriate, the dragline being more economical. Culverts and underpasses must be inspected regularly and kept clear so that these are not blocked when drain flows are high following heavy rainfall. Drains are much more likely to be neglected than canals and it will be the responsibility of the Irrigation Engineer to ensure that these are regularly inspected and cleared.

2.3.6 STRUCTURES

Canal and drain structures should be inspected regularly and repairs carried out as and when required. Particular care must be taken to ensure gates and movable weirs are well maintained and do not rust or become jammed. Structures having a high head differential across them must be checked for the occurrence of piping at the downstream end of the structure. If there is any sign of washing out of material or pitching failure then remedial measures should be taken immediately. The downstream pitching of structures should be inspected and if erosion is visible then the pitching should be improved by placing more gravel and stone.

Stop logs have been detailed for most major structures to facilitate maintenance. All stop logs, trestles, runway beams, operating gear, lifting beams and lifting hooks are to be stored at the project headquarters and transported to structures as and when required.

2.3.7 ROADS

Earth roads, associated with the channels of the irrigation and drainage system, should be graded regularly with the grader blade angled so that the material is pushed towards the centre of the road. If the material is pushed to the sides, the road is gradually reduced in level and becomes a channel where water will accummulate thus making the road impassable for long periods. After periods of heavy rain, the roads should be closed completely to vehicular traffic, especially tractors which, when rain starts, should remain whereever they are at the time. Tractors cause very deep rutting on wet roads and make them virtually impassable for other vehicles. Some damage after rain is inevitable and it is important to grade roads before they have fully dried out and become hard and rutted.

The maintenance of the surface roads is considered under the maintenance of the infrastructure works.

2.3.8 STAFF REQUIREMENTS FOR THE MAINTENANCE OF THE IRRIGATION AND DRAINAGE SYSTEM

Overall control of the maintenance of the irrigation and drainage system will be the responsibility of the Irrigation Engineer. Working under him will be an assistant engineer, surveyors, foremen, teams of labourers, mechanics, plant operators and drivers. All maintenance staff will be based at the project headquarters.

TABLE 3.1 STAFF REQUIREMENTS FOR THE MAINTENANCE OF THE IRRIGATION AND DRAINAGE SYSTEM

Name	Number	Vehicle Type
Assistant Irrigation and Drainage Engineer	1	Motor cycle
Surveyor	1	Pick-up
Assistant Surveyors	2	
Pump and Engine Mechanics	1	Motor cycle
Maintenance Foremen	5	Pick-ups
Labourers	30	
Stone Mason	1	
Plant Operator:-Hydraulic Excavator	6	
Plant Operator:-Dragline	4	
Plant Operator:-Grader	3	
Plant Operator:-Bulldozer	2	
Plant Operator:-Flail Mowers	2	
Drivers:-FWD pickup	6	
Drivers:-Trucks	4	
Drivers:-Tractors	10	
Drivers:-Low loader	1	
Drivers:-Mobile Workshop	1	

4

Transport for Operation and Maintenance Staff

2.4.1 TRANSPORT FOR OPERATION AND MAINTENANCE STAFF

The majority of the settlers will have to walk to work from the block villages where they live. Villages have been positioned to minimise walking distances between house and work place to 4 km. Use can however be made of trucks or tractor and trailer in periods of high work load.

The foreman irrigators, canal and structures operators and the pump station operators will have bicycles. The irrigation supervisors will have motorcycles and the Irrigation and Drainage Engineer and the Senior Surveyor will have a four wheel drive station wagon and pick-up respectively.

A full list of the vehicles and machinery for the operation and maintenance of the irrigation and drainage system are given in Table 4.1.

TABLE 4.1 VEHICLES AND MACHINERY FOR THE OPERATION AND MAINTENANCE OF THE IRRIGATION AND DRAINAGE SYSTEM

Item	Use	Number
FWD Station Wagon	Irrigation and Drainage Engineer	1
FWD Pick-up	Surveyor and Maintenance crews	6
12 ton trucks	General PHQ	4
Tractor and trailer	Block villages	10
Motorcycles	Irrigation supervisors, Assistant engineers and mechanics	14
Bicycles	Irrigation foreman, Canal and Structure operators	154
Mobile workshop	Maintenance	1
Low loader	Transport	1
Hydraulic excavator	Maintenance	6
Dragline	Maintenance	4
Bulldozer	Maintenance	2
Grader	Maintenance	3
Boat and cutter with trailer	Weed clearing	1
Tractor mounted flail mowers	Weed clearing	2
Concrete mixer	General	2
Water bowser	General	1
Compressor and tools	General	1
Vibrators	General	2
Water pump	General	4
Circular saw	General	1
Floating dredger	Silt removal from storage reservoirs	1

5

Infrastructure Operation and Maintenance

2.5.1 INFRASTRUCTURE OPERATION AND MAINTENANCE

The operation and maintenance of an efficient infrastructure sector within the project is most important. Without an efficient system the operation of the project is hindered and the project will become unattractive to the managerial and farm staff who are required to operate it.

Sections will be established to deal with various infrastructure components of the project as follows:

1. Workshops
2. Buildings
3. Power supply
4. Potable water supply
5. Communications
6. Roads
7. Sanitation

Section 1 will be the responsibility of a Workshop Manager and sections 2-7 the responsibility of an Infrastructure Engineer except item 6 which will be undertaken by the Chief Engineer.

The central project workshops will be located in the project headquarters and will be under the control of a Workshop Manager. All project vehicles, plant, agricultural machinery and equipment will be repaired and maintained by these workshops. One mobile workshop will be provided for routine servicing and minor repairs in the field.

The central workshop will include stores holding a fully comprehensive supply of spare parts.

The staffing of the workshops will be as follows:-

Name	Number
Workshop Manager	1
Mechanic and fitters	10
Workshop assistants	20
Storemen/clerks	2

The low loader can be used to transport vehicles and machinery which breakdown and need major repairs at the central workshops.

The Infrastructure Engineer will be responsible for the maintenance and repair of all project housing, offices, workshops, stores and other community buildings.

There should be a storage area in the project headquarters for all building materials and equipment. Staff will be attached to this section to operate, maintain and repair the services to the buildings and the villages as a whole. Twenty skilled labour personnel have been allowed for including electricians, plumbers, carpenters and masons, supported by twenty assistants.

The staffing of the infrastructure section will comprise:-

Name	Number
Infrastructure engineer	1
Building foremen	2
Artisans (carpenters, masons, plumbers)	18
Labourers	20
Storemen/clerks	2

A FWD station wagon will be provided for the Infrastructure Engineer and the Workshop Manager and two FWD pick-ups will be provided for building and services operation and maintenance.

Part 4

Economic and Financial Studies

1
Introduction

1.1 INTRODUCTION

This Part concerns itself with the financial and economic aspects of the Homboy Resettlement Scheme. It is divided into five sections. The first reviews the national economy and the role of the agricultural sector. In particular, it sets the overall context and position of the scheme within the national economy. The second section sets forth the bases for the financial and economic analyses of the scheme. Cost and price assumptions are discussed in detail and the analyses to be conducted are outlined. The third section examines market prospects and prices for crops to be produced by the scheme. Farm-gate financial and economic prices for crops are derived. In the following section, the results of the financial analyses are presented. These analyses have been conducted at three levels; the fifty family unit level, the block level and the project level. The final section discusses the results of the economic analysis.

2

Economic and Agricultural Background

2.1 GENERAL

This section is intended to provide a brief economic and agricultural background of Somalia and thus set the overall context of the Homboy Resettlement Scheme.

Somalia, which covers 638,000 km² is primarily a rural nation. Eighty four per cent of the population of 4 million live in rural areas and 71 per cent of these are thought to be nomads. According to the 1975 Census, the population is growing at an average of 2.9 per cent a year. Infant mortality is high with 15-20 per cent of children dying before the age of one year. Life expectancy is 41 years.

Somalia is, by international standards, a poor country. IBRD estimates show 1977 per capita GDP at $ 110, similar to that of many Sahelian nations whose natural resources are comparable with those of Somalia. Nevertheless, during the period 1970-76, growth in per capita GDP is estimated to have averaged 1.5 per cent. Unfortunately, at the time of writing, no national accounts for recent years are available. However, figures for 1973 show that the agricultural sector was the single largest contributor to GNP.

2.2 BALANCE OF PAYMENTS

When it comes to external trade, the importance of the agricultural sector is overshadowed by that of the livestock sector. In 1978, exports of livestock and livestock products accounted for 87 per cent of total export earnings (Table 2.1). As a result of the recovery of the livestock sector from the 1974/75 drought, its export earnings rose 69 per cent between 1977 and 1978. Despite this increase and 63 per cent rise in overall export earnings, Somalia's balance of trade continued to worsen (Figure 2.1). Between 1977 and 1978, imports rose from 1,295 So.Sh. million to 1,732 So.Sh. million. Nevertheless, the overall balance of payments remained in surplus, thanks largely to an increase in capital inflow (Table 2.2).

2.3 CENTRAL GOVERNMENT FINANCE

Over recent years, the size of the government budget has grown considerably. However expenditure has continued to exceed revenue with the result that the overall deficit has also grown, almost doubling between 1974 and 1978 Table 2.3). The deficit has been financed primarily from foreign sources, mainly with grants. Figures for 1979 show the government hopes to halve the overall deficit, largely by increasing revenue from indirect taxes.

TABLE 2.1 EXPORTS FROM SOMALIA 1973-1978 (So.Sh. million)

	1974	1975	1976	1977	1978
Bananas	79.8	64.3	88.2	53.0	59.0
Livestock	222.4	382.0	301.9	299.5	570.4
Meat	35.7	44.1	37.1	32.1	0.7
Fish	15.2	11.6	23.3	21.2	4.3
Skin and hides	14.1	26.2	44.4	23.6	29.7
Myrreh	-	-	-	-	14.8
Others	12.6	21.4	4.1	7.7	10.2
Total	**390.6**	**557.6**	**510.3**	**449.0**	**689.1**

Source: State Planning Commission.

TABLE 2.2 SOMALIA - BALANCE OF PAYMENTS 1973-1978 (So.Sh. million)

	1973	1974	1975	1976	1977	1978
Exports (f.o.b.)	358	403	558	510	449	689
Imports (c.i.f.)	(704)	(967)	(1,021)	(1,108)	(1,296)	(1,732)
Trade Balance	(346)	(564)	(463)	(589)	(847)	(1,043)
Transport and insurance	(7)	(12)	(18)	(20)	(7)	na
Travel	(9)	(14)	(32)	(40)	(15)	na
Investment income	9	12	2	8	13	na
Government (not included elsewhere)	(50)	(54)	(11)	(52)	3	na
Other services	(20)	(18)	(121)	(95)	(32)	na
Services Balance	(77)	(86)	(180)	(95)	(38)	(31)
Net Unrequired Transfers						
Private	18	23	12	7	14	492[1]
Official	163	303	631	250	666	175
Transfers Balance	**181**	**326**	**643**	**257**	**680**	**667**
Net Capital Account						
Private	28	39	59	22	97	2
Central Bank	170	225	269	424	355	494
Commercial Banks	50	(61)	(134)	93	(110)	(83)
Capital Balance	248	203	194	539	342	413
Errors and Omissions	-	(5)	(6)	-	41	45
TOTAL	6	(127)	188	103	178	51

Source: Central Bank of Somalia

Note:

1 *Not strictly comparable with earlier years since it includes the counterpart for 'Franco-Valuta' imports, whereas in earlier years, this item was included under 'short-term private capital'.*

TABLE 2.3 GOVERNMENT REVENUE AND EXPENDITURE 1974-79
(So.Sh. million)

		1974	1975	1976	1977	1978	1979
I.	Current local revenue	569.0	618.9	655.6	828.2	1,212.2	1,680.3
1.1	Tax revenue	488.7	566.5	576.5	708.6	1,058.3	1,540.0
	(i) Direct tax	38.6	45.4	54.3	59.4	62.1	65.6
	(ii) Indirect tax	450.1	501.1	522.2	649.2	996.2	1,438.4
1.2	Non-tax revenue of	80.3	72.7	79.1	119.6	153.9	176.3
	which: Share of profit of public enterprises	38.9	43.3	51.3	72.7	81.1	141.0
II.	Current expenditures	844.9	1,185.0	971.8	877.5	1,263.9	1,448.5
	1. Budget	535.0	606.7	664.7	782.5	1,263.9	1,448.5
	Personnel	231.6	248.0	283.1	338.8	605.4	719.8
	Goods & services	179.9	244.1	256.3	324.1	499.7	575.1
	Transfer	123.5	114.6	125.3	119.6	158.8	153.6
	2. Extrabudgetary expenditures	309.9	578.3	307.1	(95.0)	na	na
III.	Current Surplus or Deficit	(273.9)	(566.1)	(316.2)	(49.3)	(51.7)	231.8
IV.	Capital expenditures	481.0	354.6	945.1	862.4	1,263.3	918.9
V.	Overall Deficit	(754.9)	(920.7)	(1,288.0)	(911.7)	(1,315.0)	(677.1)
VI.	Financing						
	Foreign grants	303.5	631.3	729.9	666.0	575.0	Est. na
	Foreign loans	255.0	269.0	424.0	195.0	494.0	na
	Domestic financing	196.4	20.4	134.1	50.9	246.0	na

Source: State Planning Commission

2.4 GOVERNMENT PLANNING STRATEGY

During the past decade, the government's planning strategy has been set forth in a series of development plans, the most recent of which are the five year plan for 1974-1978 and the new three year plan 1979-1981. According to the Central Bank, the overall implementation rate of the five year plan was only 48.3 per cent. This was primarily due to unforeseen factors such as the quadrupling of oil prices and the impact of the 1974/75 drought. The stated intention of the new three year plan is first and foremost to continue and consolidate on work already started under the five year plan. Nevertheless, greater emphasis has been given to development of the agricultural sector, reflecting the government's desire to move the country to greater self-sufficiency in food (Table 2.4).

TABLE 2.4 EXPENDITURE IN SOMALIA FIVE YEAR (1974-78) AND THREE YEAR (1979-81) BY SECTOR

Sector	Five Year Plan (1974-78) Amount So.Sh. million	Per cent of total	Three Year Plan 1979-81) Amount So.Sh. million	Per cent of total
Livestock	228.1	3.2	630.8	8.9
Agriculture and forestry	1,262.2	17.8	1,618.4	22.7
Fisheries	343.1	4.8	266.5	3.8
Manufacturing and minerals	2,304.1	32.3	1,279.2	18.0
Electricity and water	609.2	8.6	541.1	7.6
Transport and communications	1,597.1	22.4	1,500.0	21.2
Health and education	448.2	6.3	623.9	8.8
Other	329.2	4.6	643.7	9.0
Total	**7,121.2**	**100.0**	**7,103.6**	**100.0**

Source: State Planning Commission.

2.5 AGRICULTURAL PRODUCTION

The potential of the agricultural sector is considerable. While only 8.2 million hectares of the country's 64 million hectares is considered cultivable, only 0.5 million hectares of this is currently being exploited (Table 2.5). Dryland farming predominates though an appreciable area is also devoted to flood irrigation. The main staple food crops, grown primarily under rainfed conditions, are sorghum and maize (Table 2.6). Sesame is the preferred oilseed, irrigated crops include vegetables, sugar cane, bananas and cotton.

TABLE 2.5 PRESENT AND POTENTIALLY CULTIVABLE LAND ('000 ha)

	Present	Potential
Controlled Irrigation		
North West Region	1	4
Shabeelle River	35	86
Jubba River	14	160
	50	**250**
Uncontrolled Flood Irrigation	100	-
Rainfed	350	7,950
Total	**500**	**8,200**

Source: Mogambo MMP/HTS, 1979.

Although output from the agricultural sector has grown considerably over the past five years, growth in production of the main commodities (as indicated in Table 2.7) has been erratic. This is largely due to climatic factors. Crop failure one year in five is not uncommon. In 1978, the value of production was 538.5 million So.Sh. (Table 2.6). While impressive, it must be remembered that the value of food imports for 1977 (the latest year for which figures are available) totalled 235 So.Sh. million.

TABLE 2.6 ESTIMATED VALUE OF AGRICULTURAL PRODUCTION IN SOMALIA IN 1978

Crop	Output ('000 tonnes)	Farm-gate Price (So.Sh./tonne)	Value (So.Sh. million)
Maize	107.7	750	80.8
Sesame	40.0	2,400	96.0
Rice	12.1	3,200[1]	38.7
Groundnuts	2.8	1,350	3.8
Vegetables	26.5	4,000[2]	106.0
Cotton	3.2	2,500[3]	8.0
Sorghum	141.1	750	105.8
Bananas Export	57.1	560	32.0
Bananas Local	30.7	200	6.1
Sugar cane	320.0	160[2]	51.2
Beans	10.1	1,000	10.1
Total			**538.5**

Source: MMP/HTS, 1979.

Notes:

[1] *Assumes a mixture of upland rice at So.Sh. 3,500/tonne and paddy rice at So.Sh. 2,850.*

[2] *Estimate.*

[3] *50 per cent Grade I, 50 per cent Grade II.*

TABLE 2.7 INDICES OF OUTPUT OF MAIN AGRICULTURAL COMMODITIES 1974-1978 (1974 = 100)

Commodity	1974	1975	1976	1977	1978
Maize	20.1	34.6	32.7	23.2	9.9
Sorghum	10.5	21.3	10.9	56.3	58.0
Sesame	10.5	12.2	7.2	10.7	8.5
Banana	17.2	11.6	10.5	7.1	7.6
Sugar cane	41.7	40.3	36.3	34.9	33.9
Aggregate Index	**100.0**	**120.0**	**97.6**	**132.2**	**117.7**

Source: Central Bank of Somalia.

2.6 CONCLUSION

Clearly there is a vital need to increase domestic food production. As already noted, this need has been recognised in the 1979-81 development plan. Because of the vagaries of the weather, an increasing effort will be made to develop controlled irrigated agriculture. The Homboy Scheme is a part of this effort. However, Homboy is, more fundamentally, part of an overall effort to re-settle the 245,000 nomads displaced by the 1974/75 drought. As such, its objectives are first and foremost social. Economic considerations are of secondary importance. This should be kept in mind when evaluating the economic performance of the scheme.

3

Bases for the Financial and Economic Analysis

3.1 GENERAL

This section establishes the bases for the financial and economic analyses. It includes a discussion of project life, salvage value of machinery, cost and price assumptions and the treatment of taxes and duties. An outline of financial and economic analyses to be conducted is also presented.

3.2 PROJECT LIFE AND SALVAGE VALUE

Project life has been taken as thirty years. This is considered a reasonable period over which to assess the project since any costs or benefits occurring after that time will have little impact. No salvage value has been put on machinery employed in the construction of the scheme. Consistent with other studies (MMP/HTS, 1979), it is maintained that there are few potential buyers in Somalia for this type of machinery. More than likely, these machines will be kept on the scheme and used for spares. However, a salvage value based on straight line depreciation has been put on agricultural machinery still on the project after thirty years (see Appendix F). The beginning of construction (in 1981) is taken as Project Year 1.

3.3 COST AND PRICE ASSUMPTIONS

Certain cost and price assumptions have been made. All prices used are in terms of December 1979 constant values.

3.3.1 Labour

In the financial analyses, all labour whether unskilled, semi-skilled or skilled, used to construct and manage the scheme has been priced at its full cost. A wage has been also paid to settlers engaged in growing crops. This wage is intended to provide settlers with the necessary cash needed to buy food and cover other expenditures between harvests.

In the economic analysis, skilled and semi-skilled labour has also been valued according to the market rate. Demand for such labour at home and abroad is high, with the result that unemployment for such categories is low. In the case of unskilled labour, seasonal unemployment is common, suggesting the need for shadow pricing. However, since virtually all unskilled labour will be provided by the settlers, it is valued at zero cost. Without the scheme, the settlers would remain in government camps and would probably represent a cost to the national economy.

3.3.2 Foreign Exchange

Foreign exchange has been valued at the official rate of exchange (6.295 So.Sh.=$1). While there is evidence to suggest that this official rate tends to undervalue the cost of foreign exchange, there is little consensus as to what the alternate rate should be. Consequently no attempt has been made to shadow price foreign exchange.

3.3.3 Inputs

The cost of inputs, with the exception of fertiliser, are based on December 1979 prices. In the case of fertiliser, projected 1985 prices have been used (see Appendix C). In the case of seed, it has been assumed that the project will multiply its own seed from stock furnished by the Afgoi Research Farm. The cost of chemicals for control of pests and weeds are based on prices furnished by import agents and European manufacturers. Most are considerably lower than ONAT prices. As a semi-autonomous body, the SDA is likely to be given the authority to buy directly on the world market. Already other projects such as Libsoma exercise this privilege. The cost of agricultural machinery is based on f.o.b. Port Kismayo prices plus ten per cent for unloading, preparation and transport to the project site in world prices. Machinery operating costs have been standardised (Appendix C). One rate is applied to all cropping operations requiring a heavy tractor (ploughing, disc-harrowing, levelling, bunding and groundnut lifting) another to all cropping operations requiring a light tractor (ridging, inter-row cultivation, sowing and transportation). The application of standard rates for a variety of cropping operations should simplify project management and accounting. Processing costs are based on current ADC rates or rates likely to be charged in the eventuality of the project constructing its own processing facilities.

3.3.4 Product Prices

Market prospects and product prices are discussed in detail in the following section. Product prices are based on projected 1985 prices and are summarised in Table 3.1. In the case of economic prices, these are taken from IBRD projections. Financial prices are based on current ADC and Somalatex prices, adjusted for projected movements in world prices. The exception is groundnuts where it is assumed that since Somalia wishes to expand production, domestic prices will not be allowed to follow the downward movement predicted in world prices.

TABLE 3.1 FINANCIAL AND ECONOMIC PRODUCT PRICES (So.Sh./q)

Crop	Financial Price	Economic Price
Rice (hulled)	403	360
Maize	113	125
Sesame	267	393
Groundnuts (shelled)	220	343
Cotton	368	395
Vegetables	45	45

3.4 TAXES AND DUTIES

As a State agency, the Settlement Development Agency (who will run the scheme) enjoys exemption from certain taxes and duties. However, at its specific request, the cost of all taxes and duties incurred in the building and running of the scheme have been included in the financial analysis. These costs have been excluded from the economic analysis since they represent transfers within the national economy. A blanket tax of 25 per cent has been applied to wages paid to semi-skilled and skilled workers. This is rate of income tax (including development tax) applied to an average wage of 800-1,000 So.Sh./month (allowances included).

3.5 FINANCIAL ANALYSIS

The financial analyses will be conducted at three levels. These correspond with the three organisational levels of the scheme; the basic unit of fifty families, the block comprising of from 12 to 30.5 units and the project as a whole. Before this is done, crop budgets for the various crops to be grown will be presented. Their relative profitability both in terms of returns to land and returns to labour will be assessed. It must be remembered though, that choice of crops grown by the project and their intensity will be based on several criteria of which profitability is only one.

Financial analysis at the fifty family unit level will concentrate on establishing a farm budget from which the value of crop production and the direct costs incurred will be determined. If the net income to the unit and hence to each family from growing crops is insufficient to cover basic needs, some form of subsidy may have to be introduced. This is particularly likely to be necessary in early years when crop yields are low. As already noted, settlers will receive some of their income in the form of wages. The remainder will be paid in the form of bonuses at harvest time. The balance between wages and bonuses will need determining as will the overall target income to be aimed at. It is important that wages cover basic needs yet not be set so high so as to discourage settlers from working for better yields, higher output and larger bonuses.

Financial analyses at the block level will look at the balance between cash receipts and cash expenditure. Cash receipts will come from the sale of crops while expenditure will include payment for direct agricultural inputs, machinery and processing, as well as wages paid to settlers and bonuses paid at the end of the cropping season. The balance will indicate the ability of the blocks to contribute towards paying for the cost of managing and operating the scheme. It will also indicate the size of the initial capital working fund needed to purchase inputs and machinery and to pay settlers wages.

At the project level, the analysis will establish the financial viability of the project as a whole. A financial projection over the entire project life will compare cash inflow with cash outflow. Elements in the cash inflow stream include the receipts of loan funds to build and operate the scheme as well as payments made by the blocks for repair and replacement of machinery. Cash outflow elements include the cost stream for construction of the entire scheme (engineering works, agricultural and village infrastructure), operation and maintenance of construction works, machinery and vehicle purchase and replacement costs and the provision of a working capital fund for agricultural production. Operating costs will include vehicle operation and staff costs. The analysis will determine the ability of the scheme to cover eventually all operating costs.

3.6 ECONOMIC ANALYSIS

The purpose of the economic analysis will be to determine the costs and benefits of the Homboy Scheme to the nation as a whole. Benefits consist of increased crop production. In calculating benefits, allowances will be made for the value of food currently produced in the project area. Benefits resulting from settlers involvement in rainfed agriculture and livestock will not be included since the analysis is concerned primarily with the impact of the irrigation scheme. Certain costs incurred in building the scheme have only been partially attributed to the project. These include the cost of the Dhey Tabaaka to Homboy road which will serve other traffic besides the project and the cost of flood protection. This latter item is likely to improve opportunities for agriculture where crops rely on residual moisture as well as improving grazing.

A series of sensitivity analyses will be conducted. These include:

20 per cent over-run in costs
20 per cent increase in the value of agricultural output
3 year delay in agricultural benefits
Exclusion of social infrastructure
Inclusion of full flood protection costs.

4

Market Prospects and Prices

4.1 GENERAL

This section examines the market prospects for crops grown by the project, and establishes product prices which will be used in the financial and economic analysis. The products concerned are rice, maize, sesame, groundnuts, cotton and tomatoes.

4.2 ORGANISATION OF MARKETING

Much of the agricultural production of Somalia is consumed locally and thus never enters the official marketing network. For example, of the estimated 107,740 tonnes of maize produced in 1978, only 10,760 tonnes were sold to the ADC. The ADC is the main government marketing agency, controlling the marketing of maize, sorghum, sesame, rice and groundnuts. ADC purchases farmers' produce at prices set by the government (see Table 4.1). In principle, farmers are expected to market all their produce through ADC, though they are permitted to keep 2 quintals per family member for home consumption.

ADC is involved not only in the purchase of agricultural produce but also in its processing, storage and distribution. Its processing facilities include rice mills at Jelib, Jowhar and Shalambod, as well as several maize driers.

TABLE 4.1 ADC PURCHASE AND SALE PRICES - DECEMBER 1979

Crop	Purchase Price	Sale Price
Maize	75	116
Sorghum	75	116
Upland rice (hulled)[1]	350	391
Paddy Rice (hulled)[2]	285	326
Sesame	240	281
Groundnuts (shelled)	220	261

Source: Agricultural Development Corporation.

Notes:

[1] *Oryza Indica.*

[2] *Oryza Japonica.*

It has storage facilities with an overall capacity of 162,000 tonnes as well as a fleet of trucks to transport crops from the producer to processing centres. ADC has just recently taken over from ONAT the distribution of certain agricultural inputs such as fertiliser and insecticides to farmers.

4.3 TRANSPORT FROM HOMBOY

The project is located 400 km west of Mogadishu. At present, the Mogadishu-Jelib road is being hard-topped. Work is expected to be completed in 1981 providing a direct link to the capital, thereby ensuring speedy evacuation of agricultural produce. One hundred kilometres to the south lies the port of Kismayo, through which machinery and agricultural inputs for the projects will pass. Again, this road is hard-topped facilitating the timely delivery of supplies.

Transport rates provided by ADC and SDA are as follows:

Rough roads (dirt) 30 cents/quintal/km
Good roads (hard top) 25 cents/quintal/km

These rates do not take into account recent increases in petroleum and diesel prices. Hence transport rates are adjusted to 35 cents/quintal/km on rough roads and 30 cents/quintal/km on good roads to reflect the increase.

4.4 MAJOR CROPS

4.4.1 Rice

Estimates of rice production in Somalia in 1975 vary from a high of 11,060 tonnes (Ministry of Agriculture) down to 3,240 tonnes (Afgoi-Mordile; MMP/HTS). For the purpose of this study, current production will be taken as 4,000 tonnes, a figure used by other studies (Mogambo MMP/HTS). Domestic production only meets a fraction of domestic requirements. Imports, which stood at 16,875 tonnes in 1974, have almost doubled to 33,155 tonnes for 1978.

According to projections from FAO and Technital, rice consumption in Somalia is expected to increase from 27,000 tonnes in 1975 to 35,000 tonnes by 1980 and 67,000 tonnes in 1990. This increase is due not only to growth in population but also to a switch from the present staples maize and sorghum which is likely to take place as incomes rise. IBRD estimate the income elasticity of demand for rice at 0.20.

On the production side, the overall output of rice is expected to increase considerably as large irrigation schemes such as Jowhar, Balad, Afgoi-Mordile, Genale, Saakow and Mogambo come on stream. However, even assuming all these projects, many of which have yet to be built, are realised, the overall increase in production will total a maximum of 20,000 tonnes by 1980 and 47,000 tonnes by 1990. Thus a very considerable shortfall of 15,000 tonnes in 1980 rising to 20,000 tonnes by 1990 will remain. Consequently any contribution by the Homboy Scheme to increase the nation's production of rice will serve to reduce the level of imports. Rice produced by the scheme will be hulled at the ADC rice mill in Jelib. It should be noted that if all the schemes planned for the Jubba valley are realised, ADC will have to increase the capacity of its rice milling facilities.

Both long-grained and short-grained rice are grown in Somalia, upland rice (long-grained indica) and paddy rice (short-grained japonica). Consumers prefer the former and this is reflected in prices paid by ADC, although these prices have remained unchanged for the past three years. It is not unreasonable to expect that in the long term, domestic prices will move in the same direction as world prices. With world prices expected to increase 15 per cent between 1978 and 1985, the projected domestic price for long-grained indica should increase from 350 So.Sh./quintal to 403 So.Sh. This latter figure will be used for the financial analysis. The Homboy Scheme is expected, at least in the beginning, to grow only rice of the long-grained indica type.

Economic prices have been derived from IBRD forecasts (see Appendix A). The world market price for Thai milled rice, 5 per cent broken f.o.b. Bankok is expected to increase from $367.5/tonne in 1978 to $423.9/tonne in 1985 (valued at 1978 constant prices). After the necessary adjustments have been made, including shipping and insurance, unloading and storage and finally local transport, this results in a projected farm-gate price of So.Sh. 360/quintal for hulled rice.

4.4.2 Maize

Maize is second only to sorghum in importance as a food staple food crop. In 1978, overall production was estimated at 125,390 tonnes by the Ministry of Agriculture. Despite impressive domestic production, imports of maize have hovered around 20,000 tonnes for the past three years. However, this is considerably below the 35,316 tonnes imported in 1975 when the impact of the drought was still being felt.

Forecasts for future consumption combine maize with sorghum. Overall consumption is expected to rise from 295,000 tonnes in 1975 to 353,000 tonnes by 1980 and 494,000 tonnes by 1990. While several large irrigation schemes being planned and developed envisage including maize in their cropping patterns, it is unlikely that overall production will increase sufficiently to cover the 40 per cent rise in demand predicted for the period 1980-1990. Production of maize at Homboy will reduce the overall deficit.

Domestic prices paid by ADC have remained at 75 So.Sh./quintal for the last three years. World prices are expected to increase 51 per cent from 107.7/tonne in 1978 to 152.1/tonne in 1985 (valued at 1978 constant prices). Applying this increase to domestic prices, the projected financial price will be 113 So.Sh./quintal. The projected farm-gate price used in the economic analysis is 125 So.Sh/quintal (see Table A2, Appendix A).

4.4.3 Sesame

Sesame is the preferred oilseed in Somalia with the area devoted to it far exceeding both groundnuts or sunflower seed. The Ministry of Agriculture estimates that in 1978 136,310 ha were planted to sesame yielding 40,890 tonnes of sesame seed. Other sources (MMP/HTS, 1979) put the area at only half this. Despite disagreement, it is clear that domestic production does not meet domestic requirements. Imports of edible oils have increased from 3,000 tonnes in 1974 to 14,000 tonnes in 1978. Currently imports account for 60 per cent of total supply of edible oils (Table 4.2).

Forecasts predict domestic per capita consumption of edible oils rising from 1.9 kg in 1975 to 3.5 kg by 1990. In reality, this latter figure has already been surpassed. As incomes continue to rise, per capita consumption will further increase. IBRD figures show that consumption rises from 5 kg/capita in the poorer developing countries to 25-30 kg in the developed nations. This together with population growth means that overall demand for edible oils is likely to increase considerably. Since few of the new schemes emphasise sesame, production is liable to continue to lag behind domestic requirements.

The bulk of sesame produced by the Homboy Scheme will be sold to ADC who will transport it to the National Oil Mill in Mogadishu. The current ADC price for sesame seed is 240 So.Sh./quintal. World prices are expected to increase 11 per cent between 1978 and 1985. If domestic prices follow this trend, this implies a financial price of 267 So.Sh./quintal. The farm-gate economic price used in the analysis is 393 So.Sh./quintal. (Appendix A).

TABLE 4.2 ESTIMATED SUPPLY OF EDIBLE OILS

	1978 (tonnes)	Extraction Rate (%)[1]	Edible Oil (tonnes)
Local production			
Sesame	24,000	35	8,400
Groundnuts	1,000	33	330
Sunflower	1,000	33	330
Cotton seed	500	13	65
Total local production of edible oil			**9,125**
Imports (tonnes)			
Seeds, nuts, kernels, etc.	1,200	45[2]	540
Edible oils	13,500	-	13,500
Total imports of edible oil			**14,040**
Total Supply of edible oil			**23,165**

Source: Mogambo MMP/HTS, 1979.

Notes:

[1] *IBRD data x 75 per cent to allow for crude rural mills.*

[2] *Processed at National Oil Mill, Mogadishu.*

4.4.4 Groundnuts

Groundnut production is very limited. An estimated 2,710 tonnes of shelled nuts were produced in 1978 on 3,880 ha. As an oilseed, any production by the Homboy scheme would serve to reduce imports of edible oils. The current price paid by ADC is 220 So.Sh./quintal of shelled nuts. World prices are expected to fall by 24 per cent between 1978 and 1985. However, it is highly unlikely that domestic prices will be allowed to drop given the desire of the Somali authorities to increase production. Thus the current ADC price will be used throughout the financial analysis.

4.4.5 Cotton

Estimates of seed cotton produced in 1978 vary from 3,250 tonnes (Ministry of Agriculture) down to 1,294 tonnes (ADC and Somalatex). The latter figure based on deliveries to the factory gate will be used in this study. Assuming 100 kg produces 33 kg of lint, this amounts to 431.4 tonnes of lint. During the same year, the State Agency handling cotton imported another 1,694.5 tonnes of lint. Thus only 20 per cent of domestic needs were met by domestic production.

A considerable increase in cotton production is envisaged as new schemes in the Jubba and Shabeelle valleys get underway and as present schemes expand production. If all the schemes currently proposed are implemented, the total area will exceed 7,000 ha producing an estimated 2,400 tonnes of cotton lint. This will exceed the capacity of Somalatex's two ginning mills at Balcad and Jamaame. However, Somalatex has plans to modernise the mill at Jamaame, more than doubling its present output of 20 bales per day to 50.

Despite the sizable increase predicted in production, demand is likely to continue to outstrip domestic production. National demand for fibre is currently estimated at 4,500 tonnes and is expected to increase to 6,000 tonnes by 1990. This reflects not only growth in population but also an increase in demand brought about by rising incomes. The income elasticity of demand for cotton in developing countries is estimated to be 0.5. Production at Homboy will help to meet this growing demand for cotton.

Cotton grown on the Homboy scheme will be sold to Somalatex who will process the seed cotton at their Jamaame ginning mill. Somalatex, who have recently taken over from ADC the purchase of seed cotton currently pay 320 So.Sh./quintal for Grade A, 270 So.Sh./ quintal for Grade B and 240 So.Sh./quintal for Grade C at the ginnery gate. The world price of cotton is expected to increase 15 per cent between 1978 and 1985. Applying this increase to domestic prices results in a projected financial price of 368 So.S./quintal for Grade A cotton. The projected ginnery price to be used in the economic analysis is 395 So.Sh./quintal (see Appendix A).

4.4.6 Tomatoes

Vegetables will be grown on the Homboy Scheme. The vegetables are intended to primarily assure the settlers a varied and healthy diet rather than be a supplementary source of income. Hence the area devoted to vegetables will be quite restricted. If a surplus above settlement needs is produced, this will have to be transported to a major centre of consumption such as Mogadishu or else to processing plants such as the tomato canning factory at Afgooye.

The main vegetable crops likely to be grown are tomatoes, onions and melons. In order to put a value on production, one crop, tomatoes, has been chosen as being representative. The financial and economic prices for tomatoes have been derived by taking the wholesale price for tomatoes in Mogadishu, and adjusting it back to the farm-gate.

	So.Sh./quintal
Wholesale price of tomatoes in Mogadishu	170
Transport Homboy-Mogadishu (400 km at 30 cents/quintal/km	120
	50
Handling/loading (10 per cent)	5
Farm-gate financial and economic price	45

4.4.7 Conclusion

All but one of the crops to be grown at Homboy are currently being imported in substantial quantities. Production from the scheme will serve to reduce the level of imports. Equally important, it will provide food for the settlers as well as for the nation as a whole.

5

Results of Financial Analyses

5.1 GENERAL

Before presenting the results of the financial analyses, the crop budgets will be presented and the overall cropping programme discussed.

Crop budgets for paddy rice, upland rice, maize, sesame, groundnuts, cotton and tomatoes are shown in Appendix D. These budgets are based on yields obtained at full development and the costs include not only direct agricultural inputs but also machinery, processing and transport costs. Machinery costs cover operation and maintenance as well as depreciation. Paddy rice, cotton and upland rice show the highest returns to land, while upland and paddy rice show highest returns to labour (Table 5.1). Tomatoes, while showing a high return to land will be grown primarily for home consumption rather than for sale.

TABLE 5.1 NET RETURNS TO LAND AND LABOUR OF CROPS AT FINANCIAL PRICES

Crop	Returns to Land (SoSh/ha)	Returns to Labour (SoSh/man-day)
Paddy rice	7,007	166.8
Upland rice	5,582	79.7
Maize 'Gu' season	2,920	26.3
Maize 'Der' season	2,360	21.3
Sesame	1,144	12.4
Groundnuts	2,485	16.7
Cotton	6,028	25.8
Tomatoes	6,862	26.6

Despite the relatively low profitability of maize, groundnuts and sesame, these crops have also been included in the proposed cropping programme (Table 5.2). The objective of the cropping programme is to grow a mixture of crops which will serve a variety of purposes, mainly providing settlers with food; assuring them an adequate cash income; and increasing Somalia's production of food and cash crops thereby reducing its import bill for these items. The overall intensity of cropping will be 160 per cent; 60 per cent in the 'Gu' season and 100 per cent in the 'Der'.

TABLE 5.2 PROPOSED CROPPING PATTERN FOR HOMBOY SCHEME

Crop	Season 'Gu' Intensity (%)	'Der' Intensity (%)
Rice	20	20
Maize	20	20
Sesame	-	15
Groundnuts	15	-
Cotton	-	40
Tomatoes	5	5
Total	**60**	**100**

5.2 FINANCIAL ANALYSES AT THE FIFTY FAMILY LEVEL

5.2.1 General

The fifty family unit is the basic unit around which the social and productive functions will be organised. As such it is a useful building block for the financial analyses of the entire scheme.

5.2.2 Organisation

Although the majority of settlers have been living at Dujuuma for several years, they are still largely unfamiliar with agricultural practices, and in particular, with growing irrigated crops. Consequently it is recommended that during the first five seasons, the fifty family units be run along State Farm lines with decision making and management concentrated at the block level. During this period, settlers will work as paid labourers and concentrate on acquiring basic farming skills. To speed this acquisition of skills, the cropping pattern will be simplified, with only maize and rice being grown during the first three seasons. This simplified pattern will ensure a rapid build up of cereals needed to meet the settlers needs for food. As of the fourth season, the full cropping pattern will be introduced (Table 5.3). Since some units are in blocks settled in the 'Der' season and others in blocks settled during the 'Gu' season, the build-up of crop production differs slightly during the first two years. However, by the third year, units in blocks starting in the 'Der' season will be growing the same areas of crops as units starting in the 'Gu' season. In Blocks 9 and 10, a small number of units will be devoted entirely to paddy rice, since some of the cropland in these blocks is only suitable for growing this crop. Nevertheless, these units will still respect the overall cropping intensity of 160 per cent.

As settlers gain greater experience, the units will be given greater autonomy, with decision making devolving from the block level to individual units. Evolving into cooperatives, units will be responsible for acquiring inputs from their respective blocks and distributing them to their members.

5.2.3 Size

Each fifty family unit will be assigned a fifty hectare plot of irrigated land to cultivate. A larger plot is not recommended since it would mean that fewer families could be settled at Homboy. With the current refugee situation, this would hardly be acceptable.

TABLE 5.3 DEVELOPMENT OF CROPPING PATTERNS ON FIFTY FAMILY UNIT

Season Year of Settlement	Crop Area Cultivated (ha) Rice	Maize	Sesame	Groundnuts	Cotton	Tomatoes	Total
(a) Where unit begins cropping in the 'Der' Season							
Gu 1	-	-	-	-	-	-	-
Der 1	25	25	-	-	-	-	50
Gu 2	15	15	-	-	-	-	30
Der 2	25	25	-	-	-	-	50
Gu 3	10	10	-	7.5	-	2.5	30
Der 3	10	10	7.5	-	20	2.5	50
Gu 4) Der 4)	20	20	7.5	7.5	20	5.0	80
(b) Where unit begins cropping in 'Gu' Season							
Gu 1	15	15	-	-	-	-	30
Der 1	25	25	-	-	-	-	50
Gu 2	15	15	-	-	-	-	30
Der 2	10	10	7.5	-	20	2.5	50
Gu 3	10	10	-	7.5	-	2.5	30
Der 3	10	10	7.5	-	20	2.5	50
Gu 4) Der 4)	20	20	7.5	7.5	20	5.0	80

5.2.4 Value of Crop Production

In the early years, yields are expected to be fairly low. However, as the settlers acquire agricultural skills, yields should start to rise. A build-up of yields, starting in the fifth year has been projected over a ten year period. Base yields, mid-period yields and yields at full development are shown in Table 5.4. The impact of the build-up of crop yields on production and the value of crop production is detailed in Appendix E. Yield increases between the base year, mid-period and yield at full development have been interpolated.

TABLE 5.4 BUILD-UP IN CROP YIELDS

Year of Settlement	Paddy Rice[1]	Upland Rice[1]	Maize Gu	Maize Der	Crop Yields (q/ha) Sesame	Groundnuts[2]	Cotton	Tomatoes
Year 1-4	25	20	20	18	5	15	12.5	70
Year 9	30	25	30	28	6.5	18	17.5	150
Year 14	35	30	40	35	8	25	25	200

Notes:
1 *Unhulled*
2 *Unshelled*

Since yields for maize grown in the 'Gu' season tend to be higher than those in the 'Der', production for each has been calculated separately. Once again with some units being settled in the 'Gu' season and others in the 'Der', the initial build-up of production differs slightly. Also, the value of crop production for units in Blocks 9 and 10 devoted entirely to paddy will be somewhat higher. The value of production from a typical fifty family unit is summarised in Table 5.5.

TABLE 5.5 NET VALUE OF CROP PRODUCTION ON A TYPICAL FIFTY FAMILY UNIT ('000 So.Sh.)

Season/Year of Settlement	Gross Value of Production	Value of Home Consumption	Gross Crop Revenues	Value of Inputs and Services Advanced	Net Crop Revenue
(a) First four seasons where cropping starts in 'Der' Season					
Gu 1	-	-	-	-	-
Der1	192.0	27.1	164.9	110.0	54.9
Gu 2	118.5	27.1	91.4	66.0	25.4
Der2	192.0	27.1	164.9	110.0	54.9
(b) First four seasons where cropping starts in 'Gu' Season					
Gu 1	118.5	27.1	91.4	66.0	25.4
1	192.0	27.1	164.9	110.0	54.9
2	118.5	27.1	91.4	66.0	25.4
2	186.6	35.0	151.6	112.6	39.0
(c) Subsequent Years					
3	290.8	69.9	220.9	172.0	48.9
4	290.8	69.9	220.9	172.0	48.9
5	313.4	73.5	239.9	172.7	67.2
6	335.7	77.1	258.6	173.5	85.1
7	358.2	80.7	277.5	174.3	103.2
8	380.5	84.3	296.2	175.0	121.2
9	403.0	87.9	315.1	175.8	139.3
10	427.9	90.1	337.8	176.8	161.0
11	452.9	92.4	360.5	177.9	182.6
12	478.0	94.6	383.4	179.0	204.4
13	503.0	96.9	406.1	180.1	226.0
14 onwards	528.0	99.1	428.9	181.1	247.8

5.2.5 Value of Production Retained for Home Consumption

A certain proportion of crop production will be retained by each unit for home consumption. The exact quantities are based on rations that the settlers at Dujuuma are currently receiving (Table 5.6). Assuming the average family size to be three adults and two children and consumption by children to be half that of adults, each unit will retain 73 quintals of rice and 219 quintals of maize during any given year. All tomatoes and other vegetables grown will also be kept for home consumption. The value of production retained is detailed in Appendix E and summarised in Table 5.5.

TABLE 5.6 RATIONS CURRENTLY BEING RECEIVED BY SETTLERS AT DUJUUMA

Item	Quantity (grammes/adult/day)	Value (So.Sh.)
Maize	300	0.348
Rice	100	0.359
Powdered milk	30	0.160
Beans	50	0.800
Oil	60	0.588
Meat	35	0.420
Sugar	60	0.360
Tea	3	0.090
		3.125

Source: WFP Mogadishu. Prices based on ADC and ENC data.

5.2.6 Value of Inputs and Services Advanced to a Unit

Each unit will be advanced the necessary agricultural inputs such as seed, seed dressing, fertilisers, herbicides and pesticides by its respective block. In addition, preparation and cultivation of land will be carried out with machinery and operators provided by the block. The block will also cover the cost of processing crops and transporting cotton to Jamaame. The value of all these inputs and services advanced to the typical unit are shown in Appendix E and appear summarised in Table 5.5.

5.2.7 Net Crop Revenue

The net value of crop production has been calculated by subtracting from gross crop revenue the value of crops retained for home consumption and the costs of inputs and services advanced (Table 5.5). The net value rises from 48,900 So.Sh. in year 3 (the year when the complete cropping pattern is introduced) to 247,800 So.Sh. in year 14 when yields reach their maximum.

5.2.8 Settlers Income

All crop production, with the exception of that retained for home consumption will be handed over to the block. The value of inputs and services advanced during the year will be deducted. The remainder will be returned to the unit, though additional charges for the cost of management may be eventually deducted.

Given their daily needs for food, other than that produced by the unit, settlers cannot be expected to work a whole season before receiving any remuneration. Consequently part of the expected crop revenues will have to be paid out in advance in the form of a wage. The wage must meet two requirements. First it must be sufficient to cover the settlers basic needs; secondly, it must be competitite with wages paid elsewhere in the region.

The most important need of settlers is food since housing and social services will be provided by the Scheme. The value of rations currently received by settlers is estimated at 3.125 So.Sh. per day for each adult (Table 5.6). For a family of three adults and two children this amounts to 12.5 So.Sh./day (assuming the children's ration is half that of an adult). Adjusting this figure by the value of rice and maize retained for home consumption, the cost falls to 9.5 So.Sh./day. With a family expected to furnish an average of 230 man-days of labour a year, this means a minimum wage of 15 So.Sh. per man-day must be paid. This is considerably above wages currently being paid for unskilled labour elsewhere in the region. Fanoole State Farm pays 10 So.Sh./day and the Jubba Sugar Project 12 So.Sh. Adjusted for the value of home production, this amounts to 7-9 So.Sh./day. In an attempt to align Homboy wages with those paid elsewhere, two wage options have been calculated, the one where settlers are paid 8 So.Sh./man-day the other where they are paid 10 So.Sh./man-day (Table 5.7).

TABLE 5.7 BUILD-UP OF SETTLERS INCOME (So.Sh.)

Year of Settlement	Gross Crop Revenues	Wages[1]	Option 1 Bonus	Total	Wages[2]	Option 2 Bonus	Total
1-3	-	1,840	-	1,840	2,300	-	2,300
4	4,418	1,840	221	2,061	2,300	442	2,742
5	4,798	1,840	288	2,128	2,300	528	2,828
6	5,172	1,840	362	2,202	2,300	621	2,921
7	5,555	1,840	444	2,284	2,300	722	3,022
8	5,924	1,840	533	2,373	2,300	829	3,129
9	6,302	1,840	630	2,470	2,300	945	3,245
10	6,756	1,840	743	2,583	2,300	1,081	3,381
11	7,210	1,840	865	2,705	2,300	1,226	3,526
12	7,668	1,840	997	2,837	2,300	1,380	3,680
13	8,122	1,840	1,137	2,977	2,300	1,543	3,843
14	8,578	1,840	1,287	3,127	2,300	1,716	4,016

Notes:

1 *8 So.Sh./man-day.*

2 *10 So.Sh./man-day.*

Given the initially slow build-up in yields, the surplus of crop revenues left after deduction of costs of production and wages is likely to remain small for several years. To motivate settlers to increase crop production, a bonus directly related to the value of crop production should be paid. Initially this bonus will have to be subsidised by the block. However, as yields increase and the value of crop production rises, the surplus of crop revenues over production costs will grow, eventually permitting the subsidy to be repaid.

The size of the bonus depends largely on the target income fixed by the Scheme for settlers' families. A target income of 5,000 So.Sh. per family per year was suggested in the Inter-Riverine Report (HTS, 1978). This figure is based on ILO recommendations. With the value of maize and rice production retained for home consumption at 1,082 So.Sh., this implies a target of income of approximately 4,000 So.Sh. If settlers participate in rainfed agriculture the contribution of the scheme to overall family could be lower. However, it is not clear the extent to which settlers will engage in rainfed farming. To cover various possibilities, two target incomes have been chosen; Option 1, 3,000 So.Sh./family; Option 2, 4,000 So.Sh./family.

During the first five seasons, settlers will only receive a basic wage. However, beginning the fourth year, bonuses will be paid. In the case of the lower target income, an initial bonus equivalent to five per cent of gross crop revenue will be paid at harvest time. This percentage will increase by one per cent over the next ten years until year 14 when it will stand at fifteen per cent. Added to the daily wage of 8 So.Sh./man-day this amounts to a family income of 2,061 So.Sh. in year 4 rising to 3,127 by year 14 (Table 5.7). In the case of the higher target income, the bonus will start at ten per cent of gross crop revenues and eventually rise to twenty per cent. When the wage of 10 So.Sh./man-day is taken into account, this results in an overall income of 2,742 So.Sh. in year 4 rising to 4,016 So.Sh. by year 14 (Table 5.7). It should be remembered that in good years the bonus will be larger and in poorer years, smaller. However, with the basic wage remaining unchanged, families should have sufficient money to meet their immediate needs.

The payment of wages and bonus have been calculated for the typical fifty family unit (Table 5.8). With the lower target income, the cost of wages and bonuses exceeds net crop revenues up until year 9 while with the higher target income this situation persists until year 11. Consequently in early years a subsidy payment from the blocks will be required. However, in both cases, the surplus generated in later years indicates that this subsidy could eventually be repaid.

TABLE 5.8 COMPARISON OF NET CROP REVENUES WITH WAGE AND BONUS PAYMENTS FOR A FIFTY FAMILY UNIT ('000 So.Sh.)

Season/Year	Net Crop Revenues	Option 1 Wages and Bonus	Option 1 Balance	Option 2 Wage and Bonus	Option 2 Balance
(a) First four seasons where cropping begins in 'Der' Season					
Gu 1	-	-	-	-	-
Der 1	54.9	46.0	8.9	57.5	2.6
Gu 2	25.4	46.0	(20.6)	57.5	(32.1)
Der 2	54.9	46.0	8.9	57.5	(2.6)
(b) First four seasons where cropping begins in 'Gu' Season					
Gu 1	25.4	46.0	(20.6)	57.5	(32.1)
Der 1	54.9	46.0	8.9	57.5	(2.6)
Gu 2	25.4	46.0	(20.6)	57.5	(32.1)
Der 2	39.0	46.0	(7.0)	57.5	(18.5)
(c) Subsequent Years					
3	48.9	92.0	(43.1)	115.0	-
4	48.9	103.1	(54.2)	137.1	(88.2)
5	67.2	106.4	(39.2)	141.4	(74.2)
6	85.1	110.1	(25.0)	146.1	(60.0)
7	103.2	114.2	(11.0)	151.1	(47.9)
8	121.2	118.7	(2.5)	156.5	(35.3)
9	139.3	123.5	15.8	162.3	(23.0)
10	161.0	129.2	31.8	169.1	(8.1)
11	182.6	135.3	47.3	176.3	6.3
12	204.4	141.9	62.5	184.0	20.4
13	226.0	148.9	77.1	192.2	33.8
14	247.8	156.4	91.4	200.8	47.0

5.3 FINANCIAL ANALYSIS AT BLOCK LEVEL

5.3.1 General

Each fifty family unit will belong to a block. These vary in size, the smallest comprising 12 units, the largest 30.5. As already mentioned, each block will advance its units the necessary inputs and services during the crop year. They will also pay the settlers a living wage. At harvest time, crop production other than that kept for home consumption, will be handed over by the units to their respective blocks. Crop revenues will be used to purchase inputs and pay for services needed during the following cropping season. Part of the crop revenues will be returned to the units in the form of a bonus and if a surplus still remains, this will be paid to the project to help defray the costs of managing the scheme.

The financial analysis at the block level is concerned with determining the viability of the blocks. Of particular interest will be the ability of the blocks to function without having to depend on endless injections of cash from the project and their ability to eventually contribute toward covering project management costs. To determine these points, a financial projection for the blocks taken as a whole has been prepared.

5.3.2 Phasing in of Blocks

A total of ten blocks are to be phased in over a five year period. The first one is scheduled to start cropping in 'Der' 82, the last will start in 'Der' 86 (Table 5.9). In all, they will contain a total of 177 units. All but 14.5 of the units will follow the normal cropping pattern. These remaining units in Blocks 9 and 10 will be limited, for reasons already discussed, to growing paddy rice.

TABLE 5.9 PHASING IN OF BLOCKS

Calendar Season/Year	Project Year	Block No.	Area (ha)	Units (No.)	
Der 82	2	1	600	12	
Gu 83	3	2 & 3	1,525	30.5	
Gu 84	4	4	925	18.5	
Der 84	4	5	1,025	20.5	
Gu 85	5	6 & 7	1,925	38.5	
Gu 86	6	8 & 9	2,100	42	31.5 normal 10.5 paddy rice
Der 86	6	10	750	15	11 normal 4 paddy rice
Total		10	8,850	177	

5.3.3 Cash Inflow

The cash inflow for the blocks will consist of two items. The first is a working capital fund established to cover the cost of inputs, and services advanced to the units. The size of the working fund for each block is determined by the size of the block and has been calculated so as to cover maximum requirements. This sum varies according to the season the block is settled. Thus inputs for blocks settled in the 'Der' season are based on year 2 requirements, processing and machinery on year 3 while inputs for blocks settled in the 'Gu' season are based on year 1 requirements, processing on year 2 and machinery on year 3 (see Appendix E). While it is true that processing costs will continue to rise until year 13, the increase involved is relatively small and thus has been ignored. Machinery requirements are limited to covering the cost of operation, which is 39 per cent of overall machinery costs. Replacement and repairs will be taken care by the project headquarters. A ten per cent contingency has been included in the working capital fund (Table 5.10).

The second inflow item is crop revenues from crops grown by the units. This is based on the total value of crop production less the value of crops kept for home consumption. Gross crop revenues for each block have been calculated in Appendix E and the total is shown in Table 5.10.

5.3.4 Cash Outflow

Cash outflow at the block level consists of two groups of items. The first one is direct costs incurred by the blocks, the second are transfers made to the units or the project headquarters. Direct costs include purchase of inputs, machinery operating costs and processing costs. These are shown on a block by block basis in Appendix E and are summarised in Table 5.10. Transfers to the project include payments for machinery repairs and replacement. They account for 61 per cent of overall machinery costs. Transfers to the units include wages paid during the growing season and bonuses paid at harvest time. These have been calculated twice, first based on the lower target income (Option 1) and then on the higher target income (Option 2). Bonuses paid to the 14.5 units growing paddy rice are the same as those paid to all other units even though their gross crop revenues are higher.

5.3.5 Net Value

The net cash flow for the blocks taken as a whole depends on the target income option chosen. In the case of Option 1, the net cash flow is negative for four years and is more than covered by the surplus generated in earlier years. The growth in the surplus in later years indicates the blocks will be able to contribute substantially towards paying of project management costs. If Option 2 is chosen, the cash flow remains negative over a longer period with the cumulative deficit not being recouped until year 17. However, the results suggest that from year 18 onwards, the blocks will also be capable of making an important contribution towards covering management costs.

5.4 FINANCIAL ANALYSIS AT THE PROJECT LEVEL

5.4.1 General

As a final step in the financial analysis, a financial projection for the project as a whole has been calculated (Table 5.11). This compares overall cash receipts with expenditures, the balance indicating the viability of Homboy Scheme.

5.4.2 Cash Inflow

Cash inflow is made up from two sources, the first is loan funds secured to finance the construction of the scheme and to purchase initial machinery and equipment, the second is payments by the blocks to the projects for services rendered.

The loan funds cover the construction of the engineering works and infrastructure. This includes not only the cost of construction but also the cost of engineering design work and supervision. Loan funds also cover the cost of the initial purchase of engineering maintenance vehicles and equipment, project management vehicles, and agricultural machinery. In addition they cover working capital funds for the blocks, contingencies on these items and the cost of expatriate technical assistance. Apart from this latter item, no other operating costs are covered by loan funds. It is hoped that in the long run, the project will generate sufficient revenue to pay for these.

TABLE 5.10 FINANCIAL PROJECTION FOR BLOCKS TAKEN TOGETHER ('000 So.Sh.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19-30
1. Inflow																			
Working capital fund	-	1,579	4,026	5,139	5,084	8,021	-	-	-	-	-	-	-	-	-	-	-	-	-
Contingency (10%)	-	158	403	514	508	802	-	-	-	-	-	-	-	-	-	-	-	-	-
Crop revenues	-	1,979	10,893	18,189	29,006	44,131	45,326	45,633	47,894	51,233	54,609	58,109	61,757	65,565	69,650	73,281	76,310	78,448	79,712
Total	-	3,716	15,322	23,842	34,598	52,954	45,326	45,633	47,894	51,233	54,609	58,109	61,757	65,565	69,650	73,281	76,310	78,448	79,712
2. Outflow																			
(a) Direct																			
Agricultural Inputs	-	667	3,778	6,236	10,036	14,414	14,528	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191
Machinery Operation	-	239	1,358	2,407	3,907	5,687	5,914	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932
Processing	-	38	221	615	945	1,594	1,820	1,921	2,011	2,139	2,273	2,416	2,567	2,735	2,915	3,081	3,217	3,308	3,356
Sub-Total	-	944	5,357	9,258	14,888	21,695	22,262	22,044	22,134	22,262	22,396	22,539	22,690	22,350	23,038	23,204	23,340	23,431	23,479
(b) Transfer																			
Machinery repairs and depreciation	-	375	2,123	3,765	6,111	8,895	9,251	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278
Wages and bonus Option 1	-	552	3,910	6,555	11,173	16,106	17,373	18,090	19,174	19,860	20,619	21,461	22,390	23,406	24,526	25,630	26,568	27,255	27,682
Sub-Total	-	927	6,033	10,320	17,284	25,001	26,625	27,368	28,452	29,138	29,897	30,739	31,668	32,684	33,804	34,908	35,846	36,533	36,960
Wages and bonus Option 2	-	690	4,888	8,195	14,067	20,486	22,396	23,617	25,444	26,299	27,227	28,242	29,348	30,556	31,875	33,164	34,253	35,041	35,542
Sub-Total	-	1,065	7,011	11,960	20,178	29,381	31,647	32,895	34,722	35,577	36,505	37,520	38,626	39,834	41,153	42,422	43,531	44,319	44,820
Total (Option 1)	-	1,871	11,390	19,578	32,172	46,696	48,886	49,412	50,586	51,400	52,293	53,278	54,358	55,534	56,842	58,112	59,186	59,964	60,439
Total (Option 2)	-	2,009	16,747	21,488	35,066	51,076	53,909	54,939	56,856	57,839	58,901	60,059	61,316	62,684	64,191	65,646	66,871	67,750	68,299
3. Net Cash Flow																			
With Option 1	-	1,845	3,932	4,264	2,426	6,258	(3,560)	(3,779)	(2,692)	(167)	2,316	4,831	7,399	10,031	12,808	15,169	17,124	18,484	19,273
With Option 2	-	1,707	2,954	2,354	(468)	1,878	(8,583)	(9,306)	(8,962)	(6,606)	(4,292)	(1,950)	441	2,881	5,459	7,635	9,439	10,698	11,413

TABLE 5.11 PROJECT FINANCIAL PROJECTION ('000 So.Sh.)

		Project Year 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Inflow														
(a) Loan Funds[1]		168,007	172,548	136,706	124,827	84,642	43,205	1,742	-	-	-	-	-	-
(b) Payments from Blocks														
Machinery repair and depreciation		-	375	2,123	3,765	6,111	8,895	9,251	9,278	onwards				
Operating surplus from Blocks:	Option 1	-	18,45	3,932	4,264	2,426	6,528	-	-	-	-	2,316	4,831	7,399
	Option 2	-	1,707	2,954	2,354	-	1,878	-	-	-	-	-	-	441
Total Inflow	Option 1	168,007	174,768	142,761	132,856	93,179	58,628	10,993	9,278	9,278	9,278	11,594	14,109	16,677
	Option 2	168,007	174,630	141,783	130,946	90,753	53,978	10,993	9,278	9,278	9,278	9,278	9,278	9,719
2. Outflow														
(a) Capital and replacement costs														
Construction of engineering works[2]		137,956	95,269	67,135	66,935	50,061	22,697	-	-	-	-	-	-	-
Construction of infrastructure[2]		9,969	59,064	44,586	32,780	11,335	-	-	-	-	-	-	-	-
Engineering maintenance vehicles and equipment		-	1,780	4,037	2,771	4,550	804	1,626	61	287	2,906	1,928	4,200	2,427
Project management vehicles		1,172	798	494	554	545	226	948	665	485	545	527	226	966
Agricultural machinery		-	2,196	5,267	6,549	6,505	7,593	3,505	2,513	4,532	5,998	7,330	7,117	3,547
Working capital funds		-	1,579	4,026	5,139	5,084	8,021	-	-	-	-	-	-	-
Contingencies[3]		14,910	6,542	5,841	4,779	2,802	1,664	608	324	530	945	979	1,154	694
Total		164,007	167,228	131,386	119,507	80,882	41,005	6,687	3,563	5,834	10,394	10,764	12,697	7,634
(b) Operating Costs														
Project management staff		4,823	7,553	9,234	11,172	11,525	10,714	8,460	8,412	onwards				
Project management vehicles		239	440	551	677	801	845	767	741	onwards				
Engineering maintenance vehicles and equipment		-	1,507	4,650	6,304	8,457	9,049	9,964	onwards					
Operating deficits of Blocks:	Option 1	-	-	-	-	-	-	3,560	3,779	2,692	167	-	-	-
	Option 2	-	-	-	-	468	-	8,583	9,306	8,962	6,606	4,292	1,950	-
Total Operating Costs	Option 1	5,062	9,500	14,435	18,153	20,783	20,608	22,741	22,896	21,809	19,284	19,117	19,117	19,117
	Option 2	5,062	9,500	14,435	18,153	21,251	20,608	27,764	28,423	28,079	25,723	23,409	21,067	19,117
Total Outflow	Option 1	169,069	176,728	145,821	137,660	101,665	61,613	29,428	26,459	27,643	29,678	29,881	31,814	26,751
	Option 2	169,069	176,728	145,821	137,660	102,133	61,613	34,451	31,986	33,913	36,117	34,173	33,764	26,751
3. Net Cash Flow														
	Option 1	(1,062)	(1,960)	(3,060)	(4,804)	(8,486)	(2,985)	(18,435)	(17,181)	(18,365)	(20,400)	(18,287)	(17,705)	(10,074)
	Option 2	(1,062)	(2,098)	(4,038)	(6,714)	(11,380)	(7,635)	(23,458)	(22,708)	(24,635)	(26,839)	(24,895)	(24,486)	(17,032)

Notes:

1. *Loan funds cover construction of engineering works and infrastructure, purchase of initial vehicles, equipment and agricultural machinery, contingencies on these items and technical assistance.*
2. *Includes design and supervision.*
3. *Ten per cent physical contingency on all items except engineering works which already includes a contingency figure.*

TABLE 5.11 (Continued)

	Project Year																
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10,031	12,808	15,169	17,124	18,484	19,273	onwards										
	2,881	5,459	7,635	9,439	10,698	11,413	onwards										
	19,309	22,086	24,447	26,402	27,762	28,551	onwards										
	12,159	14,737	16,913	18,717	19,976	20,691	onwards										
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,217	7,367	106	782	2,704	1,974	5,210	516	3,908	2,144	518	5,329	1,963	2,365	2,543	628	1,748
	655	485	527	527	244	966	665	467	527	545	244	966	647	467	545	545	244
	3,433	4,931	6,563	6,056	6,108	3,492	3,395	6,319	7,037	5,997	5,793	2,656	3,732	5,818	6,541	6,505	6,705
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	531	1,278	720	737	906	643	927	712	1,147	869	656	895	634	865	963	768	870
	5,836	14,061	7,916	8,102	9,962	7,075	10,197	7,834	12,619	9,555	7,211	9,846	6,976	9,515	10,592	8,446	9,567
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	onwards																
	onwards																
	24,953	33,178	27,033	27,219	29,079	26,192	29,314	26,951	31,736	28,672	26,328	28,963	26,093	28,632	29,709	27,563	28,684
	24,953	33,178	27,033	27,219	29,079	26,192	29,314	26,951	31,736	28,672	26,328	28,963	26,093	28,632	29,709	27,563	28,684
	(5,644)	(11,092)	(2,586)	(817)	(1,317)	2,359	(963)	1,600	(3,185)	(121)	2,223	(412)	2,458	(81)	(1,158)	988	(133)
	(12,794)	(18,441)	(10,120)	(8,502)	(9,103)	(5,501)	(8,623)	(6,260)	(11,045)	(7,981)	(5,637)	(8,272)	(5,402)	(7,941)	(9,018)	(6,872)	(7,993)

Payments from the blocks to the project consist of payments for repair and replacement of agricultural machinery. Project headquarters will be responsible for replacement of machinery and running the centrally located workshop. Payments are taken from Table 5.10. In addition, blocks will pay project headquarters any operating surplus that results from their activities. In early years, when yields are relatively low, there will be no surplus. However, as yields improve, the situation is expected to change. This payment (Table 5.10) is the blocks contribution towards covering projects operation and management costs. The payment differs according to the target income option for settlers chosen.

5.4.3 Cash Outflow

Cash outflow has been divided into capital and replacement costs and operating costs. Construction costs are based on those shown in the Engineering Bills, Vol.2, Annex . The cost of enlarging the Fanoole Main Canal has been added in. Adjustment has been made to remove any price contingencies. As noted above, the cost of design and supervision is included. Engineering maintenance vehicles and equipment costs are based on figures presented in Vo. 2, Annex while the cost of management vehicles, agricultural machinery and working capital funds are taken from Tables G5, G3 and 5.10. A ten per cent physical contingency has been included. However, this has not been applied to construction of engineering works since a contingency sum has already been included.

Operating costs include staff costs, running costs of project management vehicles as well as the running costs of engineering maintenance vehicles and equipment. These figures are taken from Tables G1, G2 and Vol. 2, Annex respectively. Finally, the operating deficits of blocks incurred in the early years of the scheme (Table 5.10) are included. These vary according to the target income option chosen.

5.4.4 Net Cash Flow

Regardless of target income option chosen, the net cash flow for the project as a whole remains negative for a good many years. However, in the case of the lower income option, the cash flow becomes positive in the nineteenth year though in some of the following years, it is also negative. In the case of the higher target income, the cash flow remains negative throughout the project's life.

5.4.5 Conclusion

The net cash flow results indicate that the project will be unable to generate sufficient revenue to cover its operation and management costs. Consequently some form of external support will be necessary. Given the total outlay of the project, the additional sum required would be quite modest. In the case of the lower income option, it could be phased out by year 19. Another approach might be to take measures to reduce management costs. A comprehensive management team has been costed, since the success or failure of the project will greatly depend on this element. However, it is entirely possible that after an initial period, the management team could be reduced as the settlers gain experience and the units take on more responsibilities. Consequently a saving from the 9.2 million So.Sh. spent annually from year 8 onwards on staff salaries and running costs of management vehicles could be made. The above figure does not include replacement of project management vehicles which fluctuates between 2.5 million and 7.3 million So.Sh./year.

A temptation that must be avoided at all costs is to lower the target income of settlers. Such action may make the project self-supporting at an earlier date, at least on paper. In reality, it could have exactly the opposite effect by removing from settlers the necessary incentives to increase production.

6

Results of Economic Analysis

6.1 GENERAL

The economic analysis determines the benefits and costs of the Homboy Scheme to the nation as a whole and evaluates the project's economic performance.

6.2 BENEFITS

As with the financial analysis, the fifty family unit has been taken as the basic unit for determining project benefits. The value of crop production on the typical fifty family unit has been calculated in Appendix F. The value of rice and maize retained for home consumption has been included as has the value of tomato production. Crops are valued at economic prices which are derived in Appendix A. By combining results for the units with the phasing in of the ten blocks, the value of agricultural production for the project as a whole has been arrived at (Table 6.1).

A certain amount of rainfed agriculture is currently practised on the proposed site of the Homboy Scheme. An estimated 3,186 ha is devoted to growing sorghum, maize, sesame and pulses. The gross value of this production has been calculated (Appendix F). Since few purchased inputs are used and the family provides virtually all the labour, the net value of production is taken to be the same as the gross value, the value of present agricultural production has been deducted from the value of production of proposed activities to give the net incremental value resulting from the project.

6.3 COSTS

Costs have been divided into capital and recurrent costs and operating costs. Engineering and infrastructure costs are taken from Volume 2, Annex . Only half the estimated 30,700,000 So.Sh. cost of the Dhey Tubaako to Homboy road has been included as has only half the estimated 37,000,000 So.Sh. cost of flood protection. In both cases, costs are allocated on the basis of sixty per cent in year 1 and forty per cent in year 2, other capital and replacement costs include purchase and replacement of engineering vehicles and equipment (Vol.2, Annex II) and project management vehicles (Appendix G). A ten per cent physical contingency has been added.

Operating costs for agricultural inputs, processing and machinery have been worked up from the unit level (Appendix F). Costs are based on economic prices presented in Appendix C and in the Crop Budgets (Appendix D). Only sixty one per cent of agricultural machinery costs are included since the remainder covers depreciation. Project Management staff costs are taken from Appendix G. Only half the cost of technical assistance is included. Technical assistance is expected to involve training of counterparts and as such will benefit

TABLE 6.1 PROJECT NET CASH FLOW AT ECONOMIC PRICES ('000 So.Sh.)

	Project Year											
	1	2	3	4	5	6	7	8	9	10	11	12
Project Benefits												
Value of Proposed Crop Production	-	2,188	12,555	22,233	36,061	55,559	58,073	60,006	62,832	66,941	71,102	75,352
Value of Present Production Foregone	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633
Value of Incremental Production	(2,633)	(445)	9,922	19,600	33,428	52,926	55,440	57,373	60,199	64,308	68,469	72,719
Project Costs												
(a) Capital and replacement												
Construction engineering works	105,159	73,885	61,607	61,424	45,939	20,829	-	-	-	-	-	-
Construction of infrastructure	8,946	53,005	40,012	29,435	10,171	-	-	-	-	-	-	-
Engineering maintenance vehicles and equipment	-	1,618	3,670	2,519	4,136	731	1,478	55	261	2,642	1,753	3,818
Project management vehicles	918	673	377	417	409	175	741	489	369	409	393	175
Agricultural machinery	-	2,196	5,267	6,549	6,505	7,593	3,505	2,513	4,532	5,998	7,330	7,117
Contingencies (Physical: 10%)	11,502	13,138	11,093	10,034	6,716	2,933	572	306	516	905	948	1,111
Total	126,525	144,515	122,026	110,378	73,876	32,261	6,296	3,363	5,678	9,954	10,424	12,221
(b) Operating Costs												
Agricultural inputs	-	637	3,613	5,942	9,570	13,718	13,812	13,486	13,486	13,486	13,486	13,486
Agricultural machinery	-	347	1,963	3,463	5,619	8,167	8,480	8,494	8,494	8,494	8,494	8,494
Agricultural processing	-	32	187	565	865	1,411	1,696	1,735	1,827	1,950	2,075	2,212
Project management staff	2,617	4,335	5,596	7,049	7,704	7,486	6,345	6,309	6,309	6,309	6,309	6,309
Project management vehicles	171	312	390	478	565	596	540	521	521	521	521	521
Engineering maintenance vehicles and equipment	-	1,245	3,764	5,131	6,866	7,352	8,054	8,054	8,054	8,054	8,054	8,054
Total	2,788	6,908	15,513	22,628	31,189	38,730	38,927	38,599	38,691	38,814	38,939	39,076
Total Capital Replacement and Operating Costs	129,313	151,423	137,539	133,006	105,065	70,991	45,223	41,962	44,369	48,768	49,363	51,297
Net cash flow	(131,946)	(151,868)	(127,617)	(113,406)	(71,637)	(18,065)	10,217	15,411	15,830	15,440	19,106	21,422

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
79,729	84,225	88,864	93,188	96,693	99,154	100,597	100,597	100,597	100,597	100,597	100,597	100,597	100,597	100,597	100,597	100,597	100,597
2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633	2,633
77,096	81,592	86,231	90,555	94,060	96,521	97,964	97,964	97,964	97,964	97,964	97,964	97,964	97,964	97,964	97,964	97,964	97,964
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,207	1,106	6,697	96	711	2,458	1,795	4,736	469	2,816	1,949	471	4,845	1,784	2,150	2,312	571	1,589
757	489	369	393	393	191	757	489	353	393	409	191	757	473	353	409	409	191
3,547	3,433	4,931	6,563	6,056	6,108	3,492	3,395	6,319	7,037	5,997	5,793	2,656	3,732	5,818	6,541	6,505	6,705
651	503	1,200	705	716	876	604	862	714	1,025	836	646	826	599	832	926	749	849
7,162	5,531	13,197	7,757	7,876	9,633	6,648	9,482	7,855	11,271	9,191	7,101	9,084	6,588	9,153	10,188	8,234	9,334
13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486	13,486
8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494	8,494
2,357	2,514	2,681	2,835	2,961	3,042	3,090	3,090	3,090	3,090	3,090	3,090	3,090	3,090	3,090	3,090	3,090	3,090
6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309	6,309
521	521	521	521	521	521	521	521	521	521	521	521	521	521	521	521	521	521
8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054	8,054
39,221	39,378	39,545	39,699	39,825	39,906	39,954	39,954	39,954	39,954	39,954	39,954	39,954	39,954	39,954	39,954	39,954	39,954
46,383	44,909	52,742	47,456	47,701	49,539	46,602	49,436	47,809	51,225	49,145	47,055	49,038	46,542	49,107	50,142	48,188	49,288
30,713	36,683	33,489	43,099	46,359	46,982	51,362	48,528	50,155	46,739	48,819	50,909	48,926	51,422	48,857	47,822	49,776	48,676

not only the Homboy Scheme but possibly future schemes. Running costs for project management vehicles are taken from Appendix G while those for engineering vehicles and equipment come from Vo. 2, Annex .

6.4 ECONOMIC RESULTS

The net cash flow for the project appears in Table 6.1. The internal rate of return is 2.5 per cent. This falls to 2.3 per cent when the full cost of flood protection is included.

6.5 SENSIVITITY ANALYSIS

The results of a series of sensitivity analyses are presented in Table 6.2. An increase in the value of agricultural production and a delay in agricultural benefits appear to have the most marked impact on overall project performance. A twenty per cent increase in the value of production is quite possible given the initial low yields and modest build-up of these yields assumed in the main analysis. Exclusion of the cost of social infrastructure also improves project performance considerably.

TABLE 6.2 SENSITIVITY ANALYSIS

Assumption	Rate of Return %
Twenty per cent cost over-run	0.3
Twenty per cent increase in the value of agricultural production	5.2
Three year delay in agricultural benefits	0.2
Exclusion of costs of social infrastructure	3.3

Incidentally, shadow pricing of foreign exchange would probably result in a higher rate of return. While costs, especially capital costs contain a high element of foreign exchange, all crop output with the exception of tomatoes can be treated as import substitution. As such, the project is also likely to have favourable impact on the nation's balance of payments.

6.6 CONCLUSION

The economic performance of the project is far from outstanding. Yet the results obtained are very similar to those obtained in other feasibility studies of large irrigation schemes in Somalia (MMP/HTS, 1979). The costs of developing and running such schemes are high while the value of crops produced is often quite modest. However, as already mentioned, in a scheme such as Homboy, social rather than economic considerations may take priority. This being the case, the overall economic performance is not unreasonable. This is particularly true if the non-quantifiable benefits of the scheme are also taken into account. These include the resettlement and creation of employment opportunities for 7,350 families that are currently living in government camps and are dependent on food aid. Creation of a detailed social infrastructure can be expected to improve hygiene, nutrition and educational opportunities. Finally the scheme will help settlers acquire agricultural skills that currently they do not possess.

APPENDIX A

ECONOMIC AND AGRICULTURAL PRICES

TABLE A.1 DERIVATION OF ECONOMIC PRICE FOR RICE (So.Sh./tonne at Constant 1978 Prices)

	Projected 1985 Price
World Market price[1] (US$/tonne)	423.9
Shipping and Insurance ($)	72.0
Price f.o.b. Kismayo ($)	495.9
Conversion to local currency[2]	3,122
Unloading and storage[3]	780
Price in Kismayo	3,902
Less local transport[4]	300
Farm-gate price So.Sh./tonne	3,602
Farm-gate price So.Sh./quintal	360

Notes:

1 *Thai milled, 5 per cent broken, f.o.b. Bankok. IBRD Commodities and Export Projection Division, May 1979.*
2 *At Official rate US$1 = So.Sh. 6.295.*
3 *From ENB (MMP/HTS, 1979).*
4 *100 km at 30 cents/quintal/km.*

TABLE A.2 DERIVATION OF ECONOMIC PRICE FOR MAIZE (So.Sh./tonne at Constant 1978 Prices)

	Projected 1985 Price
World Market price[1] (US$/tonne)	152.1
Shipping and Insurance ($)[2]	45.0
Price f.o.b. Kismayo ($)	197.2
Conversion to local currency[3]	1,241
Unloading and storage[4]	310
Price in Kismayo	1,551
Less local transport[5]	300
Farm-gate price So.Sh./tonne	1,251
Farm-gate price So.Sh./quintal	125

Notes:

1 *US No. 2 yellow f.o.b. Gulf Ports; IBRD projections.*
2 *From East African Ports.*
3 *At official rate US$1 = So.Sh. 6.295.*
4 *Based on ENB rates rather than those of ADC since the latters mark-up of 40 per cent on imported grain seems unreasonably high (MMP/HTS, 1979).*
5 *100 km at 30 cents/quintal/km.*

TABLE A.3 DERIVATION OF ECONOMIC PRICE FOR SESAME (So.Sh./tonne at constant 1978 Prices)

	Projected 1985 Price
World Market price[1] (US$/tonne)	500
Shipping and Insurance ($)	38
Price f.o.b. Kismayo ($)	**538**
Conversion to local currency[2]	3,387
Unloading and storage charges[3]	847
Price Kismayo	**4,234**
Less local transport[4]	300
Farm-gate price So.Sh./tonne	**3,934**
Farm-gate price So.Sh./quintal	**393**

Notes:

1 *c.i.f. Yemen (MMP/HTS, 1979)*
2 *At official rate US$ = So.Sh. 6.295*
3 *At 25 per cent*
4 *100 km at 30 cents/quintal/km*

TABLE A.4 DERIVATION OF ECONOMIC PRICE FOR GROUNDNUTS (So.Sh./tonne at constant 1978 Prices)

	Projected 1985 Price
World Market price[1] (US$/tonne)	473.4
Price c.i.f. Kismayo ($)[2]	**473.4**
Conversion to local currency[3]	298
Handling and storage[4]	745
Price in Kismayo	**3,725**
Less local transport[5]	300
Farm-gate price/tonne (shelled)	**3,425**
Farm-gate price/quintal (shelled)	**343**

Notes:

1 *Any origin, c.i.f. Europe IBRD Projections.*
2 *Have assumed c.i.f. Europe from any origin to be equivalent to c.i.f. at a Somali port.*
3 *At official rate US$ 1 = So.Sh. 6.295*
4 *At 25 per cent.*
5 *100 km at 30 cents/quintal/km.*

TABLE A.5 DERIVATION OF ECONOMIC PRICE FOR COTTON (So.Sh./tonne at constant 1978 Prices)

	Projected 1985 Price
World Market price[1] (US$/tonne)	1,854
Price c.i.f. Mogadishu ($)[2]	1,854
Conversion to local currency[3]	11,671
Transport and handling[4]	780
Lint price at Balaad	**12,451**
Less transport from Jamaame[5]	158
Lint price at Jamaame	**12,293**
Less ginning costs[6]	450
	11,843
Conversion to seed cotton, price/tonne[7]	3,948
Ginnery price So.Sh./tonne seed cotton	**3,948**
Ginnery price So.Sh./quintal seed cotton	**395**

Notes:

1 *Mexican SM 1 1/16 North Europe: IBRD Projection.*
2 *Have assumed c.i.f. Europe to be equivalent c.i.f. at a Somali port.*
3 *At official rate US$1 = So.Sh. 6.295.*
4 *Somalatex (MMP/HTS, 1979).*
5 *MMP/HTS, 1979.*
6 *MMP/HTS, 1979.*
7 *Assumes 100 kg of seed cotton yields 33 kg lint.*

APPENDIX B

AGRICULTURAL MACHINERY COSTS AND PRICES

TABLE B.1 TRACTOR OPERATING COSTS (So.Sh.)

	Financial Cost	Economic Cost
1. **4WD, 80-90 HP Model**		
Base cost	160,000	160,000
Depreciation (6 year life)	26,666	26,666
Maintenance (20% capital cost)	32,000	32,000
Fuel cost (15 l/hour for 1,200 hours/year	45,900	32,220
Taxes and insurance	2,000	2,000
Operator (1,200 hours at 4.5 So.Sh./hour)	5,400	4,100
Total annual operating cost	**111,966**	**96,986**
Average hourly cost at 1,200 hours/year	**93.3**	**80.8**
2. **2WD 65-70 HP Model**		
Base cost	120,000	120,000
Depreciation (6 year life)	20,000	20,000
Maintenance (20% capital cost)	24,000	24,000
Fuel (12 l/hour for 1,200 hours/year)	36,720	25,776
Tax and insurance	2,000	2,000
Operator (1,200 hours at 4.5 So.Sh./hour)	5,400	4,100
Total annual operating costs	**88,120**	**75,876**
Average hourly cost at 1,200 hours/year	**73.4**	**63.2**

TABLE B.2 COMBINE OPERATING COSTS (So.Sh.)

	Financial Cost	Economic Cost
Base cost (2/3 wheel 1/3 track)	435,000	435,000
Depreciation (5 year life)	87,000	87,000
Maintenance (20% capital cost)	87,000	87,000
Fuel (15 l/hour for 600 hours)	22,950	16,110
Tax and insurance	2,000	2,000
Operator (600 hours)	2,700	2,025
Total annual operating cost	**201,650**	**194,135**
Average hourly operating cost at 600 hours/year	**336.1**	**323.6**

TABLE B.3 IMPLEMENT OPERATING COSTS (So.Sh.)

	Disc plough (4 disc)	Disc harrow (16-20 disc)	Land plane (Eversham 3212RT)	Tool bar (with attach.)	Seed drill (combine)	A frames	ULV sprayer (portable 10-20 l)	Trailer (4-5 tonnes)
Base cost	20,000	22,000	75,000	44,500	46,400	6,400	1,000	20,500
Life expectancy (years)	6	6	8	8	4	8	5	8
Depreciation	3,333	3,666	9,375	5,563	11,600	800	200	2,563
Maintenance	3,000[2]	3,300[2]	7,500[3]	4,450[3]	6,960[2]	640[3]	150[3]	2,050[3]
Total annual operating costs	**6,333**	**6,966**	**16,875**	**10,013**	**18,560**	**1,440**	**350**	**4,613**
Hourly use/year	800	800	400	1,000	240	400	200	500
Average hourly operating costs	7.9	8.7	42.2	10.0	77.3	3.6	1.7	9.2

Notes:

1 *Inter-row cultivator, ridger and groundnut blader.*

2 *At 15 per cent of capital cost.*

3 *At 10 per cent capital cost.*

TABLE B.4 COST OF TRACTOR OPERATIONS (So.Sh./hr)

Operation	Tractor Used	Tractor Cost Financial	Tractor Cost Economic	Implement Cost[1]	Total Cost Financial	Total Cost Economic
Ploughing	Heavy	93.3	80.8	7.9	101.2	88.7
Disc harrowing	Heavy	93.3	80.8	8.7	102.0	89.5
Levelling	Heavy	93.3	80.8	42.2	135.5	123.0
Bunding	Heavy	93.3	80.8	3.6	96.9	84.4
Groundnut lifting	Heavy	93.3	80.8	10.0	103.3	90.8
Ridging	Light	73.4	63.2	10.0	83.4	73.2
Inter-row cultivation	Light	73.4	63.2	10.0	83.4	73.2
Sowing	Light	73.4	63.2	77.3	150.7	140.5
Transport	Light	73.4	63.2	9.2	82.6	72.4

Note:

[1] *Economic and financial costs are the same since no taxes or duties are imposed on agricultural machinery.*

TABLE B.5 STANDARDISATION OF MACHINERY COSTS AT FINANCIAL AND ECONOMIC PRICES (So.Sh.)

Operation	Weighting[1]	Financial Prices Cost/hour	Financial Prices Cost	Economic Prices Cost/hour	Economic Prices Cost
1. Heavy tractor operations					
Ploughing	0.5070	101.2	51.3	88.7	50.0
Discing	0.4208	102.0	42.9	89.5	37.7
Levelling	0.0468	135.5	6.3	123.1	5.8
Bunding	0.0107	96.9	1.0	84.4	0.9
Lifting	0.0147	103.3	1.5	90.8	1.3
Average cost/hour			**103.0**		**95.7**
2. Light tractor operations					
Ridging	0.1350	83.4	11.3	73.2	9.9
Inter-row cultivation	0.1350	83.4	11.3	73.2	9.9
Sowing	0.0823	150.7	12.4	140.5	11.6
Transport	0.6478	82.6	53.5	72.4	46.9
Average cost/hour			**88.5**		**78.3**

Source: Tables B.7 and B.4.

Note:

[1] *Based on proportion of machinery time spent on each operation at full development.*

TABLE B.6 BREAKDOWN OF MACHINERY COSTS BY OPERATION AT FINANCIAL PRICES (So.Sh.)

Operation	Depreciation	Repairs	Operation	Total
Ploughing	26.4	30.4	44.4	101.2
Disc harrowing	26.8	30.8	44.4	102.0
Levelling	45.6	45.5	44.4	135.5
Bunding	24.2	28.3	44.4	96.9
Groundnut lifting	27.8	31.1	44.4	103.3
Ridging	22.3	24.4	36.7	83.4
Inter-row cultivation	22.3	24.4	36.7	83.4
Sowing	65.0	49.0	36.7	150.7
Spraying	1.0	0.7	-	1.7
Transportation	21.8	24.1	36.7	82.6
Combining	145.0	145.0	46.1	336.1

TABLE B.7 BREAKDOWN OF MACHINERY CHARGES AT FINANCIAL PRICES (So.Sh.)

Operation	Weighting[1]	Depreciation		Repairs		Operation	
		Cost/hour	Cost	Cost/hour	Cost	Cost/hour	Cost
Ploughing	0.190	26.4	5.0	30.4	5.8	44.4	8.4
Discing	0.158	26.8	4.2	30.8	4.9	44.4	7.0
Levelling	0.018	45.6	0.8	45.5	0.8	44.4	0.8
Bunding	0.004	24.2	0.1	28.3	0.1	44.4	0.2
Lifting	0.006	27.8	0.2	31.1	0.2	44.4	0.3
Ridging	0.044	22.3	1.0	24.4	1.1	36.7	1.6
Inter-row	0.044	22.3	1.0	24.4	1.1	36.7	1.6
Sowing	0.027	65.0	1.7	49.0	1.3	36.7	1.0
Transport	0.211	21.8	4.6	24.1	5.1	36.7	7.7
Spraying	0.271	1.0	0.3	0.7	0.2	-	-
Combining	0.028	145.0	4.0	145.0	4.1	46.1	1.3
Total			22.9		24.7		29.9
Per cent of total			29.5		31.9		38.6

Source: Tables B.6 and B.8.

Note:

1 *Based on proportion of machinery time spent on each operation at full development.*

TABLE B.8 MACHINERY HOURS/YEAR AT FULL CROPPING PATTERN

	Hours/crop							
Operation	Paddy rice	Upland rice	Maize	Sesame	Groundnuts	Cotton	Tomatoes	Total
1. Heavy tractor operations								
Ploughing	3,074	8,163	8,163	3,230	3,230	8,163	2,153	37,526
Discing	2,204	6,175	6,175	3,473	2,316	9,263	1,544	31,150
Levelling	858	2,605	-	-	-	-	-	3,463
Bunding	209	585	-	-	-	-	-	794
Lifting	-	-	-	-	1,085	-	-	1,085
2. Light tractor operation								
Ridging	-	-	2,893	1,085	1,085	2,893	723	8,679
Inter-row	-	-	2,893	1,085	1,085	2,893	723	8,679
Dowing	1,392	3,900	-	-	-	-	-	5,292
Transport	1,357	3,803	8,450	1,219	2,438	16,250	8,125	41,642
3. Spraying								
	2,320	6,500	6,500	-	-	32,500	5,688	53,508
4. Combining								
	1,427	3,998	-	-	-	-	-	5,425

TABLE B.9 RUNNING COSTS OF VEHICLES ('000 So Sh)

	Financial Price	Economic Price
1. 4WD Petrol Station Wagon		
Base price	146,200	115,100
Maintenance (10% of initial cost)	14,620	11,510
Fuel (17l/100 km at 20,000 km/year)	10,200	5,950
Oil (15% of fuel costs)	1,530	892
Tax and insurance	1,000	1,000
Total Annual Running Costs	**27,350**	**19,352**
2. 4WD Petrol, Pickup		
Base price	121,000	95,300
Maintenance (10% of initial cost)	12,100	9,530
Fuel (17l/100 km at 20,000 km/yr)	10,200	5,950
Oil (15% of fuel costs)	1,530	892
Tax and insurance	1,000	1,000
Total Annual Running Cost	**24,380**	**17,372**
3. 12 Ton Truck, Diesel		
Base price	190,500	150,000
Maintenance (10% of initial cost)	19,050	15,000
Fuel (34l/100 km at 15,000 km/yr)	13,005	9,129
Oil (15% of fuel costs)	1,951	1,369
Tax and insurance	2,000	2,000
Total Annual Running Cost	**36,006**	**27,493**
4. 5 Ton Truck, Diesel		
Base price	153,050	120,500
Maintenance (10% of initial cost)	15,305	12,050
Fuel (28l/100 km at 15,000 km/yr)	10,710	7,518
Oil (15% of fuel costs)	1,607	1,128
Tax and insurance	1,500	1,500
Total Annual Running Cost	**29,122**	**22,196**
5. 2WD Pickup, Petrol		
Base price	50,800	40,000
Maintenance (10% of initial cost)	5,080	4,000
Fuel (13l/100 km at 20,000 km/yr)	7,800	4,550
Oil (15% of fuel costs)	1,170	683
Tax and insurance	1,000	1,000
Total Annual Running Cost	**15,050**	**10,233**
6. Motorcycle		
Base price	8,800	8,000
Maintenance (10% of initial cost)	880	800
Fuel (6l/100 km at 5,500 km/year)	990	578
Oil (15% of fuel costs)	149	87
Tax and insurance	100	100
Total Annual Running Cost	**2,119**	**1,565**

TABLE B.10 LIFE OF MACHINERY AND VEHICLES

Item	Life (Years)
(a) Agricultural Machinery	
Heavy tractor	6
Light tractor	6
Combine	5
Disc plough	6
Disc harrows	6
Land plane	8
Toolbar attachments	8
Combine seed drill	4
A frame	8
ULV sprayer (manual)	5
Trailer	8
(b) Vehicles used for project agricultural management	
4WD station wagon	6
4WD pick-up	6
2WD pick-up	6
Motorcycles	5

APPENDIX C

AGRICULTURAL INPUT COSTS AND PRICES

TABLE C.1 COST OF SEED

		Financial	Economic
Rice (unhulled)	So.Sh./quintal	282	282
Maize	So.Sh./quintal	113	113
Sesame	So.Sh./quintal	267	267
Groundnuts (shelled)	So.Sh./quintal	220	220
Cotton	So.Sh./quintal	60	60
Tomatoes	So.Sh./kg	309	309

Note:

Financial and economic cost identical since seed will be multiplied by project with stock furnished by Afgoi. See Marketing for source of prices. Tomato seed cost furnished by ONAT.

TABLE C.2 COST OF FERTILISER[1] (So.Sh./quintal)

	ONAT 1976 Prices (So.Sh./q)	Change in World Prices 1976-78[2] (%)	ONAT 1978 Prices[3] (So.Sh./q)	Projected Change World Prices 1978-85[4] (%)	Projected ONAT 1985 Prices (So.Sh./q)
Urea	131.5	+29.3	170.0	+24.3	211.3
Diamonium Phosphate	141.1	+16.5	169.0	+64.5	278.0
Potassium Sulphate	140.9	+25.5[5]	144.4	+31.2[5]	189.5

Notes:

1. *Economic and financial costs since no taxes or duties are applied.*
2. *Change measured in current prices, IBRD figures.*
3. *Estimated on basis of world price movement.*
4. *In constant 1978 prices IBRD Projections.*
5. *Movements in prices of muriate of potash considered indicative of movements in price of potassium sulphate which is not included in IBRD projections.*

TABLE C.3 COST OF CHEMICAL INPUTS (So.Sh.)

Item	Quantity	Financial	Economic[1]
Pesticides			
Nuvacron Combi. ULV	litre	39.4	35.8
Nuvacron	litre	49.3	44.8
Herbicides			
Preforan 30 EC	litre	37.5	34.1
Propanil 36 EC	litre	46.5	42.2
Insecticides			
Dinecron ULV	litre	71.4	65.9
Carbofuron	litre	28.0	25.4
Nogos 50 EC	litre	65.2	59.3
Seed Dressing			
Furadon granules	kg	17.2	15.6
Fernason D	kg	40.3	36.6

Sources: Ciba Geigy (Mogadishu); MMP/HTS, 1978/79; Imperial Chemical Industries (UK); ONAT.

Note:

[1] *10 per cent tax and duties on pesticides.*

TABLE C.4 COST OF FUEL

		Financial	Economic
Petrol	So.Sh./l	3.00	1.75
Diesel	So.Sh./l	2.55	1.79

TABLE C.5 PRODUCT PRICES (So.Sh./quintal)

	Financial	Economic
Rice (hulled)	403	360
Maize	113	125
Sesame	267	393
Groundnuts (shelled	220	343
Cotton	368	295
Tomatoes	72	72

APPENDIX D

CROP BUDGETS

TABLE D.1 CROP BUDGET: PADDY RICE (So.Sh./ha)

		Financial	Economic
1. Gross Returns			
24.5 quintals milled rice		9,874	8,820
2. Costs			
(a) Materials			
Seed (unhulled)	90 kg	254	254
Seed dressing	0.5 kg Furadon	9	8
Fertiliser	140 kg Urea	296	296
Fertiliser	50 kg DAP	139	139
Herbicide	12 l Propanil	558	506
Pesticide	5 l Nuvacron	247	224
Total material cost		**1,503**	**1,427**
(b) Machinery			
Heavy tractor operations	(5.47 hours)	563	525
Light tractor operations	(2.37 hours)	211	185
Spraying	(2.00 hours)	2	2
Combining	(1.23 hours)	413	398
Total machinery cost		**1,189**	**1,110**
(c) Other costs			
Hulling at 5 So.Sh./quintal paddy		175	145
Total Costs		**2,867**	**2,682**
3. Net Returns			
(a) Returns to land (So.Sh./ha)		**700.7**	**613.8**
(b) Returns to labour at 42 man-days/ha (So.Sh./man-day)		**166,8**	**146.1**

TABLE D.2 CROP BUDGET: UPLAND RICE (So.Sh./ha)

		Financial	Economic
1. Gross Returns			
21.0 quintals milled rice		8,463	7,560
2. Costs			
(a) Materials			
Seed (unhulled)	100 kg	282	282
Seed dressing	0.5 kg Fernason D	20	18
Fertiliser	140 kg Urea	296	296
Fertiliser	50 kg DAP	139	139
Herbicide	12 l Propanil/preforan	558	506
Herbicide	5 l Nuvacron	247	224
Total material cost		1,542	1,465
(b) Machinery			
	Same as Paddy Rice	1,189	1,110
(c) Other Costs			
Hulling at 5.0 So.Sh./q of paddy		150	125
Total Costs		2,881	2,700
3. Net Returns			
(a) Returns to land (So.Sh./ha)		5,582	4,860
(b) Returns to labour at 70 man-days/ha (So.Sh./man-day)		79.7	69.4

TABLE D.3 CROP BUDGET: MAIZE (So.Sh./ha)

			Financial	Economic
1. Gross Returns				
Gu Season	40 quintals		4,520	5,000
2. Costs				
(a) Materials				
Seed	20 kg		23	23
Seed dressing	0.2 kg Furadon		3	3
Fertiliser	150 kg Urea		317	317
Fertiliser	50 kg DAP		139	139
Pesticides	5 l Nuvacron combi		197	179
Total material costs			**679**	**661**
(b) Machinery				
Heavy tractor operations		(4.55 hours)	469	437
Light teactor operations		(4.38 hours)	390	342
Spraying		(2.00 hours)	2	2
Total machinery			**861**	**781**
(c) Other Costs				
Shelling at 1.55 So.Sh./q		Gu	60	50
Shelling at 1.55 So.Sh./q		Der	53	44
Total Cost		Gu	1,600	1,492
		Der	1,593	1,486
3. Net Returns				
(a) Returns to land (ha)		Gu	2,920	3,508
		Der	2,360	2,889
(b) Returns to labour at 111 man-days/ha (m.d.)		Gu	26.3	31.6
		Der	21.3	26.0

TABLE D.4 CROP BUDGET: SESAME (So.Sh./ha)

		Financial	Economic
1. **Gross Returns**			
Sesame seed	8 quintals	2,136	3,144
2. **Costs**			
(a) **Materials**			
Seed	8 kg	21	21
Seed dressing	0.1 kg Furadon	2	2
Fertiliser	40 kg Urea	85	85
Fertiliser	25 kg DAP	70	70
Total Materials		178	178
(b) **Machinery**			
Heavy tractor operations	(5.50 hours)	567	528
Light tractor operations	(2.78 hours)	247	217
Total Machinery Costs		814	745
Total Costs		992	923
3. **Net Returns to land (ha)**		1,144	2,221
4. **Net Returns to labour at 92 man-days/ha (/m.d.)**		12.4	24.1

TABLE D.5 CROP BUDGET: GROUNDNUTS (So.Sh./ha)

		Financial	Economic
1. Gross Returns			
Shelled nuts	17.5 quintal	3,850	6,003
2. Costs			
(a) Materials			
Seed (shelled)	90 kg	198	198
Seed dressing	0.6 kg Fernason D	24	22
Fertiliser	75 kg DAP	209	209
Total Materials		**431**	**429**
(b) Machinery			
Heavy tractor operations	(5.44 hours)	560	522
Light tractor operations	(3.78 hours)	336	295
Total Machinery Costs		**896**	**817**
(c) Other Costs			
Shelling at 1.55 So.Sh./q	unshelled nuts	38	32
Total Costs		**1,365**	**1,278**
3. Net Returns			
(a) Net Returns to land (ha)		**2,485**	**4,725**
(b) Net Returns to labour at 149 man-days/ha (/m.d.)		**16.7**	**31.7**

TABLE D.6 CROP BUDGET: COTTON (So.Sh./ha)

		Financial	Economic
1. Gross Returns			
Seed cotton	25 quintal	9,200	9,875
2. Costs			
(a) Materials			
Seed	30 kg	18	18
Seed dressing	0.2 kg Fernason D	8	7
Fertiliser	60 kg Urea	127	127
Fertiliser	35 kg DAP	97	97
Pesticides	25 l Nuvacron Combi	985	895
Total Material Costs		**1,235**	**1,144**
(b) Machinery			
Heavy tractor operations	(5.50 hours)	567	528
Light tractor operations	(6.78 hours)	603	529
Spraying	(10.00 hours)	17	17
Total Machinery Costs		**1,187**	**1,074**
(c) Other Costs			
Transport to Jamaame[1]		750	750
Total Costs		**3,172**	**2,968**
3. Net Returns			
(a) Net Returns to land (/ha)		**6,028**	**6,907**
(b) Net Returns to labour at 240 man-days/ha (/m.d.)		**25.1**	**28.8**

Note:

[1] *At 5.00 So.Sh./tonne/km. Higher than normal transport costs due to low bulk density of seed cotton. Rate provided by ADC.*

TABLE D.7 CROP BUDGET: TOMATOES (So.Sh./ha)

		Financial	Economic
1. **Gross Returns**			
Tomatoes	200 quintal	9,000	9,000
2. **Costs**			
(a) **Materials**			
Seed	0.25 kg	77	77
Nursery fertiliser	2 kg of 10:15:10	5	5
Field fertiliser	100 kg Urea	211	211
Field fertiliser	35 kg DAP	97	97
Nursery Insecticide	Dinecron	20	18
Field Insecticide	3.61 Carboforan	101	91
	1.51 Nogos	98	90
Total Materials		**609**	**589**
(b) **Machinery**			
Heavy tractor operations	(4.55 hours)	469	437
Light tractor operations	(11.78 hours)	1,048	919
Spraying	(5 hours)	12	12
Total Machinery		**1,529**	**1,368**
Total Costs		**2,138**	**1,957**
3. **Net Returns**			
(a) **Net Returns to land (/ha)**		**6,862**	**7,043**
(b) **Net Returns to labour at 258 man-days/ha (/ha)**		**26.6**	**27.3**

4

Market Prospects and Prices

4.1 GENERAL

This section examines the market prospects for crops grown by the project, and establishes product prices which will be used in the financial and economic analysis. The products concerned are rice, maize, sesame, groundnuts, cotton and tomatoes.

4.2 ORGANISATION OF MARKETING

Much of the agricultural production of Somalia is consumed locally and thus never enters the official marketing network. For example, of the estimated 107,740 tonnes of maize produced in 1978, only 10,760 tonnes were sold to the ADC. The ADC is the main government marketing agency, controlling the marketing of maize, sorghum, sesame, rice and groundnuts. ADC purchases farmers' produce at prices set by the government (see Table 4.1). In principle, farmers are expected to market all their produce through ADC, though they are permitted to keep 2 quintals per family member for home consumption.

ADC is involved not only in the purchase of agricultural produce but also in its processing, storage and distribution. Its processing facilities include rice mills at Jelib, Jowhar and Shalambod, as well as several maize driers.

TABLE 4.1 ADC PURCHASE AND SALE PRICES - DECEMBER 1979

Crop	Purchase Price	Sale Price
Maize	75	116
Sorghum	75	116
Upland rice (hulled)[1]	350	391
Paddy Rice (hulled)[2]	285	326
Sesame	240	281
Groundnuts (shelled)	220	261

Source: Agricultural Development Corporation.

Notes:
1 *Oryza Indica.*
2 *Oryza Japonica.*

It has storage facilities with an overall capacity of 162,000 tonnes as well as a fleet of trucks to transport crops from the producer to processing centres. ADC has just recently taken over from ONAT the distribution of certain agricultural inputs such as fertiliser and insecticides to farmers.

4.3 TRANSPORT FROM HOMBOY

The project is located 400 km west of Mogadishu. At present, the Mogadishu-Jelib road is being hard-topped. Work is expected to be completed in 1981 providing a direct link to the capital, thereby ensuring speedy evacuation of agricultural produce. One hundred kilometres to the south lies the port of Kismayo, through which machinery and agricultural inputs for the projects will pass. Again, this road is hard-topped facilitating the timely delivery of supplies.

Transport rates provided by ADC and SDA are as follows:

Rough roads (dirt) 30 cents/quintal/km
Good roads (hard top) 25 cents/quintal/km

These rates do not take into account recent increases in petroleum and diesel prices. Hence transport rates are adjusted to 35 cents/quintal/km on rough roads and 30 cents/quintal/km on good roads to reflect the increase.

4.4 MAJOR CROPS

4.4.1 Rice

Estimates of rice production in Somalia in 1975 vary from a high of 11,060 tonnes (Ministry of Agriculture) down to 3,240 tonnes (Afgoi-Mordile; MMP/HTS). For the purpose of this study, current production will be taken as 4,000 tonnes, a figure used by other studies (Mogambo MMP/HTS). Domestic production only meets a fraction of domestic requirements. Imports, which stood at 16,875 tonnes in 1974, have almost doubled to 33,155 tonnes for 1978.

According to projections from FAO and Technital, rice consumption in Somalia is expected to increase from 27,000 tonnes in 1975 to 35,000 tonnes by 1980 and 67,000 tonnes in 1990. This increase is due not only to growth in population but also to a switch from the present staples maize and sorghum which is likely to take place as incomes rise. IBRD estimate the income elasticity of demand for rice at 0.20.

On the production side, the overall output of rice is expected to increase considerably as large irrigation schemes such as Jowhar, Balad, Afgoi-Mordile, Genale, Saakow and Mogambo come on stream. However, even assuming all these projects, many of which have yet to be built, are realised, the overall increase in production will total a maximum of 20,000 tonnes by 1980 and 47,000 tonnes by 1990. Thus a very considerable shortfall of 15,000 tonnes in 1980 rising to 20,000 tonnes by 1990 will remain. Consequently any contribution by the Homboy Scheme to increase the nation's production of rice will serve to reduce the level of imports. Rice produced by the scheme will be hulled at the ADC rice mill in Jelib. It should be noted that if all the schemes planned for the Jubba valley are realised, ADC will have to increase the capacity of its rice milling facilities.

Both long-grained and short-grained rice are grown in Somalia, upland rice (long-grained indica) and paddy rice (short-grained japonica). Consumers prefer the former and this is reflected in prices paid by ADC, although these prices have remained unchanged for the past three years. It is not unreasonable to expect that in the long term, domestic prices will move in the same direction as world prices. With world prices expected to increase 15 per cent between 1978 and 1985, the projected domestic price for long-grained indica should increase from 350 So.Sh./quintal to 403 So.Sh. This latter figure will be used for the financial analysis. The Homboy Scheme is expected, at least in the beginning, to grow only rice of the long-grained indica type.

Economic prices have been derived from IBRD forecasts (see Appendix A). The world market price for Thai milled rice, 5 per cent broken f.o.b. Bankok is expected to increase from $367.5/tonne in 1978 to $423.9/tonne in 1985 (valued at 1978 constant prices). After the necessary adjustments have been made, including shipping and insurance, unloading and storage and finally local transport, this results in a projected farm-gate price of So.Sh. 360/quintal for hulled rice.

4.4.2 Maize

Maize is second only to sorghum in importance as a food staple food crop. In 1978, overall production was estimated at 125,390 tonnes by the Ministry of Agriculture. Despite impressive domestic production, imports of maize have hovered around 20,000 tonnes for the past three years. However, this is considerably below the 35,316 tonnes imported in 1975 when the impact of the drought was still being felt.

Forecasts for future consumption combine maize with sorghum. Overall consumption is expected to rise from 295,000 tonnes in 1975 to 353,000 tonnes by 1980 and 494,000 tonnes by 1990. While several large irrigation schemes being planned and developed envisage including maize in their cropping patterns, it is unlikely that overall production will increase sufficiently to cover the 40 per cent rise in demand predicted for the period 1980-1990. Production of maize at Homboy will reduce the overall deficit.

Domestic prices paid by ADC have remained at 75 So.Sh./quintal for the last three years. World prices are expected to increase 51 per cent from 107.7/tonne in 1978 to 152.1/tonne in 1985 (valued at 1978 constant prices). Applying this increase to domestic prices, the projected financial price will be 113 So.Sh./quintal. The projected farm-gate price used in the economic analysis is 125 So.Sh/quintal (see Table A2, Appendix A).

4.4.3 Sesame

Sesame is the preferred oilseed in Somalia with the area devoted to it far exceeding both groundnuts or sunflower seed. The Ministry of Agriculture estimates that in 1978 136,310 ha were planted to sesame yielding 40,890 tonnes of sesame seed. Other sources (MMP/HTS, 1979) put the area at only half this. Despite disagreement, it is clear that domestic production does not meet domestic requirements. Imports of edible oils have increased from 3,000 tonnes in 1974 to 14,000 tonnes in 1978. Currently imports account for 60 per cent of total supply of edible oils (Table 4.2).

Forecasts predict domestic per capita consumption of edible oils rising from 1.9 kg in 1975 to 3.5 kg by 1990. In reality, this latter figure has already been surpassed. As incomes continue to rise, per capita consumption will further increase. IBRD figures show that consumption rises from 5 kg/capita in the poorer developing countries to 25-30 kg in the developed nations. This together with population growth means that overall demand for edible oils is likely to increase considerably. Since few of the new schemes emphasise sesame, production is liable to continue to lag behind domestic requirements.

The bulk of sesame produced by the Homboy Scheme will be sold to ADC who will transport it to the National Oil Mill in Mogadishu. The current ADC price for sesame seed is 240 So.Sh./quintal. World prices are expected to increase 11 per cent between 1978 and 1985. If domestic prices follow this trend, this implies a financial price of 267 So.Sh./quintal. The farm-gate economic price used in the analysis is 393 So.Sh./quintal. (Appendix A).

TABLE 4.2 ESTIMATED SUPPLY OF EDIBLE OILS

	1978 (tonnes)	Extraction Rate (%)[1]	Edible Oil (tonnes)
Local production			
Sesame	24,000	35	8,400
Groundnuts	1,000	33	330
Sunflower	1,000	33	330
Cotton seed	500	13	65
Total local production of edible oil			**9,125**
Imports (tonnes)			
Seeds, nuts, kernels, etc.	1,200	45[2]	540
Edible oils	13,500	-	13,500
Total imports of edible oil			**14,040**
Total Supply of edible oil			**23,165**

Source: Mogambo MMP/HTS, 1979.

Notes:
[1] *IBRD data x 75 per cent to allow for crude rural mills.*
[2] *Processed at National Oil Mill, Mogadishu.*

4.4.4 Groundnuts

Groundnut production is very limited. An estimated 2,710 tonnes of shelled nuts were produced in 1978 on 3,880 ha. As an oilseed, any production by the Homboy scheme would serve to reduce imports of edible oils. The current price paid by ADC is 220 So.Sh./quintal of shelled nuts. World prices are expected to fall by 24 per cent between 1978 and 1985. However, it is highly unlikely that domestic prices will be allowed to drop given the desire of the Somali authorities to increase production. Thus the current ADC price will be used throughout the financial analysis.

4.4.5 Cotton

Estimates of seed cotton produced in 1978 vary from 3,250 tonnes (Ministry of Agriculture) down to 1,294 tonnes (ADC and Somalatex). The latter figure based on deliveries to the factory gate will be used in this study. Assuming 100 kg produces 33 kg of lint, this amounts to 431.4 tonnes of lint. During the same year, the State Agency handling cotton imported another 1,694.5 tonnes of lint. Thus only 20 per cent of domestic needs were met by domestic production.

A considerable increase in cotton production is envisaged as new schemes in the Jubba and Shabeelle valleys get underway and as present schemes expand production. If all the schemes currently proposed are implemented, the total area will exceed 7,000 ha producing an estimated 2,400 tonnes of cotton lint. This will exceed the capacity of Somalatex's two ginning mills at Balcad and Jamaame. However, Somalatex has plans to modernise the mill at Jamaame, more than doubling its present output of 20 bales per day to 50.

Despite the sizable increase predicted in production, demand is likely to continue to outstrip domestic production. National demand for fibre is currently estimated at 4,500 tonnes and is expected to increase to 6,000 tonnes by 1990. This reflects not only growth in population but also an increase in demand brought about by rising incomes. The income elasticity of demand for cotton in developing countries is estimated to be 0.5. Production at Homboy will help to meet this growing demand for cotton.

Cotton grown on the Homboy scheme will be sold to Somalatex who will process the seed cotton at their Jamaame ginning mill. Somalatex, who have recently taken over from ADC the purchase of seed cotton currently pay 320 So.Sh./quintal for Grade A, 270 So.Sh./ quintal for Grade B and 240 So.Sh./quintal for Grade C at the ginnery gate. The world price of cotton is expected to increase 15 per cent between 1978 and 1985. Applying this increase to domestic prices results in a projected financial price of 368 So.S./quintal for Grade A cotton. The projected ginnery price to be used in the economic analysis is 395 So.Sh./quintal (see Appendix A).

4.4.6 Tomatoes

Vegetables will be grown on the Homboy Scheme. The vegetables are intended to primarily assure the settlers a varied and healthy diet rather than be a supplementary source of income. Hence the area devoted to vegetables will be quite restricted. If a surplus above settlement needs is produced, this will have to be transported to a major centre of consumption such as Mogadishu or else to processing plants such as the tomato canning factory at Afgooye.

The main vegetable crops likely to be grown are tomatoes, onions and melons. In order to put a value on production, one crop, tomatoes, has been chosen as being representative. The financial and economic prices for tomatoes have been derived by taking the wholesale price for tomatoes in Mogadishu, and adjusting it back to the farm-gate.

	So.Sh./quintal
Wholesale price of tomatoes in Mogadishu	170
Transport Homboy-Mogadishu (400 km at 30 cents/quintal/km	120
	50
Handling/loading (10 per cent)	5
Farm-gate financial and economic price	**45**

4.4.7 Conclusion

All but one of the crops to be grown at Homboy are currently being imported in substantial quantities. Production from the scheme will serve to reduce the level of imports. Equally important, it will provide food for the settlers as well as for the nation as a whole.

5

Results of Financial Analyses

5.1 GENERAL

Before presenting the results of the financial analyses, the crop budgets will be presented and the overall cropping programme discussed.

Crop budgets for paddy rice, upland rice, maize, sesame, groundnuts, cotton and tomatoes are shown in Appendix D. These budgets are based on yields obtained at full development and the costs include not only direct agricultural inputs but also machinery, processing and transport costs. Machinery costs cover operation and maintenance as well as depreciation. Paddy rice, cotton and upland rice show the highest returns to land, while upland and paddy rice show highest returns to labour (Table 5.1). Tomatoes, while showing a high return to land will be grown primarily for home consumption rather than for sale.

TABLE 5.1 NET RETURNS TO LAND AND LABOUR OF CROPS AT FINANCIAL PRICES

Crop	Returns to Land (SoSh/ha)	Returns to Labour (SoSh/man-day)
Paddy rice	7,007	166.8
Upland rice	5,582	79.7
Maize 'Gu' season	2,920	26.3
Maize 'Der' season	2,360	21.3
Sesame	1,144	12.4
Groundnuts	2,485	16.7
Cotton	6,028	25.8
Tomatoes	6,862	26.6

Despite the relatively low profitability of maize, groundnuts and sesame, these crops have also been included in the proposed cropping programme (Table 5.2). The objective of the cropping programme is to grow a mixture of crops which will serve a variety of purposes, mainly providing settlers with food; assuring them an adequate cash income; and increasing Somalia's production of food and cash crops thereby reducing its import bill for these items. The overall intensity of cropping will be 160 per cent; 60 per cent in the 'Gu' season and 100 per cent in the 'Der'.

TABLE 5.2 PROPOSED CROPPING PATTERN FOR HOMBOY SCHEME

	Season	
Crop	'Gu' Intensity (%)	'Der' Intensity (%)
Rice	20	20
Maize	20	20
Sesame	-	15
Groundnuts	15	-
Cotton	-	40
Tomatoes	5	5
Total	60	100

5.2 FINANCIAL ANALYSES AT THE FIFTY FAMILY LEVEL

5.2.1 General

The fifty family unit is the basic unit around which the social and productive functions will be organised. As such it is a useful building block for the financial analyses of the entire scheme.

5.2.2 Organisation

Although the majority of settlers have been living at Dujuuma for several years, they are still largely unfamiliar with agricultural practices, and in particular, with growing irrigated crops. Consequently it is recommended that during the first five seasons, the fifty family units be run along State Farm lines with decision making and management concentrated at the block level. During this period, settlers will work as paid labourers and concentrate on acquiring basic farming skills. To speed this acquisition of skills, the cropping pattern will be simplified, with only maize and rice being grown during the first three seasons. This simplified pattern will ensure a rapid build up of cereals needed to meet the settlers needs for food. As of the fourth season, the full cropping pattern will be introduced (Table 5.3). Since some units are in blocks settled in the 'Der' season and others in blocks settled during the 'Gu' season, the build-up of crop production differs slightly during the first two years. However, by the third year, units in blocks starting in the 'Der' season will be growing the same areas of crops as units starting in the 'Gu' season. In Blocks 9 and 10, a small number of units will be devoted entirely to paddy rice, since some of the cropland in these blocks is only suitable for growing this crop. Nevertheless, these units will still respect the overall cropping intensity of 160 per cent.

As settlers gain greater experience, the units will be given greater autonomy, with decision making devolving from the block level to individual units. Evolving into cooperatives, units will be responsible for acquiring inputs from their respective blocks and distributing them to their members.

5.2.3 Size

Each fifty family unit will be assigned a fifty hectare plot of irrigated land to cultivate. A larger plot is not recommended since it would mean that fewer families could be settled at Homboy. With the current refugee situation, this would hardly be acceptable.

TABLE 5.3 DEVELOPMENT OF CROPPING PATTERNS ON FIFTY FAMILY UNIT

Season Year of Settlement	Crop Area Cultivated (ha) Rice	Maize	Sesame	Groundnuts	Cotton	Tomatoes	Total
(a) Where unit begins cropping in the 'Der' Season							
Gu 1	-	-	-	-	-	-	-
Der 1	25	25	-	-	-	-	50
Gu 2	15	15	-	-	-	-	30
Der 2	25	25	-	-	-	-	50
Gu 3	10	10	-	7.5	-	2.5	30
Der 3	10	10	7.5	-	20	2.5	50
Gu 4) Der 4)	20	20	7.5	7.5	20	5.0	80
(b) Where unit begins cropping in 'Gu' Season							
Gu 1	15	15	-	-	-	-	30
Der 1	25	25	-	-	-	-	50
Gu 2	15	15	-	-	-	-	30
Der 2	10	10	7.5	-	20	2.5	50
Gu 3	10	10	-	7.5	-	2.5	30
Der 3	10	10	7.5	-	20	2.5	50
Gu 4) Der 4)	20	20	7.5	7.5	20	5.0	80

5.2.4 Value of Crop Production

In the early years, yields are expected to be fairly low. However, as the settlers acquire agricultural skills, yields should start to rise. A build-up of yields, starting in the fifth year has been projected over a ten year period. Base yields, mid-period yields and yields at full development are shown in Table 5.4. The impact of the build-up of crop yields on production and the value of crop production is detailed in Appendix E. Yield increases between the base year, mid-period and yield at full development have been interpolated.

TABLE 5.4 BUILD-UP IN CROP YIELDS

Year of Settlement	Paddy Rice[1]	Upland Rice[1]	Maize Gu	Maize Der	Sesame	Groundnuts[2]	Cotton	Tomatoes
	Crop Yields (q/ha)							
Year 1-4	25	20	20	18	5	15	12.5	70
Year 9	30	25	30	28	6.5	18	17.5	150
Year 14	35	30	40	35	8	25	25	200

Notes:
1 *Unhulled*
2 *Unshelled*

Since yields for maize grown in the 'Gu' season tend to be higher than those in the 'Der', production for each has been calculated separately. Once again with some units being settled in the 'Gu' season and others in the 'Der', the initial build-up of production differs slightly. Also, the value of crop production for units in Blocks 9 and 10 devoted entirely to paddy will be somewhat higher. The value of production from a typical fifty family unit is summarised in Table 5.5.

TABLE 5.5 NET VALUE OF CROP PRODUCTION ON A TYPICAL FIFTY FAMILY UNIT ('000 So.Sh.)

Season/Year of Settlement	Gross Value of Production	Value of Home Consumption	Gross Crop Revenues	Value of Inputs and Services Advanced	Net Crop Revenue
(a) First four seasons where cropping starts in 'Der' Season					
Gu 1	-	-	-	-	-
Der1	192.0	27.1	164.9	110.0	54.9
Gu 2	118.5	27.1	91.4	66.0	25.4
Der2	192.0	27.1	164.9	110.0	54.9
(b) First four seasons where cropping starts in 'Gu' Season					
Gu 1	118.5	27.1	91.4	66.0	25.4
1	192.0	27.1	164.9	110.0	54.9
2	118.5	27.1	91.4	66.0	25.4
2	186.6	35.0	151.6	112.6	39.0
(c) Subsequent Years					
3	290.8	69.9	220.9	172.0	48.9
4	290.8	69.9	220.9	172.0	48.9
5	313.4	73.5	239.9	172.7	67.2
6	335.7	77.1	258.6	173.5	85.1
7	358.2	80.7	277.5	174.3	103.2
8	380.5	84.3	296.2	175.0	121.2
9	403.0	87.9	315.1	175.8	139.3
10	427.9	90.1	337.8	176.8	161.0
11	452.9	92.4	360.5	177.9	182.6
12	478.0	94.6	383.4	179.0	204.4
13	503.0	96.9	406.1	180.1	226.0
14 onwards	528.0	99.1	428.9	181.1	247.8

5.2.5 Value of Production Retained for Home Consumption

A certain proportion of crop production will be retained by each unit for home consumption. The exact quantities are based on rations that the settlers at Dujuuma are currently receiving (Table 5.6). Assuming the average family size to be three adults and two children and consumption by children to be half that of adults, each unit will retain 73 quintals of rice and 219 quintals of maize during any given year. All tomatoes and other vegetables grown will also be kept for home consumption. The value of production retained is detailed in Appendix E and summarised in Table 5.5.

TABLE 5.6 RATIONS CURRENTLY BEING RECEIVED BY SETTLERS AT DUJUUMA

Item	Quantity (grammes/adult/day)	Value (So.Sh.)
Maize	300	0.348
Rice	100	0.359
Powdered milk	30	0.160
Beans	50	0.800
Oil	60	0.588
Meat	35	0.420
Sugar	60	0.360
Tea	3	0.090
		3.125

Source: WFP Mogadishu. Prices based on ADC and ENC data.

5.2.6 Value of Inputs and Services Advanced to a Unit

Each unit will be advanced the necessary agricultural inputs such as seed, seed dressing, fertilisers, herbicides and pesticides by its respective block. In addition, preparation and cultivation of land will be carried out with machinery and operators provided by the block. The block will also cover the cost of processing crops and transporting cotton to Jamaame. The value of all these inputs and services advanced to the typical unit are shown in Appendix E and appear summarised in Table 5.5.

5.2.7 Net Crop Revenue

The net value of crop production has been calculated by subtracting from gross crop revenue the value of crops retained for home consumption and the costs of inputs and services advanced (Table 5.5). The net value rises from 48,900 So.Sh. in year 3 (the year when the complete cropping pattern is introduced) to 247,800 So.Sh. in year 14 when yields reach their maximum.

5.2.8 Settlers Income

All crop production, with the exception of that retained for home consumption will be handed over to the block. The value of inputs and services advanced during the year will be deducted. The remainder will be returned to the unit, though additional charges for the cost of management may be eventually deducted.

Given their daily needs for food, other than that produced by the unit, settlers cannot be expected to work a whole season before receiving any remuneration. Consequently part of the expected crop revenues will have to be paid out in advance in the form of a wage. The wage must meet two requirements. First it must be sufficient to cover the settlers basic needs; secondly, it must be competitite with wages paid elsewhere in the region.

The most important need of settlers is food since housing and social services will be provided by the Scheme. The value of rations currently received by settlers is estimated at 3.125 So.Sh. per day for each adult (Table 5.6). For a family of three adults and two children this amounts to 12.5 So.Sh./day (assuming the children's ration is half that of an adult). Adjusting this figure by the value of rice and maize retained for home consumption, the cost falls to 9.5 So.Sh./day. With a family expected to furnish an average of 230 man-days of labour a year, this means a minimum wage of 15 So.Sh. per man-day must be paid. This is considerably above wages currently being paid for unskilled labour elsewhere in the region. Fanoole State Farm pays 10 So.Sh./day and the Jubba Sugar Project 12 So.Sh. Adjusted for the value of home production, this amounts to 7-9 So.Sh./day. In an attempt to align Homboy wages with those paid elsewhere, two wage options have been calculated, the one where settlers are paid 8 So.Sh./man-day the other where they are paid 10 So.Sh./ man-day (Table 5.7).

TABLE 5.7 BUILD-UP OF SETTLERS INCOME (So.Sh.)

Year of Settlement	Gross Crop Revenues	Option 1 Wages[1]	Option 1 Bonus	Option 1 Total	Option 2 Wages[2]	Option 2 Bonus	Option 2 Total
1-3	-	1,840	-	1,840	2,300	-	2,300
4	4,418	1,840	221	2,061	2,300	442	2,742
5	4,798	1,840	288	2,128	2,300	528	2,828
6	5,172	1,840	362	2,202	2,300	621	2,921
7	5,555	1,840	444	2,284	2,300	722	3,022
8	5,924	1,840	533	2,373	2,300	829	3,129
9	6,302	1,840	630	2,470	2,300	945	3,245
10	6,756	1,840	743	2,583	2,300	1,081	3,381
11	7,210	1,840	865	2,705	2,300	1,226	3,526
12	7,668	1,840	997	2,837	2,300	1,380	3,680
13	8,122	1,840	1,137	2,977	2,300	1,543	3,843
14	8,578	1,840	1,287	3,127	2,300	1,716	4,016

Notes:

1 *8 So.Sh./man-day.*

2 *10 So.Sh./man-day.*

Given the initially slow build-up in yields, the surplus of crop revenues left after deduction of costs of production and wages is likely to remain small for several years. To motivate settlers to increase crop production, a bonus directly related to the value of crop production should be paid. Initially this bonus will have to be subsidised by the block. However, as yields increase and the value of crop production rises, the surplus of crop revenues over production costs will grow, eventually permitting the subsidy to be repaid.

The size of the bonus depends largely on the target income fixed by the Scheme for settlers' families. A target income of 5,000 So.Sh. per family per year was suggested in the Inter-Riverine Report (HTS, 1978). This figure is based on ILO recommendations. With the value of maize and rice production retained for home consumption at 1,082 So.Sh., this implies a target of income of approximately 4,000 So.Sh. If settlers participate in rainfed agriculture the contribution of the scheme to overall family could be lower. However, it is not clear the extent to which settlers will engage in rainfed farming. To cover various possibilities, two target incomes have been chosen; Option 1, 3,000 So.Sh./family; Option 2, 4,000 So.Sh./family.

During the first five seasons, settlers will only receive a basic wage. However, beginning the fourth year, bonuses will be paid. In the case of the lower target income, an initial bonus equivalent to five per cent of gross crop revenue will be paid at harvest time. This percentage will increase by one per cent over the next ten years until year 14 when it will stand at fifteen per cent. Added to the daily wage of 8 So.Sh./man-day this amounts to a family income of 2,061 So.Sh. in year 4 rising to 3,127 by year 14 (Table 5.7). In the case of the higher target income, the bonus will start at ten per cent of gross crop revenues and eventually rise to twenty per cent. When the wage of 10 So.Sh./man-day is taken into account, this results in an overall income of 2,742 So.Sh. in year 4 rising to 4,016 So.Sh. by year 14 (Table 5.7). It should be remembered that in good years the bonus will be larger and in poorer years, smaller. However, with the basic wage remaining unchanged, families should have sufficient money to meet their immediate needs.

The payment of wages and bonus have been calculated for the typical fifty family unit (Table 5.8). With the lower target income, the cost of wages and bonuses exceeds net crop revenues up until year 9 while with the higher target income this situation persists until year 11. Consequently in early years a subsidy payment from the blocks will be required. However, in both cases, the surplus generated in later years indicates that this subsidy could eventually be repaid.

TABLE 5.8 COMPARISON OF NET CROP REVENUES WITH WAGE AND BONUS PAYMENTS FOR A FIFTY FAMILY UNIT ('000 So.Sh.)

Season/Year	Net Crop Revenues	Option 1 Wages and Bonus	Balance	Option 2 Wage and Bonus	Balance
(a) First four seasons where cropping begins in 'Der' Season					
Gu 1	-	-	-	-	-
Der 1	54.9	46.0	8.9	57.5	2.6
Gu 2	25.4	46.0	(20.6)	57.5	(32.1)
Der 2	54.9	46.0	8.9	57.5	(2.6)
(b) First four seasons where cropping begins in 'Gu' Season					
Gu 1	25.4	46.0	(20.6)	57.5	(32.1)
Der 1	54.9	46.0	8.9	57.5	(2.6)
Gu 2	25.4	46.0	(20.6)	57.5	(32.1)
Der 2	39.0	46.0	(7.0)	57.5	(18.5)
(c) Subsequent Years					
3	48.9	92.0	(43.1)	115.0	-
4	48.9	103.1	(54.2)	137.1	(88.2)
5	67.2	106.4	(39.2)	141.4	(74.2)
6	85.1	110.1	(25.0)	146.1	(60.0)
7	103.2	114.2	(11.0)	151.1	(47.9)
8	121.2	118.7	(2.5)	156.5	(35.3)
9	139.3	123.5	15.8	162.3	(23.0)
10	161.0	129.2	31.8	169.1	(8.1)
11	182.6	135.3	47.3	176.3	6.3
12	204.4	141.9	62.5	184.0	20.4
13	226.0	148.9	77.1	192.2	33.8
14	247.8	156.4	91.4	200.8	47.0

5.3 FINANCIAL ANALYSIS AT BLOCK LEVEL

5.3.1 General

Each fifty family unit will belong to a block. These vary in size, the smallest comprising 12 units, the largest 30.5. As already mentioned, each block will advance its units the necessary inputs and services during the crop year. They will also pay the settlers a living wage. At harvest time, crop production other than that kept for home consumption, will be handed over by the units to their respective blocks. Crop revenues will be used to purchase inputs and pay for services needed during the following cropping season. Part of the crop revenues will be returned to the units in the form of a bonus and if a surplus still remains, this will be paid to the project to help defray the costs of managing the scheme.

The financial analysis at the block level is concerned with determining the viability of the blocks. Of particular interest will be the ability of the blocks to function without having to depend on endless injections of cash from the project and their ability to eventually contribute toward covering project management costs. To determine these points, a financial projection for the blocks taken as a whole has been prepared.

5.3.2 Phasing in of Blocks

A total of ten blocks are to be phased in over a five year period. The first one is scheduled to start cropping in 'Der' 82, the last will start in 'Der' 86 (Table 5.9). In all, they will contain a total of 177 units. All but 14.5 of the units will follow the normal cropping pattern. These remaining units in Blocks 9 and 10 will be limited, for reasons already discussed, to growing paddy rice.

TABLE 5.9 PHASING IN OF BLOCKS

Calendar Season/Year	Project Year	Block No.	Area (ha)	Units (No.)	
Der 82	2	1	600	12	
Gu 83	3	2 & 3	1,525	30.5	
Gu 84	4	4	925	18.5	
Der 84	4	5	1,025	20.5	
Gu 85	5	6 & 7	1,925	38.5	
Gu 86	6	8 & 9	2,100	42	31.5 normal 10.5 paddy rice
Der 86	6	10	750	15	11 normal 4 paddy rice
Total		10	8,850	177	

5.3.3 Cash Inflow

The cash inflow for the blocks will consist of two items. The first is a working capital fund established to cover the cost of inputs, and services advanced to the units. The size of the working fund for each block is determined by the size of the block and has been calculated so as to cover maximum requirements. This sum varies according to the season the block is settled. Thus inputs for blocks settled in the 'Der' season are based on year 2 requirements, processing and machinery on year 3 while inputs for blocks settled in the 'Gu' season are based on year 1 requirements, processing on year 2 and machinery on year 3 (see Appendix E). While it is true that processing costs will continue to rise until year 13, the increase involved is relatively small and thus has been ignored. Machinery requirements are limited to covering the cost of operation, which is 39 per cent of overall machinery costs. Replacement and repairs will be taken care by the project headquarters. A ten per cent contingency has been included in the working capital fund (Table 5.10).

The second inflow item is crop revenues from crops grown by the units. This is based on the total value of crop production less the value of crops kept for home consumption. Gross crop revenues for each block have been calculated in Appendix E and the total is shown in Table 5.10.

5.3.4 Cash Outflow

Cash outflow at the block level consists of two groups of items. The first one is direct costs incurred by the blocks, the second are transfers made to the units or the project headquarters. Direct costs include purchase of inputs, machinery operating costs and processing costs. These are shown on a block by block basis in Appendix E and are summarised in Table 5.10. Transfers to the project include payments for machinery repairs and replacement. They account for 61 per cent of overall machinery costs. Transfers to the units include wages paid during the growing season and bonuses paid at harvest time. These have been calculated twice, first based on the lower target income (Option 1) and then on the higher target income (Option 2). Bonuses paid to the 14.5 units growing paddy rice are the same as those paid to all other units even though their gross crop revenues are higher.

5.3.5 Net Value

The net cash flow for the blocks taken as a whole depends on the target income option chosen. In the case of Option 1, the net cash flow is negative for four years and is more than covered by the surplus generated in earlier years. The growth in the surplus in later years indicates the blocks will be able to contribute substantially towards paying of project management costs. If Option 2 is chosen, the cash flow remains negative over a longer period with the cumulative deficit not being recouped until year 17. However, the results suggest that from year 18 onwards, the blocks will also be capable of making an important contribution towards covering management costs.

5.4 FINANCIAL ANALYSIS AT THE PROJECT LEVEL

5.4.1 General

As a final step in the financial analysis, a financial projection for the project as a whole has been calculated (Table 5.11). This compares overall cash receipts with expenditures, the balance indicating the viability of Homboy Scheme.

5.4.2 Cash Inflow

Cash inflow is made up from two sources, the first is loan funds secured to finance the construction of the scheme and to purchase initial machinery and equipment, the second is payments by the blocks to the projects for services rendered.

The loan funds cover the construction of the engineering works and infrastructure. This includes not only the cost of construction but also the cost of engineering design work and supervision. Loan funds also cover the cost of the initial purchase of engineering maintenance vehicles and equipment, project management vehicles, and agricultural machinery. In addition they cover working capital funds for the blocks, contingencies on these items and the cost of expatriate technical assistance. Apart from this latter item, no other operating costs are covered by loan funds. It is hoped that in the long run, the project will generate sufficient revenue to pay for these.

TABLE 5.10 FINANCIAL PROJECTION FOR BLOCKS TAKEN TOGETHER ('000 So.Sh.)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19-30
1. Inflow																			
Working capital fund	-	1,579	4,026	5,139	5,084	8,021	-	-	-	-	-	-	-	-	-	-	-	-	-
Contingency (10%)	-	158	403	514	508	802	-	-	-	-	-	-	-	-	-	-	-	-	-
Crop revenues	-	1,979	10,893	18,189	29,006	44,131	45,326	45,633	47,894	51,233	54,609	58,109	61,757	65,565	69,650	73,281	76,310	78,448	79,712
Total	-	3,716	15,322	23,842	34,598	52,954	45,326	45,633	47,894	51,233	54,609	58,109	61,757	65,565	69,650	73,281	76,310	78,448	79,712
2. Outflow																			
(a) Direct																			
Agricultural Inputs	-	667	3,778	6,236	10,036	14,414	14,528	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191	14,191
Machinery																			
Operation	-	239	1,358	2,407	3,907	5,687	5,914	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932	5,932
Processing	-	38	221	615	945	1,594	1,820	1,921	2,011	2,139	2,273	2,416	2,567	2,735	2,915	3,081	3,217	3,308	3,356
Sub-Total	-	944	5,357	9,258	14,888	21,695	22,262	22,044	22,134	22,262	22,396	22,539	22,690	22,350	23,038	23,204	23,340	23,431	23,479
(b) Transfer																			
Machinery repairs and depreciation	-	375	2,123	3,765	6,111	8,895	9,251	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278	9,278
Wages and bonus Option 1	-	552	3,910	6,555	11,173	16,106	17,373	18,090	19,174	19,860	20,619	21,461	22,390	23,406	24,526	25,630	26,568	27,255	27,682
Sub-Total	-	927	6,033	10,320	17,284	25,001	26,625	27,368	28,452	29,138	29,897	30,739	31,668	32,684	33,804	34,908	35,846	36,533	36,960
Wages and bonus Option 2	-	690	4,888	8,195	14,067	20,486	22,396	23,617	25,444	26,299	27,227	28,242	29,348	30,556	31,875	33,164	34,253	35,041	35,542
Sub-Total	-	1,065	7,011	11,960	20,178	29,381	31,647	32,895	34,722	35,577	36,505	37,520	38,626	39,834	41,153	42,422	43,531	44,319	44,820
Total (Option 1)	-	1,871	11,390	19,578	32,172	46,696	48,886	49,412	50,586	51,400	52,293	53,278	54,358	55,534	56,842	58,112	59,186	59,964	60,439
Total (Option 2)	-	2,009	16,747	21,488	35,066	51,076	53,909	54,939	56,856	57,839	58,901	60,059	61,316	62,684	64,191	65,646	66,871	67,750	68,299
3. Net Cash Flow																			
With Option 1	-	1,845	3,932	4,264	2,426	6,258	(3,560)	(3,779)	(2,692)	(167)	2,316	4,831	7,399	10,031	12,808	15,169	17,124	18,484	19,273
With Option 2	-	1,707	2,954	2,354	(468)	1,878	(8,583)	(9,306)	(8,962)	(6,606)	(4,292)	(1,950)	441	2,881	5,459	7,635	9,439	10,698	11,413

TABLE 5.11 PROJECT FINANCIAL PROJECTION ('000 So.Sh.)

		Project Year 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Inflow														
(a) Loan Funds[1]		168,007	172,548	136,706	124,827	84,642	43,205	1,742	-	-	-	-	-	-
(b) Payments from Blocks														
Machinery repair and depreciation		-	375	2,123	3,765	6,111	8,895	9,251	9,278	onwards				
Operating surplus from Blocks:	Option 1	-	18,45	3,932	4,264	2,426	6,528	-	-	-	-	2,316	4,831	7,399
	Option 2	-	1,707	2,954	2,354	-	1,878	-	-	-	-	-	-	441
Total Inflow	Option 1	168,007	174,768	142,761	132,856	93,179	58,628	10,993	9,278	9,278	9,278	11,594	14,109	16,677
	Option 2	168,007	174,630	141,783	130,946	90,753	53,978	10,993	9,278	9,278	9,278	9,278	9,278	9,719
2. Outflow														
(a) Capital and replacement costs														
Construction of engineering works[2]		137,956	95,269	67,135	66,935	50,061	22,697	-	-	-	-	-	-	-
Construction of infrastructure[2]		9,969	59,064	44,586	32,780	11,335	-	-	-	-	-	-	-	-
Engineering maintenance vehicles and equipment		-	1,780	4,037	2,771	4,550	804	1,626	61	287	2,906	1,928	4,200	2,427
Project management vehicles		1,172	798	494	554	545	226	948	665	485	545	527	226	966
Agricultural machinery		-	2,196	5,267	6,549	6,505	7,593	3,505	2,513	4,532	5,998	7,330	7,117	3,547
Working capital funds		-	1,579	4,026	5,139	5,084	8,021	-	-	-	-	-	-	-
Contingencies[3]		14,910	6,542	5,841	4,779	2,802	1,664	608	324	530	945	979	1,154	694
Total		164,007	167,228	131,386	119,507	80,882	41,005	6,687	3,563	5,834	10,394	10,764	12,697	7,634
(b) Operating Costs														
Project management staff		4,823	7,553	9,234	11,172	11,525	10,714	8,460	8,412	onwards				
Project management vehicles		239	440	551	677	801	845	767	741	onwards				
Engineering maintenance vehicles and equipment		-	1,507	4,650	6,304	8,457	9,049	9,964	onwards					
Operating deficits of Blocks:	Option 1	-	-	-	-	-	-	3,560	3,779	2,692	167	-	-	-
	Option 2	-	-	-	-	468	-	8,583	9,306	8,962	6,606	4,292	1,950	-
Total Operating Costs	Option 1	5,062	9,500	14,435	18,153	20,783	20,608	22,741	22,896	21,809	19,284	19,117	19,117	19,117
	Option 2	5,062	9,500	14,435	18,153	21,251	20,608	27,764	28,423	28,079	25,723	23,409	21,067	19,117
Total Outflow	Option 1	169,069	176,728	145,821	137,660	101,665	61,613	29,428	26,459	27,643	29,678	29,881	31,814	26,751
	Option 2	169,069	176,728	145,821	137,660	102,133	61,613	34,451	31,986	33,913	36,117	34,173	33,764	26,751
3. Net Cash Flow	Option 1	(1,062)	(1,960)	(3,060)	(4,804)	(8,486)	(2,985)	(18,435)	(17,181)	(18,365)	(20,400)	(18,287)	(17,705)	(10,074)
	Option 2	(1,062)	(2,098)	(4,038)	(6,714)	(11,380)	(7,635)	(23,458)	(22,708)	(24,635)	(26,839)	(24,895)	(24,486)	(17,032)

Notes:

1 *Loan funds cover construction of engineering works and infrastructure, purchase of initial vehicles, equipment and agricultural machinery, contingencies on these items and technical assistance.*

2 *Includes design and supervision.*

3 *Ten per cent physical contingency on all items except engineering works which already includes a contingency figure.*

TABLE 5.11 (Continued)

Project Year 14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10,031	12,808	15,169	17,124	18,484	19,273	onwards										
2,881	5,459	7,635	9,439	10,698	11,413	onwards										
19,309	22,086	24,447	26,402	27,762	28,551	onwards										
12,159	14,737	16,913	18,717	19,976	20,691	onwards										
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,217	7,367	106	782	2,704	1,974	5,210	516	3,908	2,144	518	5,329	1,963	2,365	2,543	628	1,748
655	485	527	527	244	966	665	467	527	545	244	966	647	467	545	545	244
3,433	4,931	6,563	6,056	6,108	3,492	3,395	6,319	7,037	5,997	5,793	2,656	3,732	5,818	6,541	6,505	6,705
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
531	1,278	720	737	906	643	927	712	1,147	869	656	895	634	865	963	768	870
5,836	14,061	7,916	8,102	9,962	7,075	10,197	7,834	12,619	9,555	7,211	9,846	6,976	9,515	10,592	8,446	9,567
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
onwards																
onwards																
24,953	33,178	27,033	27,219	29,079	26,192	29,314	26,951	31,736	28,672	26,328	28,963	26,093	28,632	29,709	27,563	28,684
24,953	33,178	27,033	27,219	29,079	26,192	29,314	26,951	31,736	28,672	26,328	28,963	26,093	28,632	29,709	27,563	28,684
(5,644)	(11,092)	(2,586)	(817)	(1,317)	2,359	(963)	1,600	(3,185)	(121)	2,223	(412)	2,458	(81)	(1,158)	988	(133)
(12,794)	(18,441)	(10,120)	(8,502)	(9,103)	(5,501)	(8,623)	(6,260)	(11,045)	(7,981)	(5,637)	(8,272)	(5,402)	(7,941)	(9,018)	(6,872)	(7,993)

Payments from the blocks to the project consist of payments for repair and replacement of agricultural machinery. Project headquarters will be responsible for replacement of machinery and running the centrally located workshop. Payments are taken from Table 5.10. In addition, blocks will pay project headquarters any operating surplus that results from their activities. In early years, when yields are relatively low, there will be no surplus. However, as yields improve, the situation is expected to change. This payment (Table 5.10) is the blocks contribution towards covering projects operation and management costs. The payment differs according to the target income option for settlers chosen.

5.4.3 Cash Outflow

Cash outflow has been divided into capital and replacement costs and operating costs. Construction costs are based on those shown in the Engineering Bills, Vol.2, Annex . The cost of enlarging the Fanoole Main Canal has been added in. Adjustment has been made to remove any price contingencies. As noted above, the cost of design and supervision is included. Engineering maintenance vehicles and equipment costs are based on figures presented in Vo. 2, Annex while the cost of management vehicles, agricultural machinery and working capital funds are taken from Tables G5, G3 and 5.10. A ten per cent physical contingency has been included. However, this has not been applied to construction of engineering works since a contingency sum has already been included.

Operating costs include staff costs, running costs of project management vehicles as well as the running costs of engineering maintenance vehicles and equipment. These figures are taken from Tables G1, G2 and Vol. 2, Annex respectively. Finally, the operating deficits of blocks incurred in the early years of the scheme (Table 5.10) are included. These vary according to the target income option chosen.

5.4.4 Net Cash Flow

Regardless of target income option chosen, the net cash flow for the project as a whole remains negative for a good many years. However, in the case of the lower income option, the cash flow becomes positive in the nineteenth year though in some of the following years, it is also negative. In the case of the higher target income, the cash flow remains negative throughout the project's life.

5.4.5 Conclusion

The net cash flow results indicate that the project will be unable to generate sufficient revenue to cover its operation and management costs. Consequently some form of external support will be necessary. Given the total outlay of the project, the additional sum required would be quite modest. In the case of the lower income option, it could be phased out by year 19. Another approach might be to take measures to reduce management costs. A comprehensive management team has been costed, since the success or failure of the project will greatly depend on this element. However, it is entirely possible that after an initial period, the management team could be reduced as the settlers gain experience and the units take on more responsibilities. Consequently a saving from the 9.2 million So.Sh. spent annually from year 8 onwards on staff salaries and running costs of management vehicles could be made. The above figure does not include replacement of project management vehicles which fluctuates between 2.5 million and 7.3 million So.Sh./year.

A temptation that must be avoided at all costs is to lower the target income of settlers. Such action may make the project self-supporting at an earlier date, at least on paper. In reality, it could have exactly the opposite effect by removing from settlers the necessary incentives to increase production.

6

Results of Economic Analysis

6.1 GENERAL

The economic analysis determines the benefits and costs of the Homboy Scheme to the nation as a whole and evaluates the project's economic performance.

6.2 BENEFITS

As with the financial analysis, the fifty family unit has been taken as the basic unit for determining project benefits. The value of crop production on the typical fifty family unit has been calculated in Appendix F. The value of rice and maize retained for home consumption has been included as has the value of tomato production. Crops are valued at economic prices which are derived in Appendix A. By combining results for the units with the phasing in of the ten blocks, the value of agricultural production for the project as a whole has been arrived at (Table 6.1).

A certain amount of rainfed agriculture is currently practised on the proposed site of the Homboy Scheme. An estimated 3,186 ha is devoted to growing sorghum, maize, sesame and pulses. The gross value of this production has been calculated (Appendix F). Since few purchased inputs are used and the family provides virtually all the labour, the net value of production is taken to be the same as the gross value, the value of present agricultural production has been deducted from the value of production of proposed activities to give the net incremental value resulting from the project.

6.3 COSTS

Costs have been divided into capital and recurrent costs and operating costs. Engineering and infrastructure costs are taken from Volume 2, Annex . Only half the estimated 30,700,000 So.Sh. cost of the Dhey Tubaako to Homboy road has been included as has only half the estimated 37,000,000 So.Sh. cost of flood protection. In both cases, costs are allocated on the basis of sixty per cent in year 1 and forty per cent in year 2, other capital and replacement costs include purchase and replacement of engineering vehicles and equipment (Vol.2, Annex II) and project management vehicles (Appendix G). A ten per cent physical contingency has been added.

Operating costs for agricultural inputs, processing and machinery have been worked up from the unit level (Appendix F). Costs are based on economic prices presented in Appendix C and in the Crop Budgets (Appendix D). Only sixty one per cent of agricultural machinery costs are included since the remainder covers depreciation. Project Management staff costs are taken from Appendix G. Only half the cost of technical assistance is included. Technical assistance is expected to involve training of counterparts and as such will benefit

TABLE 6.1 PROJECT NET CASH FLOW AT ECONOMIC PRICES ('000 S

	1	2	3	4
Project Benefits				
Value of Proposed Crop Production	-	2,188	12,555	22,23
Value of Present Production Foregone	2,633	2,633	2,633	2,63
Value of Incremental Production	(2,633)	(445)	9,922	19,60
Project Costs				
(a) Capital and replacement				
Construction engineering works	105,159	73,885	61,607	61,42
Construction of infrastructure	8,946	53,005	40,012	29,43
Engineering maintenance vehicles and equipment	-	1,618	3,670	2,51
Project management vehicles	918	673	377	41
Agricultural machinery	-	2,196	5,267	6,54
Contingencies (Physical: 10%)	11,502	13,138	11,093	10,03
Total	126,525	144,515	122,026	110,37
(b) Operating Costs				
Agricultural inputs	-	637	3,613	5,94
Agricultural machinery	-	347	1,963	3,46
Agricultural processing	-	32	187	56
Project management staff	2,617	4,335	5,596	7,04
Project management vehicles	171	312	390	47
Engineering maintenance vehicles and equipment	-	1,245	3,764	5,13
Total	2,788	6,908	15,513	22,62
Total Capital Replacement and Operating Costs	129,313	151,423	137,539	133,00
Net cash flow	(131,946)	(151,868)	(127,617)	(113,40

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