

kilowatts are used in villages. However, such generators can supply electricity only to a part of the houses in such villages. Welders, carpenters and oil stations have bigger power generators for power supply as well as for lighting. Total number of households enjoying the benefit of power supply is quite limited at present.

8.39 The Government has been making efforts to increase power supply in the Province. Ras Kateriv Power Station Project is one of such projects. It aims to generate the power of 150,000 kW in the target year of 1982. After the implementation of this project, the power supply capacity in the Province will increase to about ten times of the present one. However, it is not clear at this moment whether the power to be generated at this station will be supplied in Hajjah Province, or not.

#### Telecommunications

8.40 Telecommunication networks are hardly available in the Province except telephone service between Hajjah and Sana'a for which the test operation is now underway. It is planned to connect Hajjah and Al Mahabisha by telecommunication system in 1979. However, the communication capacity, as a whole, is still poor. Therefore, information and action lags occur in the Province especially in the economic sector, which shows the backwardness of this Province.

#### (5) Major Socio-economic Problems

8.41 About 96 % of the whole population of the Province are living in the rural areas and more than 70 % of them are engaged in agriculture. The Province, however, is by no means richly endowed with agricultural resources with small and erratic rainfall and limited area of cultivable

land. Moreover, the traditional production techniques are still prevalent without the use of high yielding varieties, fertilizer and pesticides. The total area of irrigated farm land is also quite limited. Consequently, the productivity in agriculture remains low, falling behind the national average.

8.42 About 70 % of the total cultivable land in the Province is owned by tribal leaders and merchants. About 20 % is the property of religious institutions. A large majority of the farmers are engaged in agriculture as tenants under crop sharing arrangements. About 50 % to 80 % of the total proceeds is usually taken by the landowners as farm rent. The rest, or only 20 % is left for the tenants. Moreover the 10 % zagat tax is frequently borne by the tenants. There are also considerable number of peasants. Their land holding size is quite limited, just sufficient for maintaining their subsistence, taking into account the current low cropping intensity and low productivity. The agriculture in the Province is thus characterized by a large number of tenants and small independent farmers whose incomes are quite low.

8.43 The low income level of the large majority of the rural people coupled with the insufficient infrastructural facilities and social services has caused the massive out-migration of the rural inhabitants of the Province, especially among able-bodied male workers. The outflow is more prevalent in the Tihama area. In Abs Nahiya, for instance, it is reported that about 50 % to 65 % of the total male population are working elsewhere outside the Nahiya. They either head for the neighbouring Arab countries or the urban areas where they can earn higher wages and enjoy better living conditions, such as Sana'a, Taiz and Hodeidah. Inside the Province, the towns of

Al Mahabisha and Hajjah are the major destinations. The massive outflow of the rural inhabitants has drained the agriculture of its labour force. In consequence, extensive area of the terrace lands has been desolated in the mountainous area and millions of farm lands have been abandoned in the Tihama plain, posing serious problem of the weakening of the key industry in the rural areas.

Table 8.1 Population of Hajjah Province

<u>Quada</u>	<u>Nahiya</u>	Population		
		<u>Total</u>	<u>Female</u>	<u>Male</u>
Hajjah		133,910	69,463	10,736
	Hajjah	22,053	11,317	10,736
	Mabyan	20,357	10,446	9,911
	Al Maghrabah	6,232	3,062	3,170
	Al Jamimah	5,441	2,788	2,653
	At Tur	16,065	8,119	7,946
	Beni Al Awam	16,606	8,795	7,811
	Kahlan Afar	11,452	6,017	5,435
	Maswar	16,612	8,890	7,722
	Najrah	6,682	3,510	3,172
	Al Shaghadrah	12,410	6,519	5,891
Midi		74,896	35,763	39,133
	Midi	7,294	3,535	3,759
	Harad	17,394	8,336	9,013
	Abs	25,421	12,603	12,818
	Kaidenah	24,832	11,289	13,543
Al Mahabisha		74,817	38,727	36,090
	Al Mahabisha	8,567	4,465	4,102
	Al Mufleh	7,298	3,803	3,493
	Aflah & Kheiran	26,790	13,911	12,879
	Al Qof	13,682	6,893	6,789
	Kahlan Al Sharaf	7,408	3,934	3,474
	Al Sharhil	11,072	5,721	5,351
Washha		64,033	33,420	30,613
	Aslam	16,918	8,481	8,437
	Washha	19,035	9,955	9,080
	Kasher	16,380	9,056	7,324
	Mustabah	11,700	5,928	5,772
Shahara		48,922	25,210	23,712
	Shahara	15,951	8,349	7,602
	Al Madan	9,394	4,874	4,520
	Al Qufla	8,182	3,989	4,193
	Swair	4,917	2,480	2,437
	Falimat Harbour	10,478	5,518	4,960
	<b>Total</b>	<b>396,578</b>	<b>202,583</b>	<b>193,995</b>

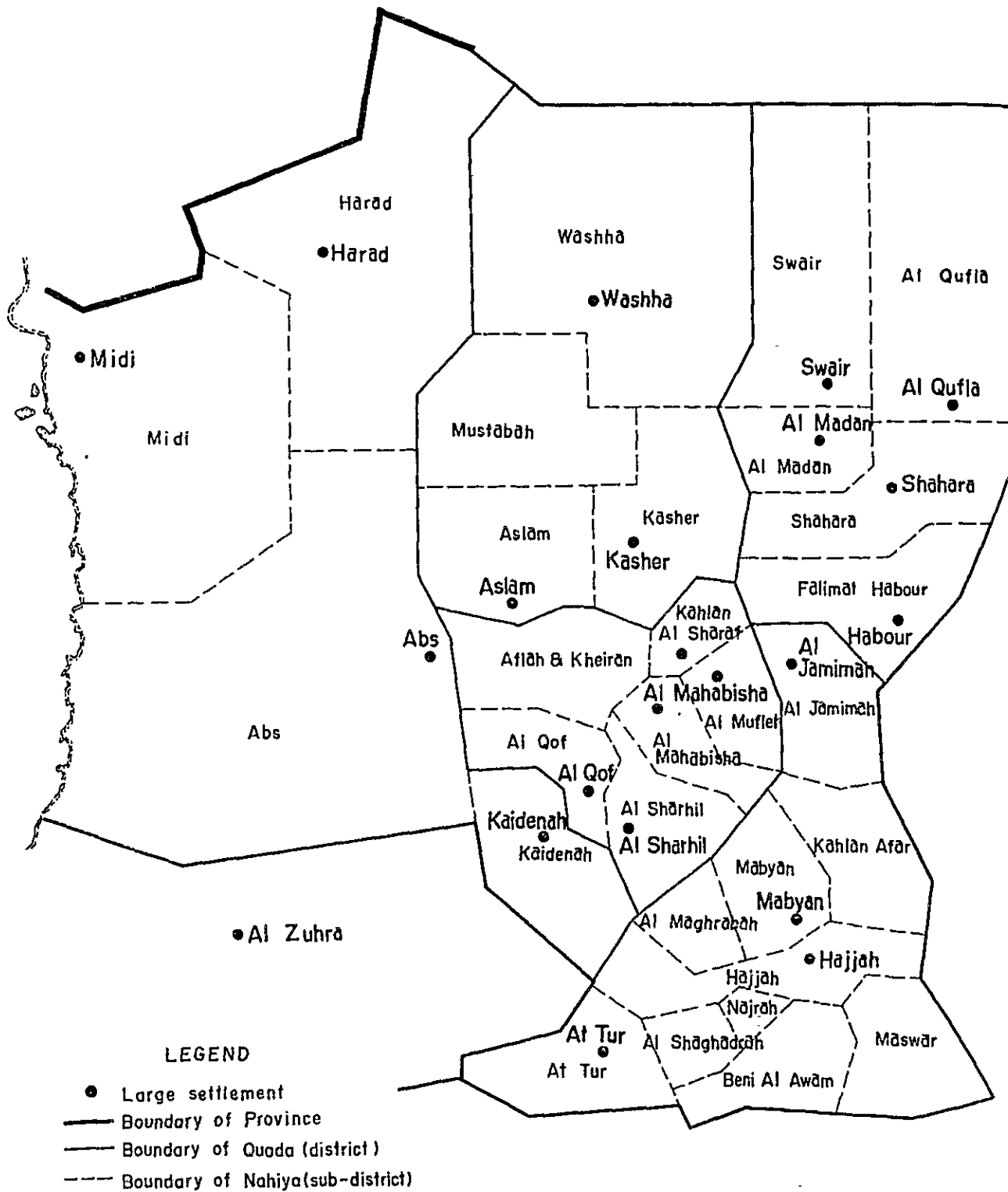


FIG. 8.1 Administrative Division of Hajjah Province

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## IX AGRICULTURAL ECONOMY

1.	General	IX - 1
2.	Agricultural Resources	IX - 1
	Agricultural land	IX - 1
	Land use	IX - 3
	Water resources	IX - 4
	Labour force	IX - 5
	Draught power	IX - 6
3.	Current Agricultural Production	IX - 7
	Crops	IX - 7
	Livestock	IX-10
4.	Prevailing Farming Patterns	IX-10
5.	Present Farming Practices	IX-13
6.	Agricultural Income	IX-14
7.	Results of Farm Economic Survey	IX-15

### Tables

9.1	Cropland and Farm Size	IX-16
9.2	Labour Force and Draught Power	IX-17
9.3	Crop Production Value	IX-18
9.4	Gross Crop Production Value, Production Cost and Net Crop Production Value	IX-19
9.5	Gross Livestock Production Value, Production Cost and Net Livestock Production Value	IX-25
9.6	Results of Farm Economy Survey	IX-31

### Figure

9.1	Present Cropping Pattern of Typical Farms	IX-39
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## IX AGRICULTURAL ECONOMY

### (1) General

9.01 The economy of the Hajjah Province primarily depends on agriculture, and the other industrial activities are also closely associated with the agricultural sector. The present chapter briefly presents survey results relating to agricultural resources, agricultural techniques and farming pattern, factors affecting agricultural production, and agricultural incomes. Present level of production, unit yields and input-output relations are also studied for most of the important crops grown under different ecological conditions.

9.02 There is no agricultural census which gives a dependable base to formulate development plans. The government publications and statistics cover only limited aspects of the present agricultural production and are far from adequate for the study. The farm economy survey was therefore carried out in the sampled areas of Mabyan, Abs and Al Mahabisha. About 150 farmers were interviewed during this survey. The agro-economic study is roughly made on the basis of the findings derived from the farm economic survey and is supported by background information available from government publications and facts on land use and soils obtained from interpretation of Landsat imagery.

### (2) Agricultural Resources

#### Agricultural land

9.03 The total land area of the Hajjah Province is 959,000 ha. In due consideration of topography, soil, climate and farming pattern, the Hajjah Province would conveniently be divided into 3 agricultural zones, i.e., lowland, midland and highland. The main features of each agricultural zone are summarized as follows:

a. Lowland

This agricultural zone extends on the coastal lowland which forms 40 km wide belt along the Red Sea. The elevation ranges from sea level to about 500 m. Extent of area is approximately 321,600 ha, or 34 % of the total area. The soil consists of mainly coarse to medium textured Fluvisols. It is level or slightly undulating and intersected by shallow-wide wadis draining from the eastern mountains toward to the Red Sea. This agricultural zone generally receives less than 300 mm rain annually which falls in the period between April to October. The mean monthly temperature does not vary much and is over 22°C all the year round. In this zone, about 79,000 ha of the lands are cropped annually. The farming pattern prevailed is of cereals - single cropping type. Draught animals are commonly used. Cropping intensity is very low.

b. Midland

The midland agricultural zone ranges from 500 to 1,500 m in elevation between lowland and highland. The landscape is generally rugged, cut by deep wadis which drain to the Tihama lowland. The estimated area is approximately 553,000 ha or 57 % of the total. The soils are composed mainly of gravelly or stony phases of Yermosols. The rainfall is over 200 mm in the foothills and concentrated around August and September. It increases by altitude reaching over 800 mm around Hajjah with two peaks in April/May and July/August. Winters are rainless. The mean monthly temperature is rather even all the year round and does not fall below 16°C. Main wind direction is east in winter and spring, and west in summer and autumn. Various farming patterns are observed in this zone. High-value cash crops such as qut, coffee and grapes are grown in the higher

elevation areas. In lower elevation areas, a combined farming of cereals and some tropical fruit is common. Along the wadi bed, small scale vegetable farming associated with cereals and livestock raising is prevailing.

#### c. Highland

The highland agricultural zone consists of higher mountains with elevation ranging from 1,500 m to 3,360 m. The topography is very rugged. The area of this zone is 84,400 ha and mainly covered by coarse to medium textured Yermosols. The rainfall is over 1,000 mm around Al Mahabisha and decreases towards the north-east (470 mm around Shahara). The rainfall pattern and climatic characteristics are similar to those of midland agricultural zone. Common farming pattern is of a mixed livestock-crop type. The farmers grow sorghum and some fruit trees and keep poultry as a side line.

#### Land use

9.04 The present land use map in the Hajjah Province is prepared on the basis of interpretation of aerial photos and Landsat imagery and results of the field survey (see Chapter VI). Large part of the area is occupied by less developed area in terms of the land use. Out of a total land area of 959,000 ha, approximately 770,000 ha (80 %) are dwarf grassland, open shrub and grassland on rocky slopes. About 28,000 ha (3 %) is unused land. An additional 20,000 ha (2 %) is occupied for village and house yard. The crop lands are only 141,000 ha (15 %) out of which 84,000 ha is regularly cultivated for agricultural production and the remaining 57,000 ha of marginal agricultural land is cultivated only during high rainfall years. The areas of cropland and farm size by Quada (district) are given in Table 1.

9.05 About 88 percent (125,000 ha) of cultivated land depends solely on rainfall. About 9 percent (12,000 ha) is supplied with a spate irrigation by seasonal flood flow, and 3 percent (4,000 ha) is supplied with regular irrigation by wells.

9.06 The irrigated croplands occupy scattered, narrow strips along the wadis in the Tihama lowland. Sorghum, maize and vegetables are commonly grown twice a year. The rainfed croplands are widely distributed on both flat lowland and rugged mountains. In the mountain regions, the croplands are usually terraced. As major crops, sorghum, millet and maize are grown. Vegetables and some of sub-tropical fruit trees are also grown on the wadi lands. The marginal croplands where cultivation is made only in the high rainfall year dominant on low rainfall areas extending along low reaches of wadis.

#### Water resources

9.07 There are approximately 16,000 ha of irrigated croplands in the Hajjah Province. These irrigated croplands have been developed on the flat lowlands where irrigation water is available. Water sources of existing irrigation facilities are the seasonal wadi flood flows and groundwater by wells. In a few cases, the permanent spring water is also utilized for irrigation. Inter-mountain plains where springs are exploited, extend around Al Mahabisha and by using sufficient amount of water, cash crops like paddy, vegetables and sub-tropical fruits are annually cultivated. Water resources, however, is quite limited for further expansion of irrigated croplands.

### Labour force

9.08 According to the latest population census in 1975, the resident labour force of the Hajjah Province was estimated at about 100,300 or 25.3 % of a total population of 396,600, and 73,200 or 73 % resident labour force was engaged in agriculture. The population census also gives a figure of 76,900 as a total number of household. Since about 55,400 or 72 % of a total number of household is considered as farm households, an average farm labour per farm household would be 1.3 persons, which is extremely less than those of other agricultural countries. This figure perhaps results from limited participation of women in agriculture and serious outmigration of inhabitants to Saudi Arabia. The available labour force by Quada is given in Table 9.2.

9.09 The Hajjah Province, in terms of land use, have approximately 141,000 ha of cropland comprising 83,900 ha of regular cropland and 57,500 ha of marginal cropland. Based on the population structure and present land use, average farm size, cropped area and economic active labour force per farm household by Quada are estimated as shown below:

<u>Quada</u>	<u>Farm holding (A)</u>	<u>Area under cultivation (B)</u>	<u>Cropping intensity (B/A)</u>	<u>Available labour force</u>
	(ha)	(ha)	(%)	(No.)
Hajjah	1.4	1.0	71	1.3
Midi	5.6	4.3	77	1.4
Al Mahabisha	1.3	0.8	62	1.3
Washha	1.4	0.8	57	1.3
Shahara	1.4	0.9	64	1.3
Average	2.5	1.5	60	1.3

9.10 Even under the traditional farming practices and low cropping intensity, the present low family labour force seems to be insufficient for the labour requirement. The Midi Quada having most of the lowland agricultural zone faces serious shortage of resident farm labour force.

#### Draught power

9.11 Oxen are the main sources of draught power. However, there is a shortage of draught power during the period of plowing, harrowing and seeding. The number of cattle and available draught power are estimated on the basis of the farm economic survey and are given below:

<u>Quada</u>	<u>Total number of cattle</u> (head)	<u>No. of cattle/farm</u> (head)	<u>Available draught power/farm</u> (ha)	<u>Area under cultivation per farm</u> (ha)
Hajjah	19,400	1.05	1.05	1.0
Midi	39,700	3.90	3.90	4.3
Al-Mahabisha	14,000	1.06	1.06	0.8
Washara	7,400	1.10	1.10	0.8
Shahara	7,500	1.10	1.10	0.9
Total or Ave.	88,000	1.64	1.64	1.5

1/: Available draught power per farm household is estimated on the following basis:

- a. A couple of oxen can plough 0.2 ha per day.
- b. The period for field preparation is 40 days per cropping season.
- c. Available number of coupled oxen is 12.5 % of a total cattle population.

Available Draught Power

$$\begin{aligned}
 &= \text{No. of coupled oxen available} \\
 &\quad \times 0.2 \text{ ha/day (work efficiency per coupled oxen)} \\
 &\quad \times 40 \text{ days (No. of working days)}
 \end{aligned}$$

9.12 In Hajjah Quada, for example, a figure of 1.05 ha available draught power means that the farmers have enough draught power for field preparation of 1.05 ha cropland. In the midland and highland areas, available draught power seems to be short. However, problem is not acute because a considerable part of fields are occupied by perennial crops. In the Midi Quada, on the other hand, shortage of draught power results in continuous abandonment of the marginal lands.

### (3) Current Agricultural Production

#### Crops

9.13 In the Hajjah Province, crop production is heavily concentrated on foodgrains, namely, sorghum and millet. More than 80 % of all cropped area are planted to these crops as follows:



<u>Crops</u>	<u>Cultivated area</u> (ha)	<u>Production</u> (ton)	<u>Unit yield</u> (ton/ha)
Sorghum/Millet	70,000	56,000	0.8
Wheat	500	400	0.8
Barley	400	400	1.0
Maize	500	750	1.5
Legumes	1,000	800	0.8
Qut	6,800	15×10 <sup>6</sup> bundles	2,200 bundles
Coffee	1,000	400	0.4
Grapes	1,000	4,800	4.8
Fruits	1,800	14,400	8.0
Potatoes	200	1,600	8.0
Sesame	100	50	0.5
Tobacco	100	120	1.2
Cotton	100	60	0.6
<b>Total</b>	<b>83,900</b>		

9.14 Historically, more than 90 % of a total cropped area was planted to these foodgrains. In recent years, diversification of cropping practices has reduced this to about 85 % of all cultivated area. Despite this predominance of grains, the distinctly different ecological zones of the Province permit the growing of a wide range of crops. In the midland and highland, low temperature zone crops like potatoes, grapes and deciduous fruits are grown successfully. Various legumes such as beans and pulses are also grown extensively. In the sub-tropical climate and relatively ample rainfall of the areas extending along wadi beds, sorghum, millet, maize are the principal crops. A large variety of fruits and vegetables are also grown, including bananas, citrus fruits, tomatoes and onions. In the lowland agricultural zone with its tropical climate, warm winters, hot summers and scant rainfall, sorghum and millet are the staple crops. With irrigation, the area is well adapted for

the growing of tobacco and sesame. Also melons, green and dry edible beans, tomatoes and onions are nice crops for this zone. Fruit crops of the lowland zone are dates, bananas, papaya and mangoes.

9.15 Farming method is still very primitive. Seeds are provided locally and is of inferior quality. Fertilizer is used only in the irrigated fields. No pest and insect control measures are applied. Crop yields are generally low. For example, sorghum and millet yields of 800 kg per ha, wheat yields of 800 kg per ha, barley yield of 1,000 kg per ha, maize yield of 1,500 kg per ha are among the lowest in the country.

9.16 The most important cash crop in the Hajjah Province and also the most controversial, is qut, a mildly narcotic plant which is widely consumed by the population. Although there are no statistics estimating the acreage planted to qut, the farm inputs used and the value of annual production, there is ample evidence suggesting that qut growing has expanded rapidly in recent years and that agricultural resources are increasingly diverted to this crop. Qut owes its popularity among farmers to a strong consumer demand, high prices and relatively low production cost. Qut is more drought resistant and requires less care than most competing crops, especially coffee. As a result, qut is extremely profitable to farmers and its returns generally exceed those of competing crops by a wide margin. The area under qut cultivation is estimated at about 6,800 ha or only 8 % of the total cropped areas. The production value from qut, however, occupies approximately 80 % of the total crop production values of the Hajjah Province as shown in Tables 9.3 and 9.4.

### Livestock

9.17 It is estimated that over 360,000 sheep and goats, 42,000 donkeys and 88,000 cattle exist in the Province. There are also considerable numbers of camels. Semi-nomadic husbandry is common. Animal diseases are widespread owing to the lack of veterinary facilities. Among the livestock products, hides and skins occupy an important place in the local economy. Meager and uncertain feed supplies together with lack of modern veterinary care create heavy losses and keep production rates at very low level. The Livestock Credit and Processing Project sponsored by World Bank reported that offtake of cattle would be estimated about 9 % to population and milk yields at 200 liters per lactation, and offtake of sheep and goats including unrecorded domestic slaughtering would be estimated at about 35 %, and the milk yields at 17 liters per lactation. Annual animal production in the Province is roughly estimated and given in Table 9.5.

#### (4) Prevailing Farming Patterns

9.18 As mentioned in Paragraph 9.03, the Hajjah Province is divided into 3 agricultural zones, i.e., lowland, midland and highland agricultural zones. The farming patterns prevailing in each zone are as follows:

<u>Agricultural zone/Quada</u>	<u>Dominant farming pattern</u>	<u>Major crops</u>
Lowland (0 - 500 m) Quada: Midi	<ul style="list-style-type: none"> <li>- Large scale rainfed cereal (millet, sorghum) production</li> <li>- Seminomadic rough grazing (cattle, camels, goats, sheep)</li> <li>- Small scale irrigated cereal and cash crops production by diverted stream flow</li> </ul>	<ul style="list-style-type: none"> <li>Sorghum</li> <li>Millet</li> <li>Maize</li> <li>Sesame</li> <li>Tobacco</li> <li>Legumes</li> <li>Vegetables</li> <li>Tropical fruits</li> </ul>
Midland (500 - 1,500 m) Quada: Hajjah Shahara Washha	<ul style="list-style-type: none"> <li>- Rough grazing on perennial low vegetation (sheep, goats)</li> <li>- Small scale irrigated cereal and vegetables production (by diverted and sheet flow) on the wadi lands</li> <li>- Small scale rainfed cereal production on the terraced lands</li> <li>- Qut production</li> </ul>	<ul style="list-style-type: none"> <li>Sorghum</li> <li>Maize</li> <li>Vegetables</li> <li>Legumes</li> <li>Qut</li> <li>Sub-tropical fruits</li> </ul>
Highland (1,500-2,500m) Quada: Al Mahabisha	<ul style="list-style-type: none"> <li>- Intensive cereal production under rainfed condition</li> <li>- Grazing (goats, sheep, cattle)</li> <li>- Intensive qut production on the gentle-slope lands complementally irrigated by hill-slope run off</li> <li>- Intensive coffee production</li> </ul>	<ul style="list-style-type: none"> <li>Sorghum</li> <li>Qut</li> <li>Coffee</li> <li>Grapes</li> </ul>

9.19 Lowland agriculture is popular in Midi Quada, midland agriculture in Washha, Shahara and Hajjah Quadas, and highland agriculture prevails in Al Mahabisha Quada. Midi Quada extends over large and flat lowland of the Hajjah Province. The lowland agriculture is characterized by large farm size, low labour force and low rainfall. Water shortage is serious in this area. Although there are many shallow wells for drinking and irrigation purposes, excessive use of groundwater has already lowered the water table in some areas and increased salinity problem for use in others. Spate irrigation is practised in some areas, but is not reliable owing to irregular stream flow. Low and erratic rainfall makes the lowland agriculture unstable. Agricultural income is generally low. Outmigration of the rural inhabitants is accelerated by harsh environment, low agricultural income and better wages offered by neighbouring oil-producing countries. In consequence, a large number of the rural inhabitants have left their villages and millions of farmlands are being abandoned. As a result, sand dunes are rapidly spreading in these areas.

9.20 The midland agricultural zone receives more rainfall than the lowland area. In this area, rainfed sorghum cultivation is common. The sorghum planting is usually done in late May. If it rains in March, farmers grow two crops of sorghum. In the wadi beds, sub-tropical crops like papaya, bananas, hot peppers, tomatoes and okra are grown. The choice of planting crop is also determined by the timing of spring rains. Generally, on the cropland range between 500 m to 1,000 m in elevation, sorghum, millet and maize are the principle crops. Relying on rain alone, only one crop is harvested a year, but if the wadi water rises, two or three crops plus some vegetables can be raised. On the lands over 1,000 m in elevation, qut is main crop. Some deciduous

fruit trees are also grown for supplementary income. Soil erosion is serious problem in this area.

9.21 Al Mahabisha Quada represents the highland agriculture in the Hajjah Province. Al Mahabisha Quada is located on the central part of the Hajjah Province. The annual rainfall is around 1,000 mm. Blessed with ample rainfall, farming practices are intensively carried out and crop production is relatively high. Almost all the farm lands are terraced. The major crop is qut followed by sorghum, grapes, coffee and vegetables.

#### (5) Present Farming Practices

9.22 Sorghum and millet are the staple food for inhabitants of the Hajjah Province and these crops are planted over 70,000 ha or 83 % of a total cultivated land. The total production of these crops in 1976 - 1977 was estimated at approximately 56,000 tons. The productivity of these cereals remain relatively low, though straw and leaves play an important role for the fodder sources for livestock raising. The common farming practices for these crops are outlined as follows:

Sorghum: Main varieties cultivated in the Hajjah Province are local varieties such as Hamra, Saifi and Chariba. Sowing time varies from area to area. There are two planting seasons on the regularly irrigated lands, i.e., July and February. On the rainfed farm lands, March to May is common for planting and the crops are harvested in the period from September to middle of November. The growth period spans over 4 to 5 months in main crop and 40 to 80 days in ratoon crops. Seeding rate is about 30 kg per ha. Spacing of rows is generally 30 to 60 cm. Fertilizers and agro-chemicals are not generally applied. Labour requirement

for the cultivation is estimated at about 75 man-days per ha.

Millet: The seed is sown at the beginning of the rain, often in furrow between the ridges on which sorghum will later be sown. If the rainfall is poor and sorghum likely to fail, a second millet crop is sown or seedlings transplanted, as the crop will be less likely to suffer from drought. Quick-maturing varieties are sometimes interplanted with sorghum as a catch crop. The crop generally grown from seed but suckers of the previous season may be cut back and planted. In some areas, it is grown alone, one or two crops a year depending on the rainfall. Thus, Millet plays an important role in the rotation system of northern area. In the harvesting season, the stems are cut low down, huddled together, and stocked in the field. The heads are cut in 30 cm from the stem and are dried and stored. The bundles are rolled up ready for transport. The head may be threshed and winnowed on the house yard.

#### (6) Agricultural Income

9.23 The estimated agricultural production, production value and production costs are given in Tables 9.4 (crop) and 9.5 (livestock) and are summarized as in the followings. The production cost is estimated on the basis of the results of farmer's field trials conducted by Tihama Development Authority and data obtained from the farm economy survey.

(Unit: 10<sup>6</sup> YRs)

<u>Description</u>	<u>Crop</u>	<u>Livestock</u>	<u>Total</u>
Gross production value	1,348	71	1,419
Production cost	227	22	249
Net production value	1,121	49	1,170
No. of farm household			55,400
Net production value per farm household		YRs	21,120

(7) Results of Farm Economic Survey

9.24 There is no agricultural census which gives a dependable base to formulate development plans. The farm economic Survey, therefore, is carried out in the sampled areas of Mabyan, Al Mahabisha and Abs in close cooperation with Planning and Statistics Department, Ministry of Agriculture. The results of farm economic survey is summarized in Table 9.6.



Table 9.1 Cropland and Farm Size

<u>Quada</u>	<u>No. of farm household</u>	<u>Cropland (ha)</u>	<u>Cropped area (ha)</u>	<u>Average farm size (ha)</u>	<u>Average cropped area (ha)</u>
Hajjah	18,600	25,500	18,600	1.4	1.0
Midi	10,200	79,100	43,500	5.6	4.3
Al Mahabisha	13,100	17,200	10,300	1.3	0.8
Washha	6,700	9,400	5,600	1.4	0.8
Shahara	6,800	9,800	5,900	1.4	0.9
<b>Total or Ave.</b>	<b>55,400</b>	<b>141,000</b>	<b>83,900</b>	<b>2.5</b>	<b>1.5</b>

Table 9.2 Labour Force and Draught Power

<u>Quada</u>	<u>Population</u>	<u>No. of household</u>	<u>No. of farm household</u>	<u>Active force labour</u>	<u>No. of farm labour</u>	<u>No. of farm labour/farm</u>	<u>No. of cattle</u>	<u>No. of cattle/farm</u>
Hajjah	133,900	25,900	18,600	33,900	24,700	1.3	19,400	1.05
Midi	74,900	14,200	10,200	18,900	13,800	1.4	39,700	3.90
Al Mahabisha	91,800	18,200	13,100	23,200	16,900	1.3	14,000	1.06
Washha	47,100	9,200	6,700	11,900	8,700	1.3	7,400	1.10
Shahara	48,900	9,400	6,800	12,400	9,100	1.3	7,500	1.10
<b>Total</b>	<b>396,600</b>	<b>76,900</b>	<b>55,400</b>	<b>100,300</b>	<b>73,200</b>	<b>Ave. 1.3</b>	<b>88,000</b>	<b>1.64</b>

Table 9.3 Crop Production Value

<u>Crops</u>	<u>Cultivated area</u> (ha)	<u>Unit yield</u> (ton/ha)	<u>Unit price</u> (YRs/ton)	<u>Products</u> (tons)	<u>Value</u> ( $\times 10^3$ YRs)
Cotton	100	0.6	2,000	60	120
Coffee	1,000	0.4	28,000	400	11,200
Qut	6,800	2,200 bundles	70	14,960 $\times 10^3$	1,047,200
Wheat	500	0.8	2,000	400	800
Barley	400	1.0	1,800	400	720
Grapes	1,000	4.8	12,000	4,800	57,600
Vegetables	400	8.0	5,000	3,200	16,000
Legumes	1,000	0.8	6,000	800	4,800
Tobacco	100	1.2	21,000	120	2,520
Sesame	100	0.5	25,000	50	1,250
Potatoes	200	8.0	4,000	1,600	6,400
Maize	500	1.5	1,500	750	1,125
Sorghum/Millet	70,000	0.8	2,000	56,000	112,000
Fruits, etc.	1,800	8.0	6,000	14,400	86,400
<b>Total</b>	<b>83,900</b>				<b>1,348,135</b>

Table 9.4 Gross Crop Production Value, Production Cost and Net Crop Production Value (Halhah Province)

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRS)	(C) Unit production cost (YRS/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRS)	(E) Production tax, (B) $\times 10\%$ (YRS)	(F) Gross production cost, (D) + (E) ( $\times 10^3$ YRS)	(G) Net production value, (B) - (F) ( $\times 10^3$ YRS)
Cotton	100	120	220	22	12	34	86
Coffee	1,000	11,200	4,000	4,000	1,120	5,120	6,080
Qut	6,800	1,047,200	4,000	27,200	104,720	131,920	915,280
Wheat	500	800	200	100	80	180	620
Barley	400	720	200	80	72	152	568
Grapes	1,000	57,600	15,000	15,000	5,760	20,760	36,840
Vegetables	400	16,000	2,500	1,000	1,600	2,600	13,400
Legumes	1,000	4,800	1,500	1,500	480	1,980	2,820
Tabacco	100	2,520	2,500	250	252	502	2,018
Sesame	100	1,250	2,000	200	125	325	925
Potatoes	200	6,400	2,500	500	640	1,140	5,260
Maize	500	1,125	270	135	115	250	875
Sorghum/Millet	70,000	112,000	240	16,800	11,200	28,000	84,000
Fruits, etc.	1,800	86,400	14,000	25,200	8,640	33,840	52,560
Total	83,900	1,348,135		91,987	134,816	226,803	1,121,332

- to be continued -

Table 9.4(a) Gross Crop Production Value, Production Cost and Net Crop Production Value (Hajjah Quada)

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRS)	(C) Unit production cost (YRS/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRS)	(E) Production tax, (B) $\times 10\%$ (YRS)	(F) Gross production cost, (D) + (E) ( $\times 10^3$ YRS)	(G) Net production value, (B) - (F) ( $\times 10^3$ YRS)
Cotton	-	-	-	-	-	-	-
Coffee	500	5,600	4,000	2,000	560	2,560	3,040
Qut	900	138,600	4,000	3,600	13,860	17,460	121,140
Wheat	200	320	200	40	32	72	248
Barley	100	180	200	20	18	38	142
Grapes	200	11,520	15,000	3,000	1,152	4,152	7,368
Vegetables	100	4,000	2,500	250	400	650	3,350
Legumes	200	960	1,500	300	96	396	564
Tobacco	-	-	-	-	-	-	-
Sesame	-	-	-	-	-	-	-
Potatoes	-	-	-	-	-	-	-
Maize	100	225	270	27	23	50	175
Sorghum/Millet	16,100	25,760	240	3,864	2,576	6,440	19,320
Fruits, etc.	200	9,600	14,000	2,800	960	3,760	5,840
Total	18,600	196,765	-	15,901	19,677	35,578	161,187

- to be continued -

Table 9.4(b) Gross Crop Production Value, Production Cost and Net Crop Production Value (Midi Quada)

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRS)	(C) Unit production cost (YRS/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRS)	(E) Production tax, (B) $\times$ 10% (YRS)	(F) Gross production cost, (D)+(E) ( $\times 10^3$ YRS)	(G) Net production value, (B)-(F) ( $\times 10^3$ YRS)
Cotton	100	120	220	22	12	34	86
Coffee	-	-	-	-	-	-	-
Out	-	-	-	-	-	-	-
Wheat	-	-	-	-	-	-	-
Barley	-	-	-	-	-	-	-
Grapes	-	-	-	-	-	-	-
Vegetables	150	6,000	2,500	375	600	975	5,025
Legumes	550	2,640	1,500	825	264	1,089	1,551
Tobacco	100	2,520	2,500	250	252	502	2,018
Sesame	100	1,250	2,000	200	125	325	925
Potatoes	100	3,200	2,500	250	320	570	2,630
Maize	100	225	270	27	23	50	175
Sorghum/Millet	41,300	66,080	240	9,912	6,608	16,520	49,560
Fruits, etc.	1,000	48,000	14,000	14,000	4,800	18,800	29,200
Total	43,500	130,035	-	25,861	13,004	38,865	91,170

-- to be continued --

Table 9.4(c) Gross Crop Production Value, Production Cost and Net Crop Production Value (Al-Mahabisha Quada).

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRS)	(C) Unit production cost (YRS/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRS)	(E) Production tax, (B) $\times 10\%$ (YRS)	(F) Gross production cost (D) + (E) ( $\times 10^3$ YRS)	(G) Net production value, (B) - (F) ( $\times 10^3$ YRS)
Cotton	-	-	-	-	-	-	-
Coffee	300	3,360	4,000	1,200	336	1,536	1,824
Qut	5,500	847,000	4,000	22,000	84,700	106,700	740,300
Wheat	100	160	200	20	16	36	124
Barley	100	180	200	20	18	38	142
Grapes	400	23,040	15,000	6,000	2,304	8,304	14,736
Vegetables	50	2,000	2,500	125	200	325	1,675
Legumes	100	480	1,500	150	48	198	282
Tobacco	-	-	-	-	-	-	-
Sesame	-	-	-	-	-	-	-
Potatoes	50	1,600	2,500	125	160	285	1,315
Maize	100	225	270	27	23	50	175
Sorghum/Millet	3,500	5,600	240	840	560	1,400	4,200
Fruits, etc.	100	4,800	14,000	1,400	480	1,880	2,920
Total	10,300	888,445	-	31,907	88,845	120,752	767,693

- to be continued -

Table 9.4(d) Gross Crop Production Value, Production Cost and Net Crop Production Value (Washha Ouada)

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRs)	(C) Unit production cost (YRs/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRs)	(E) Production tax, (B) $\times 10\%$ (YRs)	(F) Gross production cost, (D)+(E) ( $\times 10^3$ YRs)	(G) Net production value, (B)-(F) ( $\times 10^3$ YRs)
Cotton	-	-	-	-	-	-	-
Coffee	100	1,120	4,000	400	112	512	608
Qut	200	30,800	4,000	800	3,080	3,880	26,920
Wheat	100	160	200	20	16	36	124
Barley	100	180	200	20	18	38	142
Grapes	200	11,520	15,000	3,000	1,152	4,152	7,368
Vegetables	50	2,000	2,500	125	200	325	1,675
Legumes	50	240	1,500	75	24	99	141
Tabacco	-	-	-	-	-	-	-
Sesame	-	-	-	-	-	-	-
Potatoes	-	-	-	-	-	-	-
Maize	100	225	270	27	23	50	175
Sorghum/Millet	4,200	6,720	240	1,008	672	1,680	5,040
Fruits, etc.	500	24,000	14,000	7,000	2,400	9,400	14,600
Total	5,600	76,965	-	12,475	7,697	20,172	56,793

- to be continued -



Table 9.4(e) Gross Crop Production Value, Production Cost and Net Crop Production Value (Shahara Qadad)

Crops	(A) Cultivated area (ha)	(B) Gross production value ( $\times 10^3$ YRS)	(C) Unit production cost (YRS/ha)	(D) Total production cost, (A) $\times$ (C) ( $\times 10^3$ YRS)	(E) Production tax, (B) $\times$ (10%) (YRS)	(F) Gross production cost, (D)+(E) ( $\times 10^3$ YRS)	(G) Net production value, (B)-(F) ( $\times 10^3$ YRS)
Cotton	-	-	-	-	-	-	-
Coffee	100	1,120	4,000	400	112	512	608
Qut	200	30,800	4,000	800	3,080	3,880	26,920
Wheat	100	160	200	20	16	36	124
Barley	100	180	200	20	18	38	142
Grapes	200	11,520	15,000	3,000	1,152	4,152	7,368
Vegetables	50	2,000	2,500	125	200	325	1,675
Legumes	100	480	1,500	150	48	198	282
Tabacco	-	-	-	-	-	-	-
Sesame	-	-	-	-	-	-	-
Potatoes	50	1,600	2,500	125	160	285	1,315
Maize	100	225	270	27	23	50	175
Sorghum/Millet	4,900	7,840	240	1,176	784	1,960	5,880
Fruits, etc.	-	-	-	-	-	-	-
Total	5,900	55,925	-	5,843	5,593	11,436	44,489

Table 9.5 Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Hajjah Province)

(1) <u>Meat Production</u>						
Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production ( $\times 10^3$ tons)	Unit price (YRs/kg)	Production value ( $\times 10^3$ YRs)	
Cattle adult	88,000	200	1,260	15	18,990	
calves	—	50	80	10	800	
Sheep	168,000	10	588	30	17,640	
Goats	195,000	10	683	20	13,650	
Chickens	402,000	0.8	322	37.5	12,060	
						63,140

(2) <u>Milk and Eggs Production</u>						
Livestock Population (heads)	Off-take (%)	No. of adult (heads)	Production per head (litre, kg)	Production ( $\times 10^3$ litre, kg)	Unit price (YRs)	Production value ( $\times 10^3$ YRs)
Cattle	88,000	9.0	7,920	200	2	3,168
Sheep	168,000	35.0	58,800	17	2	1,998
Goats	195,000	35.0	68,250	17	2	2,320
Chickens	402,000	2.5	10,050	10	20	2,000
						9,486

(3) <u>Production Cost</u>							
No. of slaughtered animals (heads)	Feed per head (YRs)	Amount ( $\times 10^3$ YRs)	Production value Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1) + (2) - (3) ( $\times 10^3$ YRs)	
Cattle adult	6,330	1,050	6,646	18,990	3,168	6,646	15,512
calves	1,600	100	160	800	—	160	640
Sheep	58,800	100	5,880	17,640	1,998	5,880	13,758
Goats	68,250	100	6,825	13,650	2,320	6,825	9,145
Chickens	402,000	5	2,010	12,060	2,000	2,010	12,050
			21,521	63,140	9,486	21,521	51,105

(4) <u>Net Production Value</u>			
	Meat (1)	Milk & eggs (2)	Cost (3)
Cattle adult	18,990	3,168	6,646
calves	800	—	160
Sheep	17,640	1,998	5,880
Goats	13,650	2,320	6,825
Chickens	12,060	2,000	2,010
	63,140	9,486	21,521

:Source; Appraisal of Livestock Credit and Processing Project, Yemen Arab Republic (World Bank authorization) - to be continued -



Table 9.5(b) Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Midi Quada)

(1) <u>Meat Production</u>									
Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production ( $\times 10^3$ tons)	Unit price (YRS/kg)	Production value ( $\times 10^3$ YRS)				
Cattle adult	39,700	—	572.0	15	8,580				
calves	—	2,860	35.5	10	355				
Sheep	51,000	17,850	178.5	30	5,355				
Goats	61,000	21,350	213.5	20	4,270				
Chickens	72,000	72,000	57.6	37.5	2,160				
						20,720			

(2) <u>Milk and Eggs Production</u>									
Population (heads)	Off-take (%)	No. of adult (heads)	Production per head (litre, kg)	Production ( $\times 10^3$ litre, kg)	Unit price (YRS)	Production value ( $\times 10^3$ YRS)			
Cattle	39,700	9.0	200	715	2	1,430			
Sheep	51,000	35.0	17	303	2	606			
Goats	61,000	35.0	17	363	2	726			
Chickens	72,000	2.5	10	18	20	360			
							3,122		

(3) <u>Production Cost</u>									
No. of slaughtered animals (heads)	Feed per head (YRS)	Amount ( $\times 10^3$ YRS)	Production value Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1) + (2) - (3) ( $\times 10^3$ YRS)			
Cattle adult	2,860	1,050	3,003	1,430	3,003	7,007			
calves	710	100	71	—	71	284			
Sheep	17,850	100	1,785	606	1,785	4,176			
Goats	21,350	100	2,135	726	2,135	2,861			
Chickens	72,000	5	360	360	360	2,160			
							16,488		
							7,354		

(4) <u>Net Production Value</u>									
			Production value Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1) + (2) - (3) ( $\times 10^3$ YRS)			
Cattle			8,580	1,430	3,003	7,007			
adult			8,580	1,430	3,003	7,007			
calves			355	—	71	284			
Sheep			5,355	606	1,785	4,176			
Goats			4,270	726	2,135	2,861			
Chickens			2,160	360	360	2,160			
			20,720	3,122	7,354	16,488			

- to be continued -

Table 9.5(c) Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Al-Mahabisha Quada)

(1) Meat Production					
Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production ( $\times 10^3$ tons)	Unit price (YRS/kg)	Production value ( $\times 10^3$ YRS)
Cattle	14,000	—	—	—	—
adult	—	1,010	200	15	3,030
calves	—	250	50	10	125
Sheep	34,000	11,900	10	30	3,570
Goats	39,000	13,650	10	20	2,730
Chickens	96,000	0.8	76.8	37.5	2,880
					12,335

(2) Milk and Eggs Production						
Population (heads)	Off-take (%)	No. of adult (heads)	Production per head (litre, kg)	Production ( $\times 10^3$ litre, kg)	Unit price (YRS)	Production value ( $\times 10^3$ YRS)
Cattle	14,000	9.0	1,260	200	2	504
Sheep	34,000	35.0	11,900	17	2	404
Goats	39,000	35.0	13,650	17	2	464
Chickens	96,000	2.5	2,400	10	20	480
						1,852

(3) Production Cost					
No. of slaughtered animals (heads)	Feed per head (YRS)	Amount ( $\times 10^3$ YRS)	Production value Meat Milk & eggs (1)	Cost (3)	Net production value (1)+(2)-(3) ( $\times 10^3$ YRS)
Cattle					
adult	1,050	1,061	3,030	1,061	2,473
calves	100	25	125	25	100
Sheep	100	1,190	3,570	1,190	2,784
Goats	100	1,365	2,730	1,365	1,829
Chickens	5	480	2,880	480	2,880
		4,121	12,335	4,121	10,066

(4) Net Production Value				
	Production value Meat (1)	Production value Milk & eggs (2)	Cost (3)	Net production value (1)+(2)-(3) ( $\times 10^3$ YRS)
Cattle				
adult	3,030	504	1,061	2,473
calves	125	—	25	100
Sheep	3,570	404	1,190	2,784
Goats	2,730	464	1,365	1,829
Chickens	2,880	480	480	2,880
	12,335	1,852	4,121	10,066

- to be continued -

Table 9.5(d) Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Washha Quada)

(1) <u>Meat Production</u>															
Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production ( $\times 10^3$ tons)	Unit price (YRs/kg)	Production value ( $\times 10^3$ YRs)	(2) <u>Milk and Eggs Production</u>									
						Population (heads)	Off-take (\$)	No. of adult (heads)	Production per head (litre, kg)	Production ( $\times 10^3$ litre, kg)	Unit price (YRs)	Production value ( $\times 10^3$ YRs)			
Cattle	7,400	—	—	—	—	—	—	—	—	—	—	—	—	—	—
adult	—	530	200	106.0	15	1,590	—	—	—	—	—	—	—	—	—
calves	—	140	50	7.0	10	70	—	—	—	—	—	—	—	—	—
Sheep	17,000	5,950	10	59.5	30	1,785	—	—	—	—	—	—	—	—	—
Goats	20,000	7,000	10	70.0	20	1,400	—	—	—	—	—	—	—	—	—
Chickens	48,000	48,000	0.8	38.4	37.5	1,440	—	—	—	—	—	—	—	—	—
															6,285
(3) <u>Production Cost</u>															
Livestock population (heads)	No. of slaughtered animals (heads)	Feed per head (YRs)	Amount ( $\times 10^3$ YRs)	(4) <u>Net Production Value</u>											
				Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1)+(2)-(3) ( $\times 10^3$ YRs)								
Cattle	7,400	—	—	—	—	—	—	—	—	—	—	—	—	—	—
adult	—	1,050	556	1,590	266	556	1,300	—	—	—	—	—	—	—	—
calves	—	100	14	70	—	14	56	—	—	—	—	—	—	—	—
Sheep	17,000	100	595	1,785	202	595	1,392	—	—	—	—	—	—	—	—
Goats	20,000	100	700	1,400	238	700	938	—	—	—	—	—	—	—	—
Chickens	48,000	5	240	1,440	240	240	1,440	—	—	—	—	—	—	—	—
															946
(3) <u>Production Cost</u>															
Livestock population (heads)	No. of slaughtered animals (heads)	Feed per head (YRs)	Amount ( $\times 10^3$ YRs)	(4) <u>Net Production Value</u>											
				Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1)+(2)-(3) ( $\times 10^3$ YRs)								
Cattle	7,400	—	—	—	—	—	—	—	—	—	—	—	—	—	—
adult	—	1,050	556	1,590	266	556	1,300	—	—	—	—	—	—	—	—
calves	—	100	14	70	—	14	56	—	—	—	—	—	—	—	—
Sheep	17,000	100	595	1,785	202	595	1,392	—	—	—	—	—	—	—	—
Goats	20,000	100	700	1,400	238	700	938	—	—	—	—	—	—	—	—
Chickens	48,000	5	240	1,440	240	240	1,440	—	—	—	—	—	—	—	—
															946
															2,105
															2,105
															5,126

- to be continued -

Table 9.5(e) Gross Livestock Production Value, Production Cost and Net Livestock Production Value (Shahara Quada)

(1) <u>Meat Production</u>															
Livestock population (heads)	No. of slaughtered animals (heads)	Meat production per head (kg)	Meat production ( $\times 10^3$ tons)	Unit price (YRs/kg)	Production value ( $\times 10^3$ YRs)	(2) <u>Milk and Eggs Production</u>									
						Population (heads)	Off-take (%)	No. of adult (heads)	Production per head (litre, kg)	Production ( $\times 10^3$ litre, kg)	Unit price (YRs)	Production value ( $\times 10^3$ YRs)			
Cattle adult	7,500	540	200	15	1,620										
calves	---	140	50	10	70										
Sheep	18,000	6,300	10	30	1,890										
Goats	20,000	7,000	10	20	1,400										
Chickens	49,000	49,000	0.8	37.5	1,470										
															6,450
(3) <u>Production Cost</u>															
Livestock population (heads)	No. of slaughtered animals (heads)	Feed per head (YRs)	Amount ( $\times 10^3$ YRs)	(4) <u>Net Production Value</u>											
				Meat (1)	Milk & eggs (2)	Cost (3)	Net production value (1)+(2)-(3) ( $\times 10^3$ YRs)								
Cattle adult	540	1,050	567	1,620	270	567	1,323								
calves	140	100	14	70	---	14	56								
Sheep	6,300	100	630	1,890	214	630	1,474								
Goats	7,000	100	700	1,400	238	700	938								
Chickens	49,000	5	245	1,470	240	245	1,465								
			2,156	6,450	962	2,156	5,256								
							962								

Table 9.6 Results of Farm Economy Survey

Farm size	Mabyan		Al Mahabisha		Abs	
	No. of farm	%	No. of farm	%	No. of farm	%
0 - 0.25	4	8	5	17	4	15
0.25 - 0.5	2	4	4	13	8	31
0.5 - 0.75	7	14	4	13	5	19
0.75 - 1.0	7	14	2	7	1	4
1.0 - 1.25	4	8	1	3	1	4
1.25 - 1.5	6	12	2	7	3	11
1.5 - 1.75	4	8	2	7	1	4
1.75 - 2.0	1	2	1	3	1	4
2.0 - 2.25	5	10	2	7	1	4
2.25 - 2.5	2	4	2	7	1	4
2.5 - 2.75	1	2	0	-	1	4
2.75 - 3.0	0	-	1	3		
3.0 - 4.0	1	2	1	3		
4.0 - 5.0	1	2	1	3		
5.0 - 10.0	3	6	2	7		
10.0 over						
Total	50	100	30	100	26	100

-- to be continued --



(2) Distribution of Family Size

<u>Family member</u>	<u>Mabyan</u>		<u>Al Mahabisha</u>		<u>Abs</u>	
	<u>No. of household</u>	<u>%</u>	<u>No. of household</u>	<u>%</u>	<u>No. of household</u>	<u>%</u>
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3 - 4	0	0	1	3	3	12
5 - 9	6	12	14	47	8	31
10 - 14	22	44	9	30	6	23
15 - 19	16	32	4	13	4	15
20 -	6	12	2	7	5	19
<b>Total</b>	<b>50</b>	<b>100</b>	<b>30</b>	<b>100</b>	<b>26</b>	<b>100</b>

- to be continued -

(3) Value of Buildings

<u>Location</u>	<u>Nos/Farm</u>	<u>M<sup>2</sup>/house</u>	<u>Value (YRS)</u>	<u>Remarks</u>
Hajjah	1	165	150,000	Three storied, Stone
Mabyan	1	-	10,000	Stone
Mabyan	1	80	20,000	Stone
Mabyan	1	64	20,000	Stone
Mabyan	1	227	50,000	Tenement Stone
Al-Mahabisha	1	136	100,000	Stone
Al-Mahabisha	1	112	70,000	Two storied, Stone
Al-Mahabisha	1	64	3,000	
Abs	2	19	10,000	Grass
Abs	2	19	10,000	Grass
Abs	1	300	50,000	Tenement Brick-clay
Abs	1	160	150,000	Three storied, Stone

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- to be continued -

(4) Present Typical Farm Budget in Mabyan (Hajjah Quada)

<u>Crop income</u>														
Crop	Area (ha)	Yield (tons/ha)	Products (tons)	Price (YRS/kg)	Value (YRS)	<u>Livestock income</u>								
						Livestock	No. of animals (head)	Yield/head/year	Products	Value				
								milk (l)	milk (l)	milk (YRS)				
								meat (kg)	meat (kg)	meat (YRS)				
										Total (YRS)				
Millet	0.03	0.9	0.03	1,500	40	Milkcow	1.7	1,500	28	2,550	48	5,100	720	5,820
Sorghum	0.60	1.0	0.60	2,000	1,200	Cattle	1.0	18	18	18	18	36	270	306
Coffee	0.05	0.4	0.02	28,000	560	Donkey	0.9							50
Fruit	0.05	8.0	0.40	12,000	4,800	Goats	4.3	6	3.5	26	15	52	540	592
Out	0.07	2,200 bundles	154	70	10,780	Sheep	0.7	6	3.5	4	2	8	40	48
Stover	0.60	8.0	4.8	0.05	240	Chicken	4.0		0.8		3	114	114	114
Sub-total					17,620									6,930

Production cost

Crop	Area (ha)	Unit production cost (YRS/ha)	Total production cost (YRS)	Tax (YRS)	Total cost (YRS)	<u>Production cost</u>				
						Livestock	No. of animals (head)	Feed/head/year (kg)	Price of feed (YRS/kg)	Total cost (YRS)
Millet	0.03	240	7	4	11	Milkcow	1.7	3,000	0.05	255
Sorghum	0.60	240	144	120	264	Cattle	1.0	1,000	0.05	50
Coffee	0.05	4,000	200	56	256	Donkey	0.9	1,000	0.05	50
Fruit	0.05	14,000	700	480	1,180	Goats	4.3	500	0.05	108
Out	0.07	4,000	280	1,078	1,358	Sheep	0.7	500	0.05	18
Miscellaneous					460	Chicken	4.0	30	0.07	8
Sub-total					6,598	Miscellaneous				766

Crop income (A)

11,022

Gross farm income (A) + (B)

16,697

Remarks: 1/ Grain/Stover ratio of sorghum is estimated at 1/8.  
2/ Cost includes seeds, fertilizers, agro-chemicals, tools and hired labor wages, etc.

- to be continued -

(5) Present Typical Farm Budget in Al-Mahabisha (Mahabisha Qada)

Crop income				Livestock income							
Crop	Area (ha)	Yield (tons/ha)	Products (tons)	Price (YRS/kg)	Value (YRS)	Livestock	No. of animals (head)	Yield/head/year	Products	Value	Total (YRS)
								milk (kg)	milk (kg)	milk meat (YRS)	
								meat (kg)	meat (kg)	meat (YRS)	
Millet	0.10	0.6	0.06	1,500	90	Milkcow	1.2	1,500	1,800	34	4,110
Sorghum	0.10	0.7	0.07	2,000	140	Cattle	1.0	18	18	18	306
Fruit	0.03	8.0	0.02	12,000	240	Donkey	0.5				
Qut 1/	0.40	2,200 bundles	880	70	61,600	Goats	2.1	6	13	7	166
Stover	0.10	8.0	5.60	0.05	280	Sheep	0.4	6	2	1	34
Sub-total					62,350	Chicken	14.0	0.8		11	418
						Sub-total					5,034

Production cost				Production cost						
Crop	Area (ha)	Unit production cost (YRS/ha)	Total production cost (YRS)	Tax (YRS)	Total cost (YRS)	Livestock	No. of animals (head)	Feed/head/year (kg)	Unit price of feed (YRS/kg)	Total cost (YRS)
Millet	0.10	240	24	9	33	Milkcow	1.2	3,000	0.05	180
Sorghum	0.10	240	24	14	38	Cattle	1.0	1,000	0.05	50
Fruit	0.03	14,000	420	24	444	Donkey	0.5	1,000	0.05	25
Qut	0.40	4,000	1,600	6,160	7,760	Goats	2.1	500	0.05	53
Miscellaneous					1,241	Sheep	0.4	500	0.05	10
Sub-total					9,516	Chicken	14.0	30	0.07	29
						Miscellaneous				556
						Sub-total				903
Crop income (A)					52,834	Livestock income (B)				4,131
Gross farm income (A) + (B)					56,965					

Remarks: 1/ Grain/Stover ratio of sorghum is estimated at 1/8.  
 2/ Cost includes seeds, fertilizers, Agro-chemicals, tools and hired labour wages, etc.

- to be continued -

(6) Present Typical Farm Budget in Abs (Midi Quada)

<u>Crop income</u>				<u>Livestock income</u>										
<u>Crop</u>	<u>Area (ha)</u>	<u>Yield (tons/ha)</u>	<u>Products (tons)</u>	<u>Price (YRS/kg)</u>	<u>Value (YRS)</u>	<u>Livestock</u>	<u>No. of animals (head)</u>	<u>Yield/head/year</u>	<u>Products</u>	<u>Value</u>	<u>Total (YRS)</u>			
						<u>milk (l)</u>		<u>milk (kg)</u>	<u>meat (kg)</u>	<u>milk meat (YRS)</u>	<u>milk meat (YRS)</u>			
Millet	1.0	0.8	0.80	1,500	1,200		2.6	1,500	28	3,900	73	7,800	1,095	8,895
Sorghum red	0.6	0.9	0.54	2,000	1,080		3.9	18	18	70	70	140	1,050	1,190
Sorghum white	0.5	0.9	0.45	2,000	900		1.6							
Vegetables	0.1	7.0	0.7	7,000	4,900		3.7		3.5	120	70	240	1,720	1,960
Stover <sup>1/</sup>	1.1	8.0	8.8	0.05	440		20.0	6	3.5	128	75	256	1,800	2,056
<u>Sub-Total</u>					<u>8,520</u>		<u>15.3</u>	<u>0.8</u>	<u>12</u>	<u>456</u>	<u>14,557</u>			

Production cost

<u>Crop</u>	<u>Area (ha)</u>	<u>Unit production cost<sup>2/</sup> (YRS/ha)</u>	<u>Total production cost (YRS)</u>	<u>Tax (YRS)</u>	<u>Total cost (YRS)</u>
Millet	1.0	240	240	120	360
Sorghum red	0.6	240	144	108	252
Sorghum white	0.5	240	120	90	210
Vegetables	0.1	2,500	250	490	740
Miscellaneous					234
<u>Sub-total</u>					<u>1,796</u>

Crop income (A)

Gross farm income (A) + (B)

6,724

17,623

Remarks: 1/ Grain/Stover ratio of sorghum is estimated at 1/8.

2/ Cost includes seeds, fertilizers, Agro-chemicals, tools and hired labor wages, etc.

Production cost

<u>Livestock</u>	<u>No. of animals (head)</u>	<u>Feed/head/year (kg)</u>	<u>Unit price of feed (YRS/kg)</u>	<u>Total cost (YRS)</u>
Milkcow	2.6	3,000	0.05	390
Cattle	3.9	1,000	0.05	195
Camel	1.6	1,000	0.05	80
Donkey	3.7	1,000	0.05	185
Goats	20.0	500	0.05	500
Sheep	21.3	500	0.05	533
Chicken	15.3	30	0.07	32
Miscellaneous				1,743
<u>Sub-total</u>				<u>3,658</u>

Livestock income

10,899

-- to be continued --

(7) Living Expenditure

<u>Expenditure</u>	<u>Mabyan</u> (YRS) (%)	<u>Al Mahabisha</u> (YRS) (%)	<u>Abs</u> (YRS) (%)
Food	19,900 43	22,000 42	26,100 56
Clothes	5,000 11	6,400 12	2,900 6
Education	800 2	2,000 4	500 1
Housing	3,500 8	4,100 8	3,600 8
Medical	400 0.5	3,200 6	4,300 9
Consumable	2,100 5	1,100 2	1,400 3
Electric	5,700 12	5,500 10	1,200 3
Properties	400 0.5	300 -	500 1
Ceremonial	7,400 16	6,000 11	4,400 10
Social expenses	700 2	2,400 5	1,500 3
Total	45,900 100	53,000 100	46,400 100

(8) Present Typical Farm Budget

<u>Description</u>	<u>Mabyan (YRS)</u>	<u>Al. Mahabisha (YRS)</u>	<u>Abs (YRS)</u>
I Crop income	17,600	62,400	8,500
II Livestock income	6,900	5,000	14,600
III Wage and other income	29,300	100	28,900
IV Total gross income	53,800	67,500	52,000
V Farming expenditure	7,900	10,400	5,600
VI Living expenditure	45,900	53,000	46,400
VII Total gross outgo V + VI	53,800	63,400	52,000
Net reserve, IV - VII	0	4,100	0

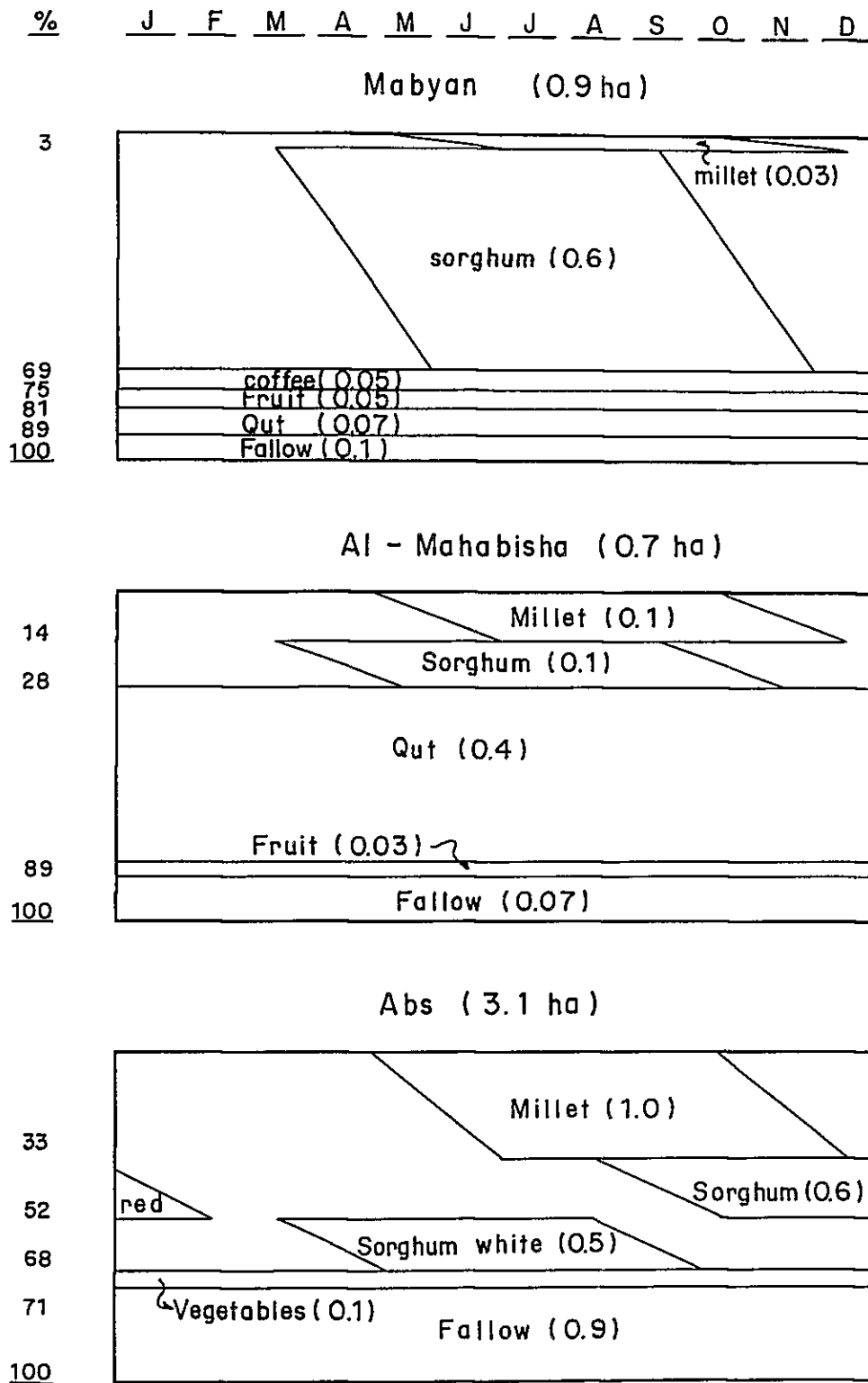


Fig. 9.1 Present Cropping Pattern



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## X PRESENT DEVELOPMENT PLAN AND ACTIVITIES

1. Development Organizations	X-1
Public administration and institutions to serve agriculture	X-1
Local Development Association	X-1
Foreign aid organizations	X-2
Problems and constraints of the development organizations	X-2
2. Present Development Plans	X-3
Rural road	X-3
Rural water supply	X-3
Electrification	X-4
Master plan and other projects	X-4



## X PRESENT DEVELOPMENT PLAN AND ACTIVITIES

### (1) Development Organizations

#### Public administration and institutions to serve agriculture

10.01 The Hajjah Province is located in the north-western part of the country, neighbouring northern provinces where the localities rather prefers to retain autonomy from national level authorities. In the Province itself, local administration is not fully developed and operates in the manner of traditional village organization, rather than as an extension of national public administration. In reality, public administration can only operate effectively with the support of the traditional form of local organization which has worked successfully over the years to settle the questions and problems relating to land and water rights, intra-communal disputes and to support local works of various kinds.

10.02 No branch offices of institutions to serve agriculture, except a branch office of ACB in Abs established in March, 1979, are existent in the Province, though they are desperately needed with a view to improving present farming practices as well as to introducing modern production techniques.

#### Local Development Association

10.03 Of some 150 LDAs established in the ten provinces of the country, 32 associations or about one fifth of the total are located in the Hajjah Province as of 1979. They have been working very effectively and also have strong influence over the National LDA Assembly Committee which comprises the heads of the LDA Administrative Committees.

10.04 Similar to the LDAs in other Provinces, LDAs in the Province have concentrated their activities in the project categories of rural access road, water supply, school and health facilities. They have been working quite successfully, constructing most of the existing rural access roads and water supply systems in the Province.

#### Foreign aid organizations

10.05 Since independence, YAR has received substantial amounts of foreign aid. Classified as a "least developed country" with low per capita income and as a "most severely affected country" which suffered a heavy economic damage by quadruple hike of oil price in 1974, most of the assistance was provided in the form of grants and concessional loans. Although complete record of all assistance received by YAR is not available, it can be estimated that cumulative aid disbursements reached nearly US\$750 million by the end of the 1976/77 fiscal year. Saudi Arabia, the Gulf States, Arab Fund, USSR, China, West Germany, United States and IDA are the major donors. Utilizing the foreign aid, several projects are under way in the Hajjah Province, brief descriptions of which are given in Section (2) of this chapter.

#### Problems and constraints of the development organizations

10.06 The development organizations in the Hajjah Province share common problems and constraints with these in other provinces as follows:

- a. acute shortage of all kinds of skills including shortage of qualified staffs for planning, administration and supervision.
- b. acute shortage of financial resources to cover the costs of rapidly growing number of development projects.

- c. insufficient coordination between the development organizations and associations.

These factors work as major institutional constraints which hinder the Province from further development.

## (2) Present Development Plans

### Rural road

10.07 Five-Year Plan envisaged to connect the town of Hajjah, the provincial capital of the Hajjah Province, with Sana'a, the Capital of the Republic, by constructing a 77 km long paved road between Hajjah and Amran with a total investment of YR77 million. As of 1979, the construction is under way by technical and financial assistance of China. Upon completion, Hajjah will be connected with Sadah, the provincial capital of Sadah Province, and Taiz, center of the economic activities in the southern parts of YAR as well as with Sana'a through north-south artery of YAR. The distance between Sana'a and Hajjah would be reduced to about 4 hours by car trip. This road is expected to make a great contribution to the overall development of the Province by opening up new markets for agricultural commodities produced in the Province as well as by moving civilization into the Province.

10.08 Besides Hajjah-Amran road, the Highway Authority has worked out a network of secondary and feeder roads which are highly desirable to be implemented.

### Rural water supply

10.09 A water supply project is in progress in the town of Al Mahabisha by German assistance. The Japanese Government is also undertaking survey works for the implementation of water supply projects. The Rural Water Supply

Corporation has three (3) water supply projects in contemplation, one in Qufi Shamal, another in Sharhil and the other in Miftah.

#### Electrification

10.10 For the town of Hajjah, a electrification project is envisaged in the Five-Year Plan with a total investment of YR12 million.

#### Master plan and other projects

10.11 Besides these individual programme, study works are under way to draw up a comprehensive master plan with the technical assistance of the Japanese Government, aiming at achieving integrated rural development of the Hajjah Province.

10.12 During the first field survey conducted from December 1978 through January 1979, the Japanese team made a series of interviews to the people concerned with the development of the Province and gathered numbers of requests for development projects, comprising road construction, water supply, schools and hospitals, and agricultural projects. These projects are will be carefully examined in the studies of each development sector.

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## XI BASIC CONCEPT AND STRATEGY FOR DEVELOPMENT

- |  |      |
|--|------|
| 1. Present Environment for Development | XI-1 |
| 2. Basic Concept for Development       | XI-4 |
| 3. Development Strategy                | XI-6 |

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## XI. BASIC CONCEPT AND STRATEGY FOR DEVELOPMENT

### (1) Present Environment for Development

11.01 About 96 % of the whole population of the Province are living in the rural areas and more than 90 % of them are engaged in the agriculture. Other industries including home industry, local manufacture, transport service, building and construction industry, commerce and public services still remain at their initial stage of development and they play rather minor role in the overall economic operations of the Province.

11.02 The Province, however, is by no means richly endowed with agricultural resources with small and erratic rainfall and limited area of cultivable land. Out of the total area of about 9,590 km<sup>2</sup>, only 1,410 km<sup>2</sup> are under cultivation. Of the 1,410 km<sup>2</sup> of the cultivated land, only 150 km<sup>2</sup> is under irrigation including spate irrigation. The rest or about 89 % of the total farm land is cultivated under rain-fed condition. Average annual rainfall is about 700 mm in the mountainous area and about 160 mm in the Tihama plain. Most of the rainfall is concentrated during two rainy seasons, April through May and July through August. Only 5 percent of the rainfall is available as surface water, most of which is in the form of flood discharge. The total maximum ground water which is normally rechargeable is estimated at only 20 million m<sup>3</sup> per annum. The water resources available in the Province is quite limited and are unevenly distributed both in time and space. Manpower resources are still under-developed. The literacy rate is as low as 19 percent, which is far below the national average. The manpower situation is characterized by an overall scarcity of qualified labour, as a result of the fact that basic facilities for development of human resources, such as education and training, are in severe shortage.

11.03 Moreover, the traditional production techniques are still prevalent without the use of high yielding varieties, fertilizer and pesticides. The agricultural support services, required for the introduction and dissemination of the modern production techniques, have no branch offices in the Province, except the Agricultural Credit Bank (ACB) which has a branch office in Abs. Consequently, the productivity in agriculture in the Province remains low, falling behind the national average.

11.04 About 70 % of the total cultivable land in the Province is owned by tribal leaders and merchants. About 20 % is the property of religious institutions. A large majority of the farmers are engaged in agriculture as tenants under crop sharing arrangements. About one-third to one half of the total proceeds are usually taken by the land-owners as farm rent. The rest, or only one half to two thirds is left for the tenants. Moreover the 10 % zakat tax is frequently borne by the tenants. There are also considerable number of peasants. Their land holding size is quite limited, just sufficient for maintaining their subsistence, taking into account the current low crop intensity and low productivity. The agriculture in the Province is thus characterized by a large number of tenants and small independent farmers whose incomes are quite low.

11.05 All the roads running in the Province are primitive tracks, suitable only for four-wheel drive vehicles and animal transport. Even these roads are usually closed during rainy seasons. Most of the villages and towns are socially and culturally isolated from each other and market-ing areas are confined within wadi flood basins and sub-range of mountains. In rural areas, no villages are equipped with domestic water supply system. Villagers are forced to consume a large portion of day time in the laborious

work of water fetching. The water is usually contaminated and causes various water borne diseases. Health facilities are inadequate both in number and quality. The number of population per hospital bed is bigger than the national average. Although the number of primary schools can be considered sufficient, most of them are incomplete having only three grades or less and are suffering from acute shortage of qualified teaching staffs. In the Province, telecommunication facilities are hardly available. Very few villagers can afford electricity supply mainly through small portable generators. The Province is in no sense well equipped with social infrastructure and only few people enjoy satisfactory social services.

11.06 Industry in YAR as a whole, is still in its infancy. Besides, there are serious limiting factors which work as constraints against industrial development. In the Province, the environment for industrialization is worse, suffering an acute shortage of management and technical skills as well as industrial requisites such as electricity, internal transport and water. Up to date, industrial development has been concentrated on the major cities located in the southern part of the country and the situation is most likely to be unchanged in the foreseeable future.

11.07 In the economic and cultural context, the Province lags far behind the advanced provinces in the southern part of the country. This disparity together with the opportunities for earning higher wages abroad have accelerated the massive outmigration of these rural inhabitants who have been putting up with the poor standard of living for long.

(2) Basic Concept for Development

Major Objectives

11.08 Under these conditions, a comprehensive and integrated rural development of the Province has long been aspired for by the inhabitants and is of urgent necessity. The major objectives of the development, some of which are interrelated and interdependent each other, should comprise:

- a. to raise the low incomes of a large majority of rural inhabitants.
- b. to improve social and economic partiality among the rural people.
- c. to improve the standard of living of the rural inhabitants, giving due attention to their basic needs for food, water supply, health, elementary education and other social services.
- d. to move civilization into the rural areas.
- e. to realize solidarity between the historically scattered communities.
- f. to prevent the massive outmigration of the rural people.
- g. to reduce the economic-social-cultural imbalance between the southern advanced provinces and the Province.
- h. to reinforce the central authority in the Province.

11.09 Considering all these, the ultimate objectives of the integrated rural development can be formulated as follows:

- a. to increase agricultural production and stimulate economic growth, and
- b. to improve the condition of rural life.

11.10 Agriculture should play the pivotal role in attaining these objectives. Even with the limited resources endowed, agriculture could grow substantially. The present low productivity could greatly be improved by adopting modern agricultural production techniques, i.e., use of high yielding plant varieties, chemical fertilizer and insecticides and farm mechanization with the aid of the proper agricultural support activities including extension and research services. Improvement of road transport will open up new markets and expand marketing area for farm products, accelerating the reorientation from subsistence farming to market-oriented agriculture. Crop diversification from low-value crops to more profitable high-value crops will further stimulate the expansion of agricultural production.

11.11 The improvement of social infrastructure should also play a substantial role in accomplishing the development objectives. The effects derived from the betterment of social infrastructure will be twofold. It will raise by a large margin the standard of living in the rural areas by improving health condition, realizing solidarity between the scattered communities, moving civilization and various amenities into the rural areas and the like. Meanwhile, it will raise the productivity of the rural economy by providing labour with higher physical performance and skills as well as by relieving women and children from laborious work of water fetching and thereby providing additional labour to the labour-short economy.

11.12 The higher incomes attained by the restoration and modernization of agriculture together with the improved standard of living achieved by the betterment of social infrastructure will alleviate the heavy outmigration of the able-bodied rural inhabitants, which will reinforce the human resources base of the agricultural production and



further promote agricultural development.

(3) Development Strategy

11.13 It would not be practicable nor efficient, however, to start the implementation of all the development projects immediately throughout the Province because of the following reasons:

- a. statistics and data base required for minute planning and implementation of development projects are very feeble.
- b. organizations equipped with necessary technical and managerial expertise to handle and promote development planning and implementation of the projects as well, is not yet fully developed.
- c. present agricultural frame does not permit the immediate dissemination of modern agriculture because of the lack of essential factors including the institutions to serve agriculture, adequate road transport and the like.
- d. limited availability of investment fund.

11.14 A stage-wise development policy will, therefore, have to be adopted under these situations for development. The development projects should be of small scale initially and be gradually expanded as more knowledge and experience are obtained together with building of skilled manpower. The initial projects will have to be carefully determined in accordance with the priority of each development projects to be identified in the studies on various development sectors. The initial projects which will have the top priority, will then be integrated in a particular area where physical and economical environment is favourable. In the first place, all the development efforts will be

concentrated to this priority area. Development of other areas will be made successively on the basis of the achievement and results of the initial integrated projects to be carried out in the priority area.

11.15 The priority area will have to be selected after full studies on all the development possibilities which will be made in the following chapters. The project categories which will be given priority, are discussed below.

11.16 The following three categories of development projects should be placed the highest priority, considering their importance in the overall development of the Province as well as their urgent necessity for implementation evidenced by strong demand by the inhabitants and should, therefore, be implemented during the first stage of the integrated rural development.

- a. basic projects for agricultural development
- b. rural water supplies
- c. construction and upgrading of rural roads

11.17 Agriculture should play the leading role in the restoration and further development of the rural areas of the Province. Under the present development environment, however, much remains to be done before the full agricultural development is materialized. Necessary measures should be taken in order to enhance and make better use of the meager agricultural resources in the Province. Afforestation and restoring of vegetation cover, which would have beneficial effects of soil retention and fostering of water resources, should be accelerated. Measures should be taken to restore and enhance the soil fertility that is at present in an exhausted condition. With a view to procuring a proper understanding of the water resources in the Province,

a meteorological and hydrological observation network should be set up. The data will be analyzed and will be fully utilized for water resources development planning as well as for better use of the existing resources. In advance of the full introduction of the modern agriculture into the Province, basic research activities as well as training of qualified personnel to serve agriculture will also be required.

11.18 Supply of hygienic water will bring about the direct benefits of improvement of public health, saving in time and money and improvement of animal health. Improvement of public health will lead to higher physical performance and resistance against diseases as well as to longer life expectancy. Women and children could spend additional time saved through the water supply projects either on sewing, handicraft, better housekeeping, farming or attending school. Money saved could be utilized for investment on capital investment. Improvement of animal health will lead to better and faster meat production. Water supply projects will thus produce the indirect benefit of higher productivity of the economy. Supply of hygienic water is indispensable for securing public health as well as for raising the productivity of the economy.

11.19 The effects and benefits derived from the reinforcement of the present road network will be magnificent and manifold. From a social and cultural point of view, it will make a great contribution to breaking up regional isolation by linking the historically scattered rural communities. It will move civilization into the rural areas and improve health and educational environment by providing the inhabitants better access to these facilities. Better availability of consumption goods at cheaper prices will also be achieved. It will make substantial contribution to the economic

development of the Province by expanding marketing area for farm products as well as providing timely marketing information. It will further realize smooth supply of farm inputs and promote the dissemination of agricultural support service. Opening up of new roads and the upgrading of the existing ones are the pre-requisites to the cultural life in the rural inhabitants as well as to the restoration and further development of agriculture.



## XII RURAL WATER SUPPLIES

1.	General	XII - 1
2.	Necessity of Rural Water Supplies	XII - 1
3.	General Development Plan	XII - 4
4.	Water Supply Facilities	XII - 5
5.	Operation and Maintenance	XII - 6

### Tables

12.1	List of Water Supply Schemes	XII - 7
12.2	Design of Pumps	XII - 8
12.3	Design of Pipes and Public Hydrants	XII - 9

### Figures

12.1	Location of Water Supply Schemes	XII-10
12.2	Typical Profile of Water Supply System	XII-11
12.3	General Plan of Water Supply Schemes	XII-12
	a. Hajjah area	XII-12
	b. Mabyan area	XII-13
	c. Bani Kais area	XII-14
	d. Bayt Idhaqah area	XII-15
	e. Kuhlän area	XII-16
	f. Al Mahabisha area	XII-17
	g. Miftah area	XII-18
	h. Kusher area	XII-19
	i. Aslam area	XII-20
	j. Habour area	XII-21
	k. Shahara area	XII-22
	l. Washha area	XII-23

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## XII RURAL WATER SUPPLIES

### (1) General

12.01 At present, very few people can afford hygienic water supply in YAR. A large majority of the people generally get their drinking water either from cisterns or from wadi streams, which are usually insanitary causing serious health problem. Women and children carry the laborious work of fetching water from water sources which are usually located far away from their dwellings spending quite a long time. In the Hajjah Province, only the town of Hajjah, capital of the Province, is equipped with domestic water supply system. Even in this town, however, the system does not cover the whole population. In rural areas, no water supply system is in existence. Supplying the population with hygienic drinking water has long been a strong wish of the whole population of the Province.

### (2) Necessity of Rural Water Supplies

12.02 The necessities of and the major benefits derived from the execution of rural water projects are described as follows:

- a. Improvement of public health: The Yemen National Health Programme 1976/77 - 1981/82 lists ten (10) priority diseases to be expelled from the country; the first three out of ten in order of priority are a) diarrhoeal diseases b) tuberculosis and c) schistosomiasis malaria. Of these diseases, diarrhoeal diseases and schistosomiasis are prevalent in the Hajjah Province. Diarrhoeal diseases are largely caused by contaminated water and are the principal reasons for the high infant mortality in the Province. Schistosomiasis is mainly caused by infestation with schistosomes in standing



waters, particularly cisterns. The estimated prevalence in the Hajjah Province is 255 patients per 1,000 persons, much higher than the national average of 97 patients per 1,000 persons, and the highest in the country. Supply of hygienic water coordinated with health facilities would make a great contribution to improving the health condition of the people and bring down by big margin the high infant mortality in the Province.

- b. Time savings: Majority of the villages get their water either from cisterns fed by rainfall, wadis or springs. Daily time consumption spent on water fetching, for which women and children are usually responsible, is quite considerable. The average daily time consumption per woman or child for water fetching is estimated at nearly two hours. As the standard of living goes up, demand for water per capita is expected to grow rapidly. As the population grows, total time consumption for water fetching will go up proportionately. Construction of water supply systems would provide people with better access to water sources and reduce sharply the average walking distance. Consequently, time consumption per capita for fetching water would substantially be reduced and women and children would be relieved from the daily laborious work.
- c. Money savings: Water supply in the Hajjah Province is partly cared for by water lorries that bring water from distant wadis and wells into towns and villages. The customers are usually rich people per capita consumption of whom is much higher than the average. Water supply system would provide these people with hygienic water at

cheaper price than that through water lorries and the balance could be saved.

- d. Improvement of animal health: At present, live-stock drink water either from cisterns or wadi streams. The water is usually contaminated or at least insanitary and causes various animal diseases. The implementation of water supply projects would provide hygienic water for livestock and could thereby improve the animal health coordinated with veterinary care.

12.03 The implementation of water supply projects would bring about significant indirect benefits besides the direct ones, coordinated with various supporting activities. The execution of water supply projects would substantially improve the health condition of the population of the Province, which will lead to higher physical performance and resistance against diseases as well as to higher life expectancy. Women and children would be released from laborious work of water fetching. Additional time could be spent on longer recreation periods and better child care. Younger women with less family responsibility would be engaged in agricultural works. With the help of training programmes, they could spend their spare time on sewing, handicraft and better housekeeping. Children could spend the additional time either on animal husbandry or hopefully on attending school. The execution of water supply projects would thus enhance labour force which is insufficient in the Province both in quality and quantity. Improvement of animal health through hygienic water supply will also lead to better and faster meat production. Construction of water supply system would significantly contribute to the increase of the productivity of the economy.

### (3) General Development Plan

12.04 Water supplies would be provided to twenty-five (25) towns and villages, as marked and numbered on Fig. 12.1, with population totalling 132,000 inhabitants and containing about 32 percent of the total population of the Province. It is difficult to increase the number of the beneficiaries at the present stage, because most of the settlements are very scattered and generally too small in size. Capacity of each water supply unit to be installed, however, will have enough room for future expansion when needs arise, and will be able to supply water to about half of the population at the ultimate stage.

12.05 The first stage project for rural water supplies will comprise twenty-five (25) water supply schemes, and will cover almost all of the large settlements with the population more than 1,000. The second stage will therefore be rather small scale, especially for the small settlements with the population less than 1,000. The present chapter deals with only the first stage schemes.

12.06 Water supply installation would consist of intake boxes or tube wells as the intake facilities, pumps, storage tanks, pipes and public hydrants as shown on Fig. 12.2. The designs are planned to provide eighty litres per day per person, which is considered to be sufficient to cover all domestic uses including village livestock. Water sources are surface water, ground water and springs.

12.07 The water will be pumped up from intake facilities to the storage tanks which will be built on the high places from where water will be conveyed by gravity to the public hydrants in villages.

#### (4) Water Supply Facilities

12.08 The present designs are of very preliminary nature and will not be used for construction purpose, but will give basic idea for rural water supplies in the Province.

12.09 Intake facilities will be the intake boxes or tube wells. If the water table is too low at the intake site, a cut-off structure will be constructed to dam up the underground wadi flow.

12.10 The pumps will be multistage volute type with very high-head capacity, and will be operated for eight hours daily. There are two ways of operating the pumps; i.e., diesel driven and electric driven.

- a. Diesel driven pumps: The initial cost is comparatively low. However, pump operations are rather complicated and may be difficult to master for the local inhabitants.
- b. Electric driven pumps: A power generating station will be required, resulting in higher initial costs. The pump operations are rather easy.

Although the initial cost is higher, the electric-driven pump units are recommendable for their easier operation. The electric power can also be used for lighting at night and for other domestic uses.

12.11 As far as pipes are concerned, ductile cast iron pipe, steel pipe and hard vinyl chloride pipe will be used. The storage tank structures will be made of reinforced concrete and the capacity have been designed to meet the daily consumption.

12.12 Each rural water supply scheme was studied on the

basis of the topographic maps scaled 1 to 50,000. The general plans of each scheme are shown in Fig. 12.3.

(5) Operation and Maintenance

12.13 It is proposed that the pumps and pipes with same specifications should be used at every water supply schemes sites for easier arrangement of spare parts and operators. It is also proposed that the pumps should be operated by salaried pump operators recruited from the local community, and that these operators should receive a basic training in advance.

Table 12.1 List of Water Supply Schemes

<u>Name of town or village</u>	<u>Planned service population</u> (persons)	<u>Planned supply amount</u> (m <sup>3</sup> per day)	<u>Water resources</u>
1. Hajjah	15,000	(existing)	
2. Suq Al Aman	1,800	144	Wadi Waru
3. Ash Shafadirah	9,500	760	Wadi Husayb
4. North Mabyan	5,400	432	Wadi Mawr
5. Jabal Al Dafir	4,800	384	Wadi Sharas
6. Mabyan	5,100	408	Wadi Mawr
7. Bani Kais	5,200	416	Wadi Laah
8. Bayt Idhaqah	5,200	416	Wadi Hijlah
9. Kuhlan	5,900	472	Wadi Umyan
10. Affar	3,700	296	Wadi Umyan
11. Sharhil	4,000	320	Wadi Yamaniyah
12. Qufl Shamal	2,300	184	Wadi Yamaniyah
13. Al Shaafeen	3,100	248	Wadi Yamaniyah
14. Al Mahabisha	15,000	(under construction)	
15. Miftah	2,000	160	Wadi Mawr
16. Kusher	3,400	272	Wadi Mawr
17. Al Muhanag	4,000	320	Wadi Bawhal
18. Aslam	1,600	128	Wadi Bawhal
19. Habour	2,100	168	Wadi Hashid
20. Shahara	2,000	160	Wadi Hashid
21. Al Madan	6,700	536	Wadi Mawr
22. Washha	12,500	1,000	Wadi Harad
23. Abs	5,300	424	Wadi Bawhal
24. Harad	2,300	184	Wadi Harad
25. Midi	3,800	304	Wadi Harad

(131,700)

Table 12.2 Design of Pumps

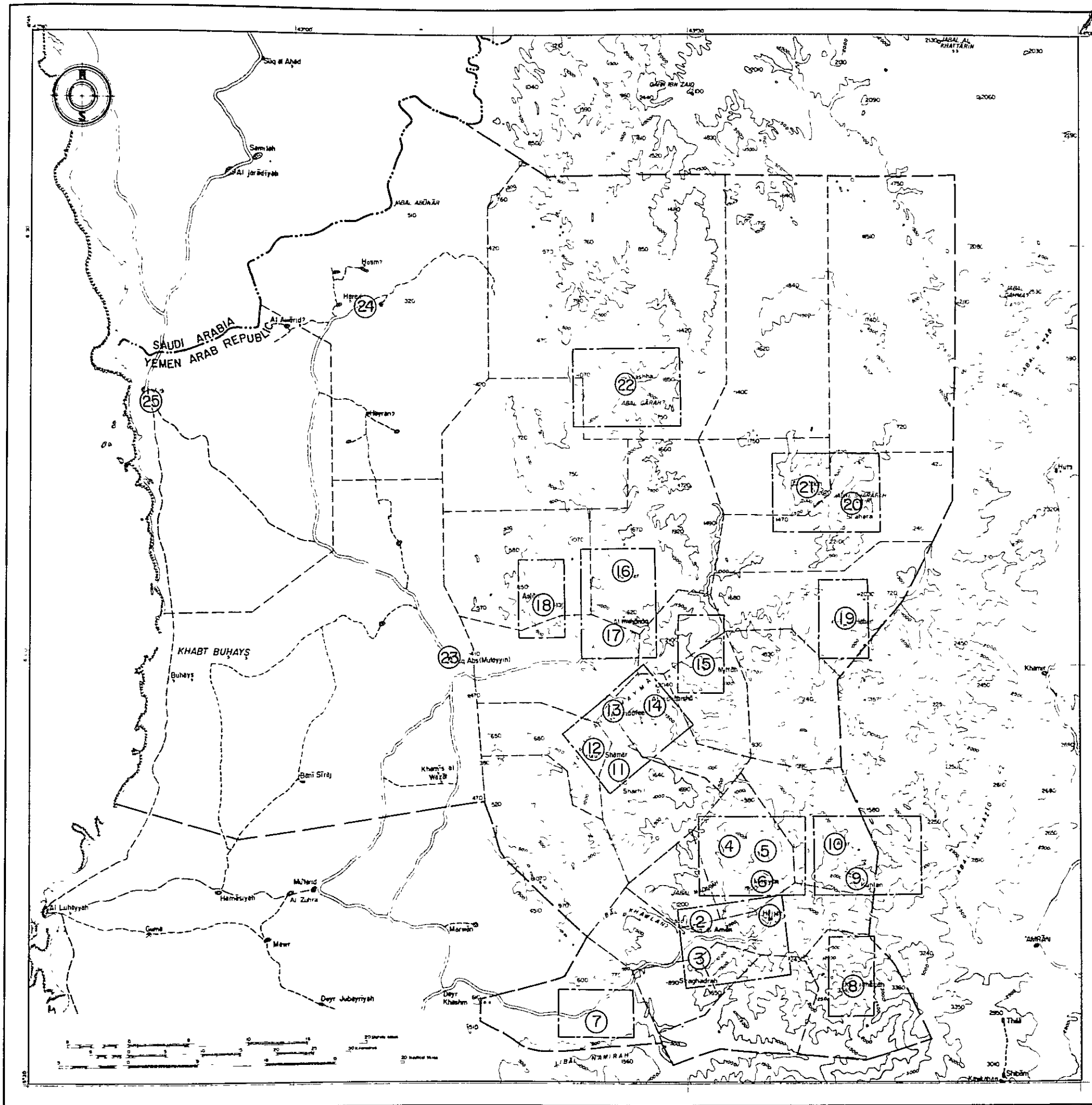
Name of town or village	Discharge of water source  (m <sup>3</sup> per min.)	Pump station (Type-Number of pumps)				
		P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
1. Hajjah	(existing)					
2. Suq Al Aman	0.3	C-1				
3. Ash Shafadirah	1.6	E-2	E-2	F-1	D-1	
4. North Mabyan	0.9	F-1	F-1	D-1		
5. Jabal Al Dafir	0.8	E-1	E-1	E-1	C-1	
6. Mabyan	0.9	F-1	E-1	E-1	D-1	
7. Bani Kais	0.9	F-1				
8. Bayt Idhaqah	0.9	F-1	D-1	D-1	B-1	
9. Kuhlan	1.0	F-1	F-1	F-1	E-1	
10. Affar	0.7	E-1	E-1	E-1		
11. Sharhil	0.7	E-1	D-1			
12. Quf1 Shamal	0.4	C-1				
13. Al Shaafeen	0.6	D-1				
14. Al Mahabisha	(under construction)					
15. Miftah	0.4	C-1	C-1	C-1	C-1	
16. Kusher	0.6	D-1				
17. Al Muhanag	0.7	E-1	E-1	E-1		
18. Aslam	0.3	C-1				
19. Habour	0.4	C-1	C-1	C-1		
20. Shahara	0.4	C-1	C-1	C-1	C-1	
21. Al Madan	1.2	D-2	D-2	D-2	D-2	D-1
22. Washha	2.1	F-2	F-2	F-1	D-1	
23. Abs	0.9	F-1				
24. Harad	0.4	C-1				
25. Midi	0.7	E-1				

<u>Pump Type</u>	(Actual head 300m)					
Type	A	B	C	D	E	F
Bore-Power (mm) (kw)	50-22	50-30	80-45	80-55	100-75	100-90
Discharge (m <sup>3</sup> per min.)	0.1	0.2	0.3,0.4	0.5,0.6	0.7,0.8	0.9,1.0

Table 12.3 Design of Pipes and Public Hydrants

<u>Name of town or village</u>	<u>Pipes</u>		<u>Number of public hydrants</u>
	<u>Diameter (mm)</u>	<u>Total length (m)</u>	
1. Hajjah	(existing)		
2. Suq Al Aman	50-75	6,900	4
3. Ash Shafadirah	50-150	21,500	14
4. North Mabyan	50-75	16,400	8
5. Jabal Al Dafir	50-100	16,100	11
6. Mabyan	50-100	20,500	10
7. Bani Kais	50-100	15,000	13
8. Bayt Idhaqah	50-100	15,300	8
9. Kuhlan	50-100	20,000	12
10. Affar	50-100	12,100	6
11. Sharhil	50-100	8,900	5
12. Qufi Shamal	50-75	8,800	6
13. Al Shaafeen	50-75	12,300	10
14. Al Mahabisha	(under construction)		
15. Miftah	50-75	14,300	4
16. Kusher	50-75	19,000	8
17. Al Muhanag	50-100	15,700	8
18. Aslam	50-75	8,600	4
19. Habour	50-75	12,600	5
20. Shahara	50-75	11,200	3
21. Al Madan	50-100	14,800	7
22. Washha	50-150	33,100	15
23. Abs	50-100	5,000	5
24. Harad	50-75	5,000	5
25. Midi	50-100	5,000	5





List of Water Supply Schemes

Name of Town or Village	Planned Service Population (Persons)
1 Hajjah	15,000
2 Suq Al Aman	1,800
3 Ash Shafadirah	9,500
4 North Mabyan	5,400
5 Jabal Al Dafir	4,800
6 Mabyan	5,100
7 Bani Kais	5,200
8 Bayt Idhaqah	5,200
9 Kuhlan	5,900
10 Affar	3,700
11 Sharhil	4,000
12 Qufi Shamal	2,300
13 Al Shaafeen	3,100
14 Al Mahabisha	15,000
15 Miftah	2,000
16 Kusher	3,400
17 Al Muhanaq	4,000
18 Aslam	1,600
19 Habour	2,100
20 Shahara	2,000
21 Al Madan	6,700
22 Washha	12,500
23 Abs	5,300
24 Harad	2,300
25 Midi	3,800


 Boundary  
 of Maps Scaled 1/50,000

Fig.12.1 Location of Water Supply Scheme



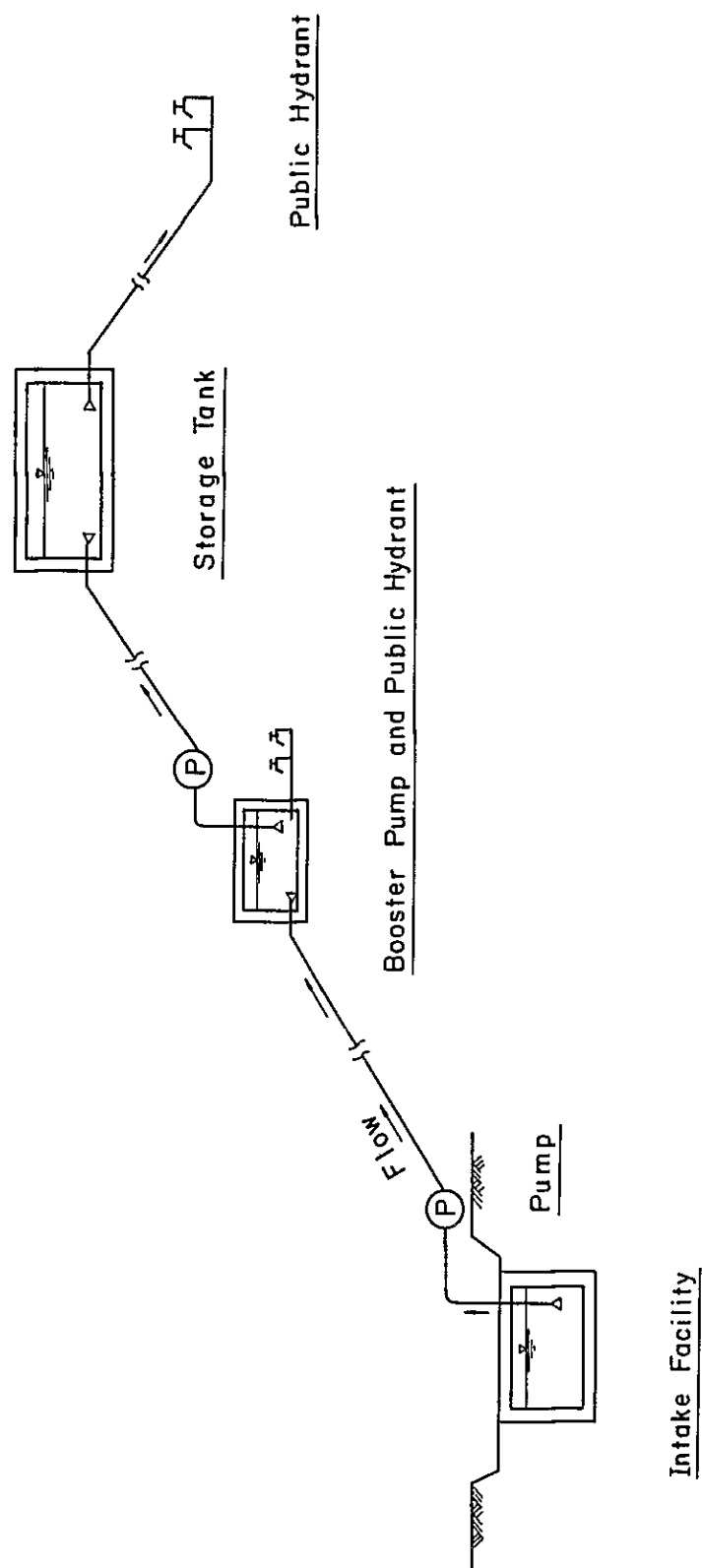
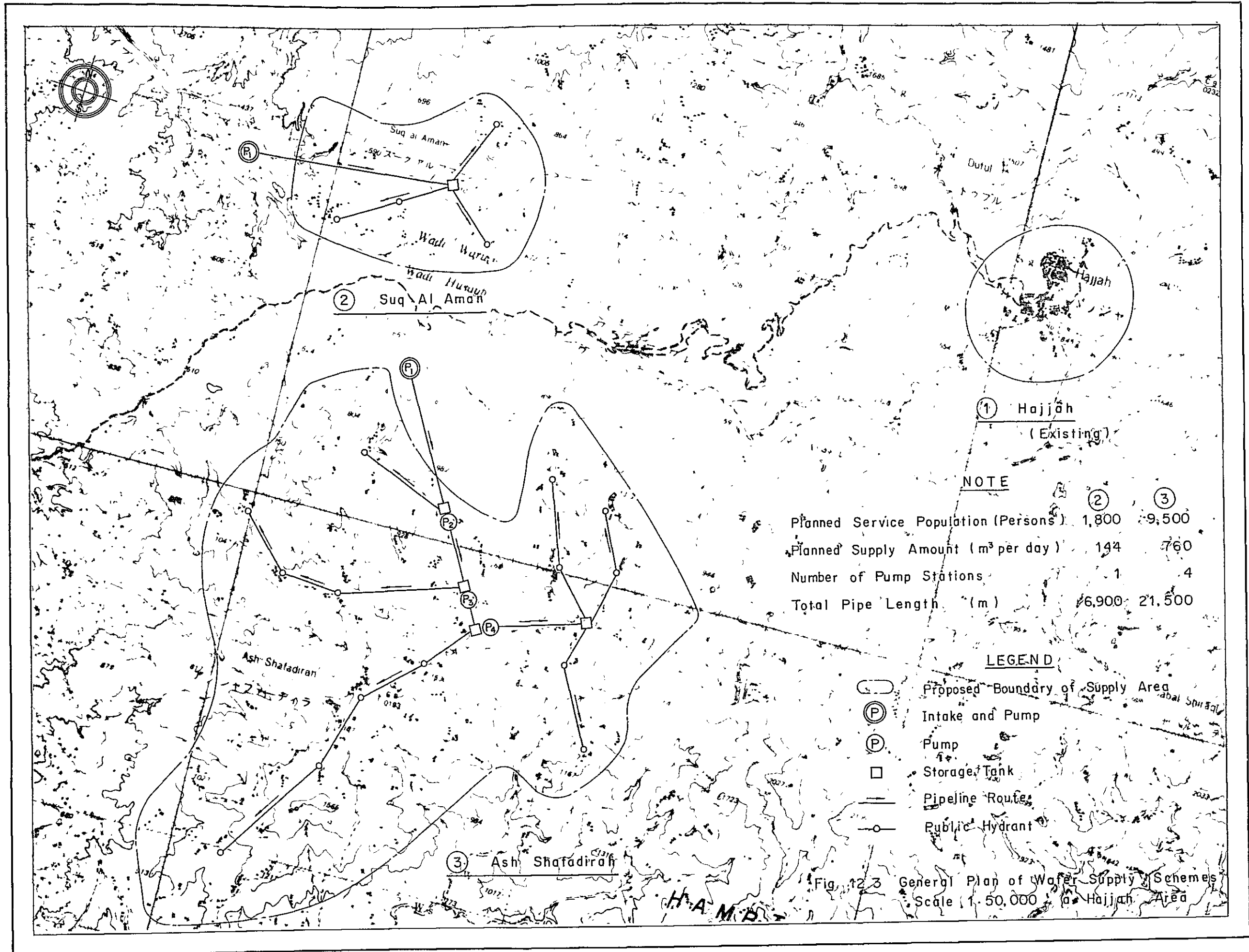
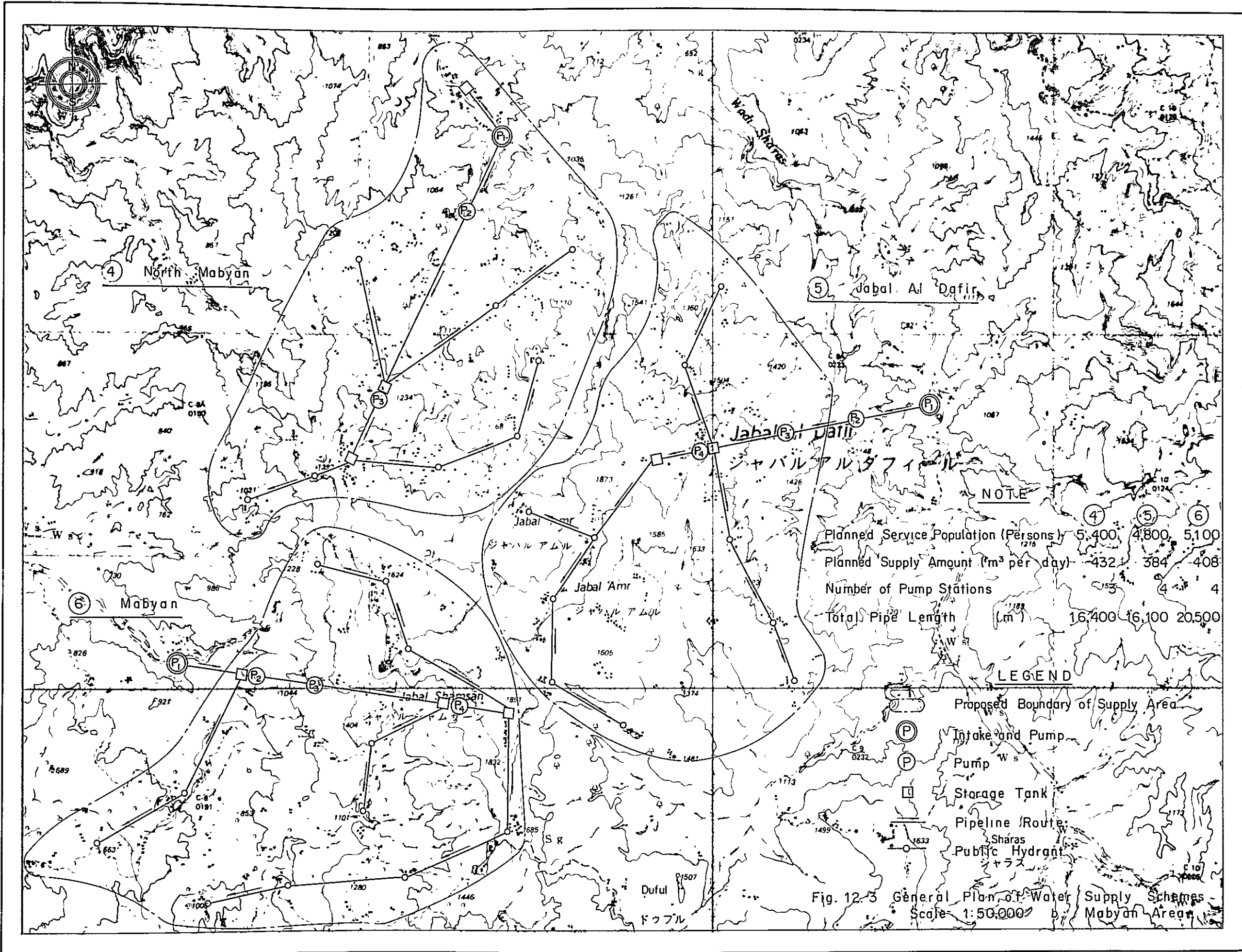
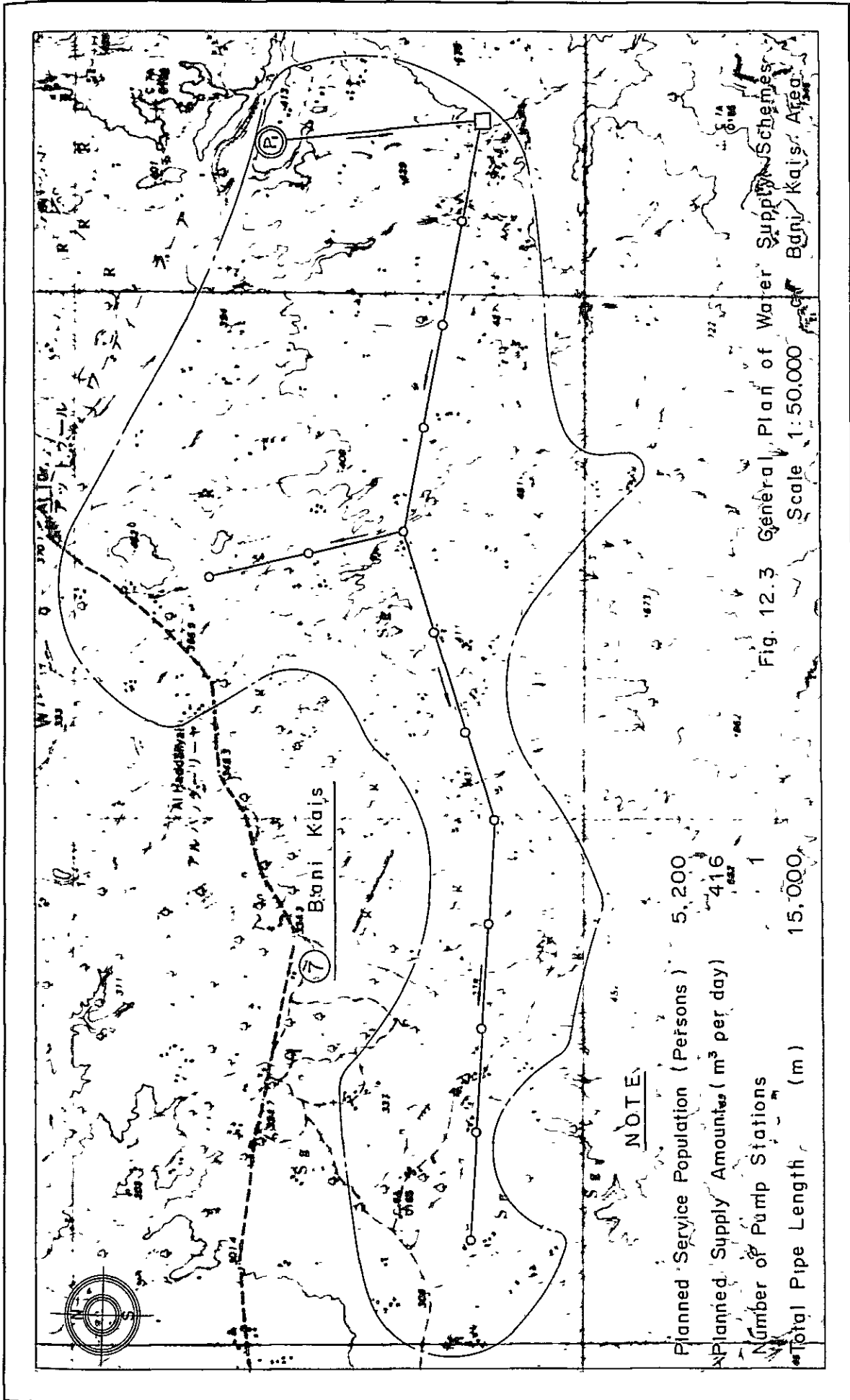


Fig. 12.2 Typical Profile of Water Supply System



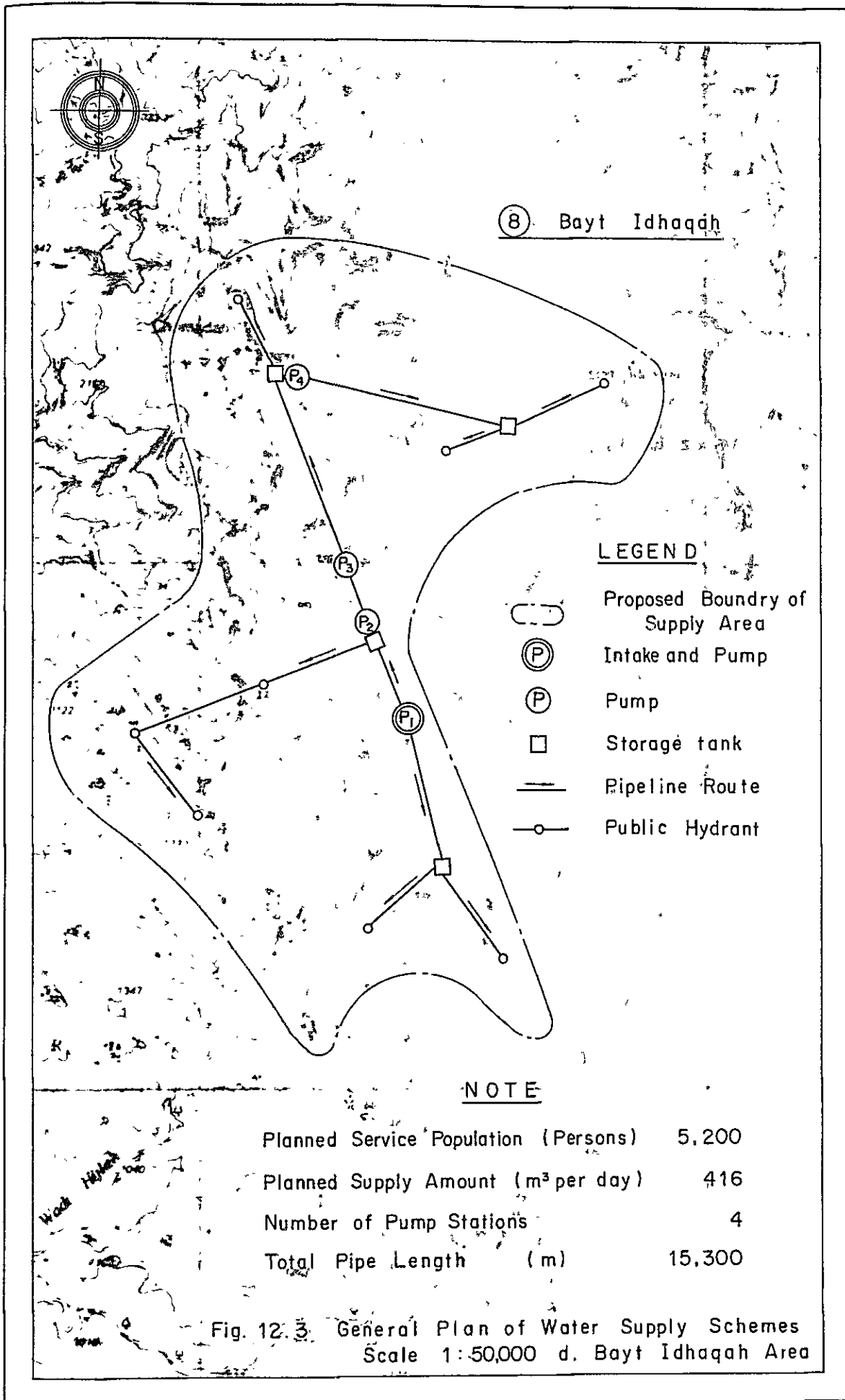


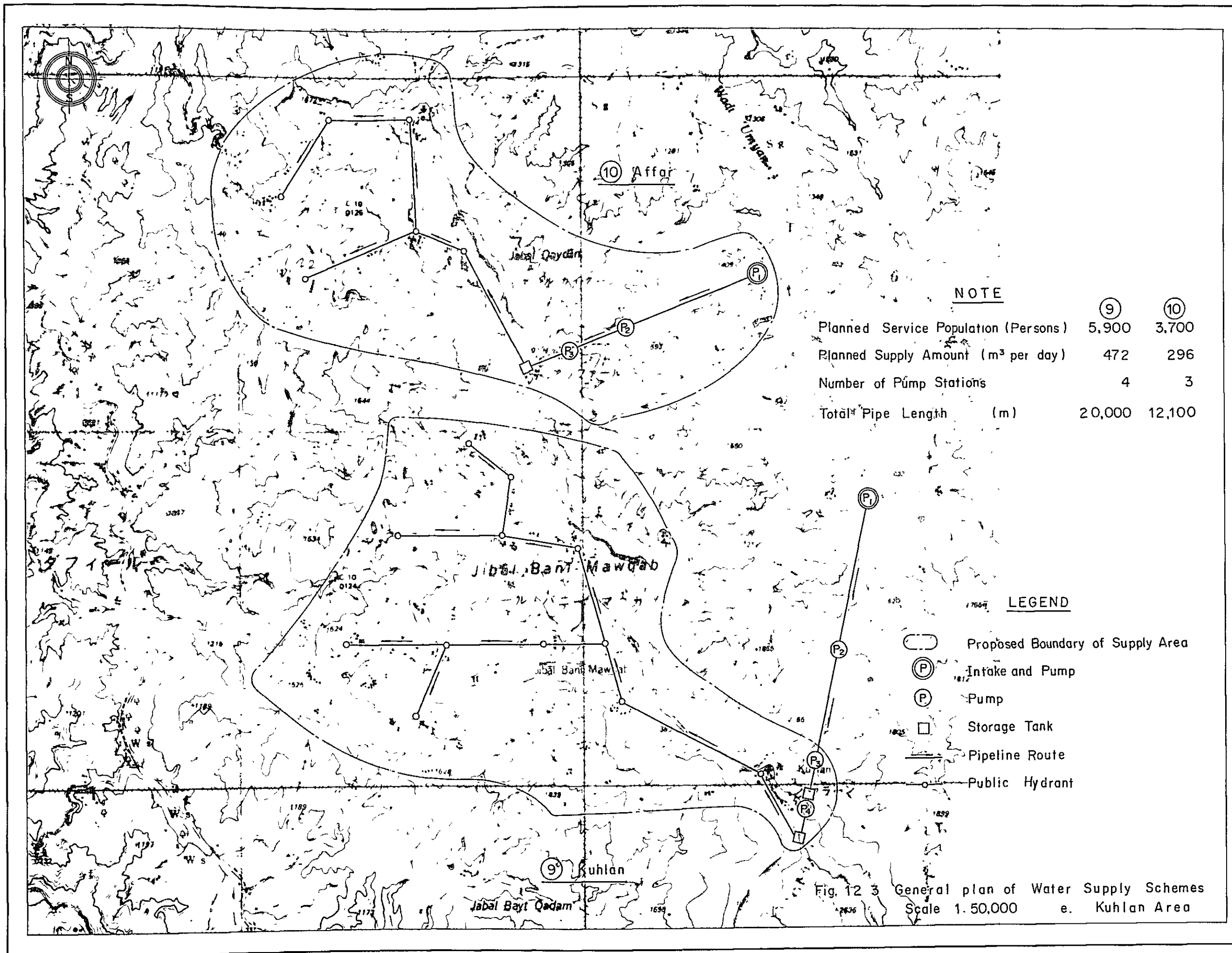


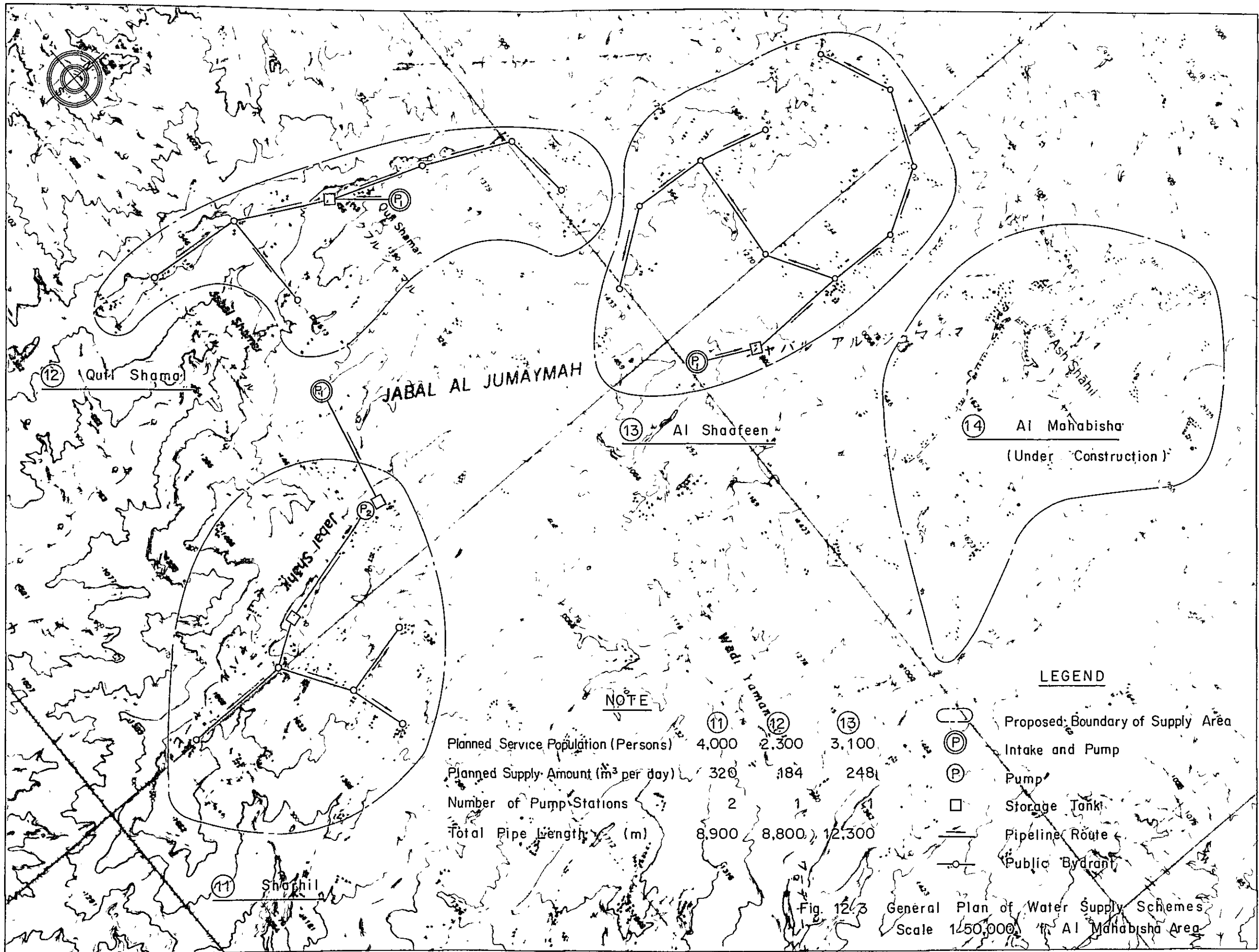




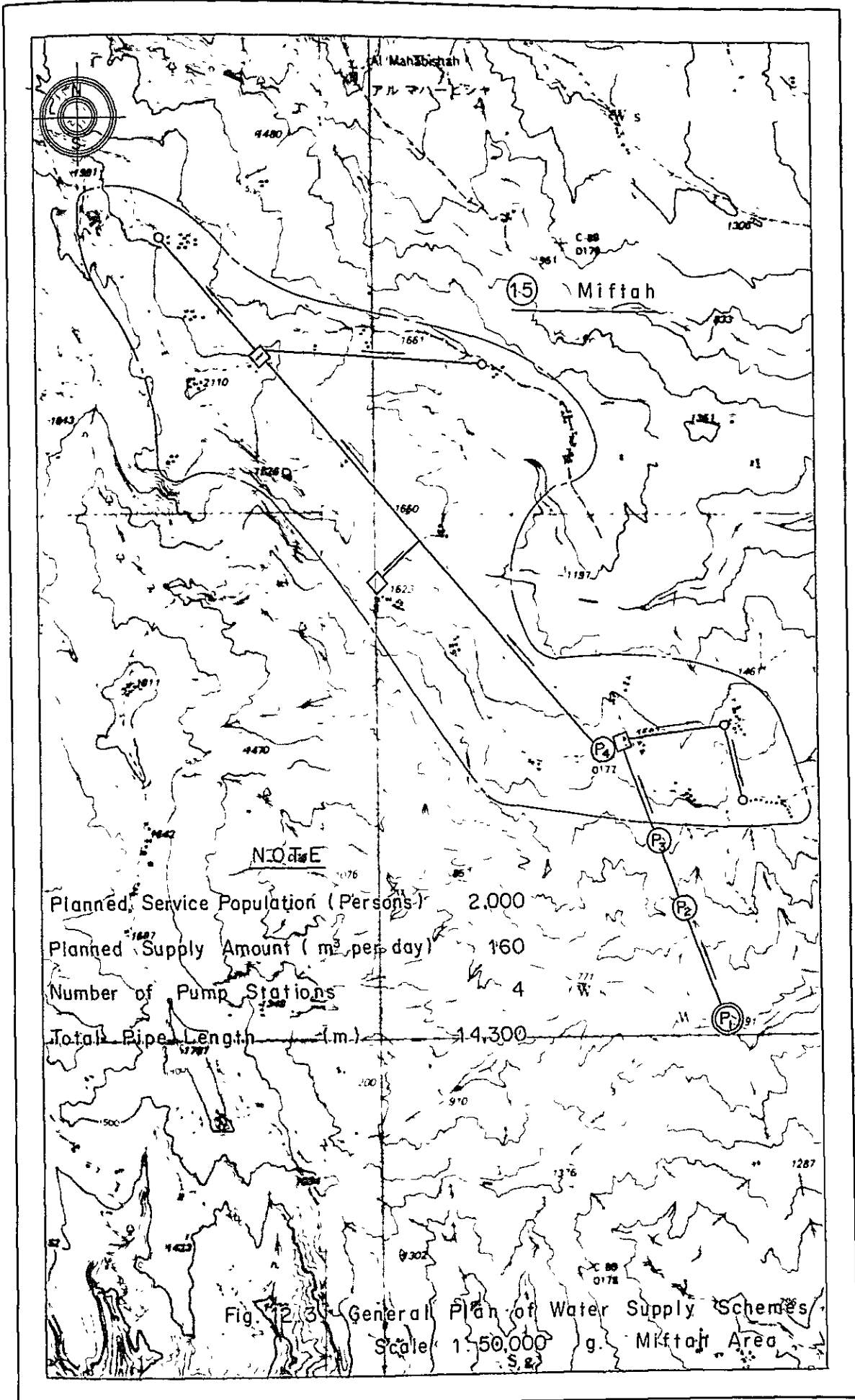


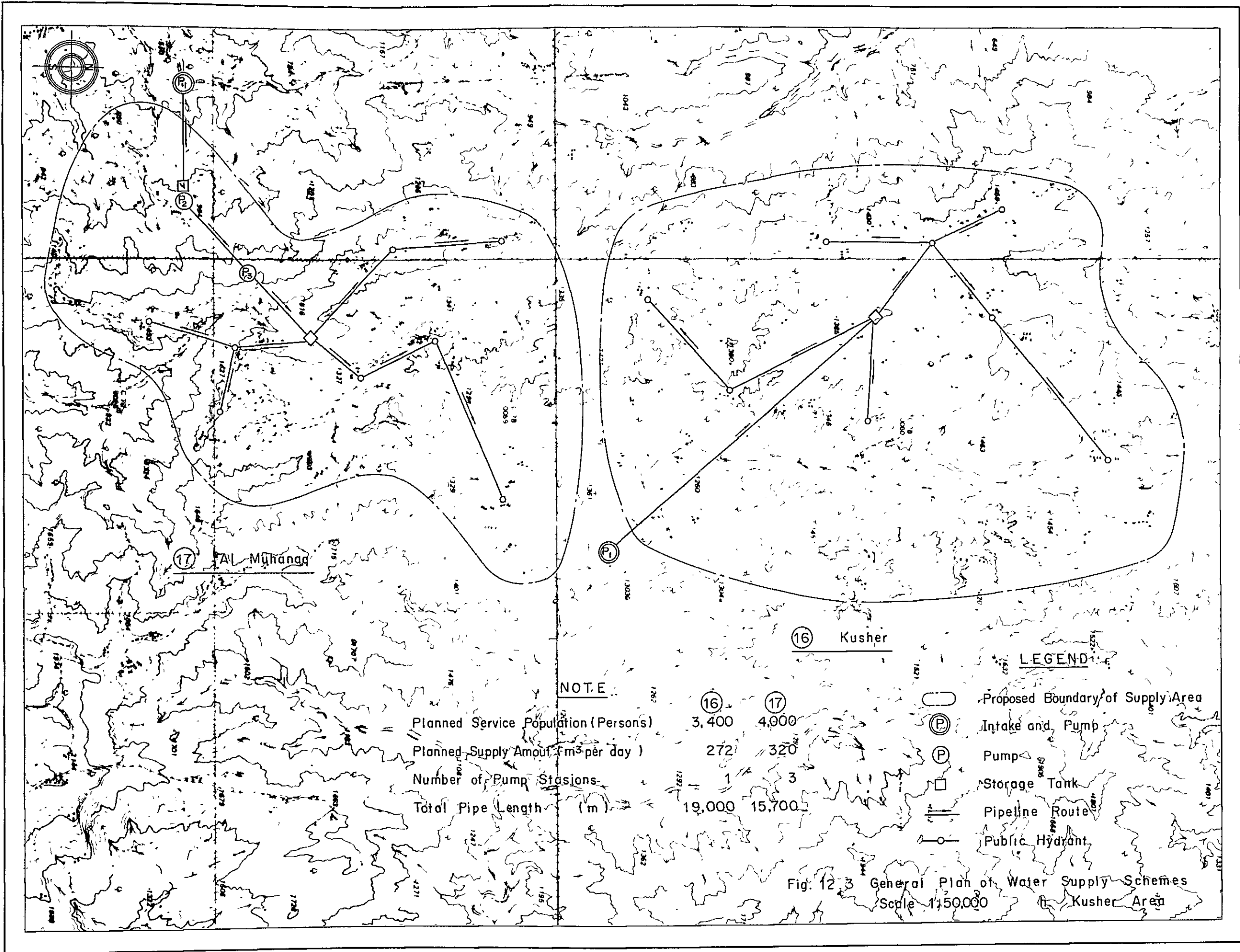




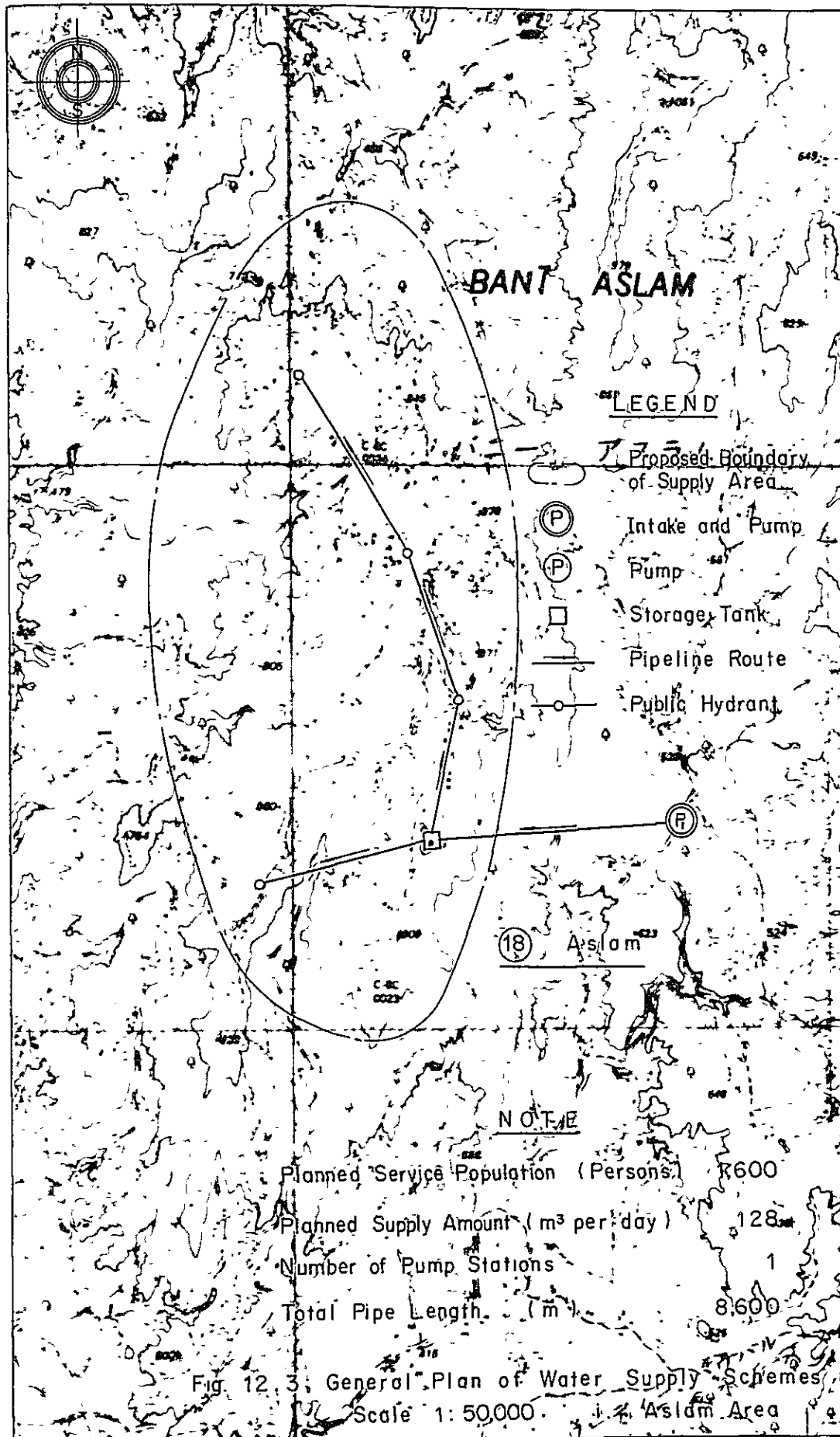








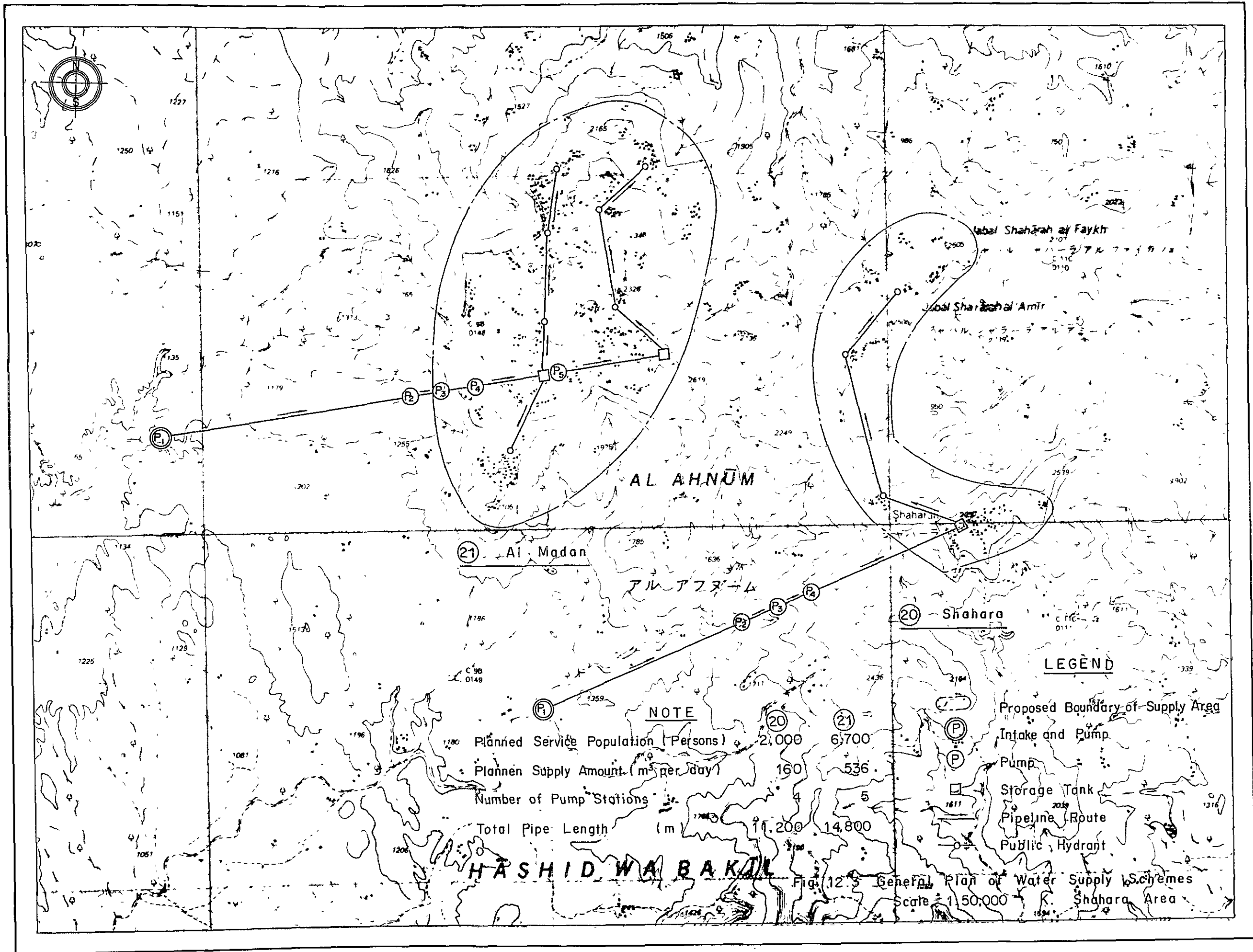


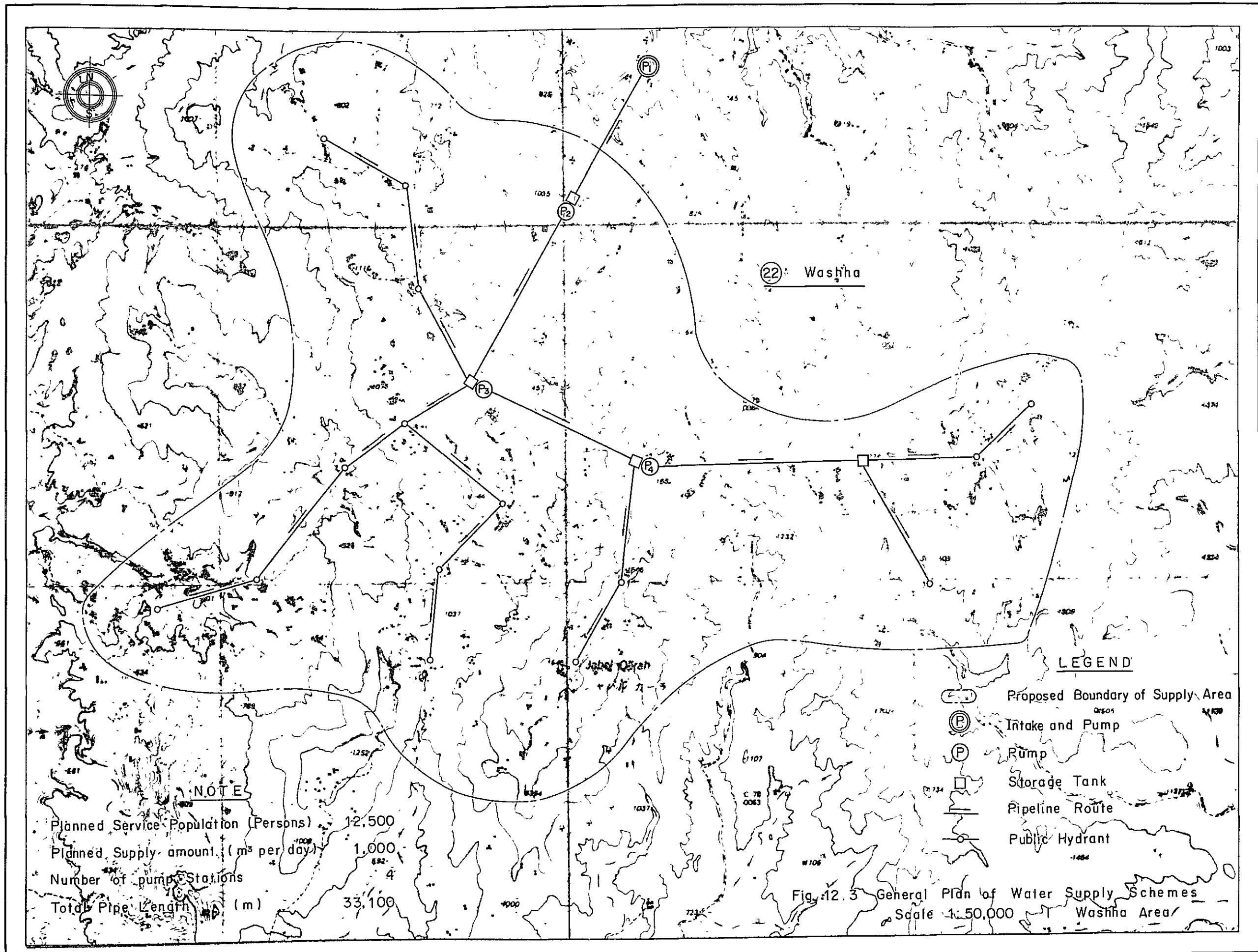














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### XIII RURAL ROAD NETWORK

1.	General	XIII - 1
2.	Existing Road Network	XIII - 1
3.	Necessity for Improvement of Road Network	XIII - 2
4.	Proposed Road Network	XIII - 5
5.	Proposed Design Standards	XIII - 6

#### Tables

13.1	Existing Roads of YAR	XIII - 7
13.2	Roads under Construction	XIII - 8
13.3	Proposed Secondary Roads	XIII - 9
13.4	Design Standards for Secondary Roads	XIII-10
13.5	Design Standards for Feeder Roads	XIII-11

#### Figures

13.1	Existing Road Network of YAR	XIII-12
13.2	Existing Road Network in Hajjah Province	XIII-13
13.3	Proposed Road Network	XIII-14





## XIII RURAL ROAD NETWORK

### (1) General

13.01 The modernization of road network in Yemen started 20 years ago under bilateral aid. Design standards have mostly determined on a project-by-project basis. The road network is not classified officially. However, it is customary to refer to some roads as main road, and to others as secondary or feeder roads.

13.02 Reliable data on vehicle registration, fuel consumption, commodities hauled or length of haul are not available, though they are necessary for the analysis of road network planning.

13.03 Ministry of Public Works is responsible for all the road networks. The Highway Authority which was established only in 1972 within the Ministry as the executing agency, is directly responsible for the planning, design, construction and maintenance of the national highway network. Local Development Association takes care of feeder roads construction under supervision of the Highway Authority. However, feeder roads are constructed usually following existing trails and tracks with limited improvement of horizontal and vertical alignment, decided largely on the spot by the technicians in charge.

### (2) Existing Road Network

13.04 The existing roads of YAR totals about 3,700 km, out of which 1,040 km are paved main roads. These are listed in Table 13.1. The roads totaling length of 752 km are under construction. They are listed in Table 13.2. The existing paved roads and the roads under construction are shown in Fig. 13.1. The nation-wide road network is still poor.

13.05 In the Hajjah Province, modern road network is non-existent at present. The only available land transport means are primitive tracks suitable only for four-wheel drive vehicles and animal transport, which are usually closed during rainy season. General lack of transport facilities has been a major cause of social and cultural isolation between the regions in the Province and of confinement of marketing areas within wadi flood basins and sub-range of mountains.

13.06 The road network in the Hajjah Province is shown in Fig. 13.2. There are two principal roads. One is running through the Tihama lowland from Al Zahra to Harad in the north-south direction. The other is Amran-Khashm road which is traversing the mountainous area and Tihama lowland in the east-west direction. No paved roads run in the Hajjah Province. The Amran-Hajjah road which is now under construction is planned to be paved by the cooperation of People's Republic of China.

13.07 The road network is very poor in comparison with other developed provinces. The road structure itself is also poor. Smooth transportation is hindered by narrow width, steep vertical alignment, small horizontal radii and bumpy surfaces.

### (3) Necessity for Improvement of Road Network

13.08 Development of adequate transport facilities is of urgent necessity for the economic and social development of the Province. The necessity of and the benefits obtained through the extension and improvement of road network in the Province are described hereunder:

- a. Breaking up of regional isolation: At present, regions in the Province are isolated from each

other and also isolated from outside the Province. It is of vital importance to break up to the regional isolation, aiming and realizing one unified province in the social and cultural context and effective central authority over the Province which is in line with the objective of the Five-Year Plan.

- b. Improvement of health and education environment: At present, health and educational facilities are very poor and dispersedly located in the Province. Opening of new roads and improvement of the existing ones would provide better access for the rural inhabitants to these facilities and hence enhance the health and educational standard of the people in the Province.
- c. Better availability of consumption goods at cheaper prices: The construction of new roads and betterment of the existing ones would bring about better availability of consumption goods including farm and dairy products as well as imported goods through the reduced transportation cost.
- d. Promotion of local self-help and solidarity between local communities: Project implementation would require the active participation of the local communities, especially supply labourers. The organization of these activities might be covered by the representatives of the LDAs concerned. LDAs concerned usually take responsibility for project maintenance. If necessary, however, a special institution might be founded. Reinforcing present institutions and building up new ones will be a big step to train people in the relatively new fields up self-help, responsibility and administration of local communities.

Moreover, joint operation between the local communities will promote the solidarity of the historically scattered villages and tribes.

- e. Expansion of marketing area: The present poor condition of land transport facilities in the Province has placed a severe restriction on the expansion of marketing area for agricultural products. The extension and betterment of the road network would make a great contribution to the expansion of marketing area for farm products, leading to increased products for marketing as well as to increased overall agricultural outputs.
- f. Providing marketing information: There is an acute shortage of marketing information needed for adequate distribution of products. The opening of new roads and the improvement of the existing ones would provide traders as well as farmers with timely and precise information for marketing.
- g. Better farm input supply: The introduction of modern agricultural production techniques will accompany the rapid expansion in the use of new agricultural inputs to be brought in and from outside, such as fertilizer, pesticides and farm machinery. The extended and improved road network will make it possible to procure these inputs whenever needed at cheaper prices.
- h. Dissemination of agricultural support services: No branch offices of agricultural institutions except the one of ACB in Abs have yet been established in the Province and no support services are available. However, in order to evolve from the subsistence agriculture into the modern agriculture, it is indispensable to set up these

offices and disseminate support services to wherever they are required through the extended and improved road network.

13.09 These effects and benefits yielded from the road projects would ultimately realize a) increased productivity and greater production of agriculture, b) promotion of agriculture for marketing, and c) crop diversification through enlarged market size. The construction of a new improved road network would bring about magnificent benefits for the development of economy as well as for the improvement of the standard of living of the people in the Province and hence is of vital importance for the development of the Province.

#### (4) Proposed Road Network

13.10 Three (3) secondary roads have been planned to be improved or newly constructed so as to form a rectangular shape together with Sana'a-Sadah main road which is running through the mountainous area in the east of the Hajjah Province. The first one is existing Harad-Al Zuhra road, which is running through the Tihama lowland in the north-south direction. The second one is Amran-Hajjah-Al Zuhra road, traversing the mountainous area. The third one is Huth-Washha-Harad road in east-west direction.

13.11 Besides these three secondary roads, Hajjah-Al Mahabisha-Abs secondary road has also been planned to be improved so that the political and economic centers in the Province could be connected. The road must run across the Wadi Mawr between Hajjah and Al Mahabisha. A bridgework with a total length of about 200 m will be required at the wadi crossing to secure passage of traffic during the flood season.

13.12 It is anticipated that these four secondaries will form main arteries of the economy of the Province and these arteries would fulfill their functions to maximum extent possible, giving due consideration for the growth trend of the economy.

13.13 Feeder roads are so planned as to link all the principal towns and villages in the area, making best possible use of the existing roads. Special attention has been paid to the connection of feeder roads with secondary roads or other feeder roads in order to avoid the simple side-track roads.

13.14 The proposed road network of secondary and feeder roads is shown in Fig. 13.3. The secondary roads are listed in Table 13.3. The total length of the feeder roads reaches to 1,700 km in the area, and together with the secondary roads, the road density in the area becomes 220 m/km<sup>2</sup>.

#### (5) Proposed Design Standards

13.15 Proposed design standards for the secondary roads and feeder roads are listed in Table 13.4 and Table 13.5 respectively, though they are tentative, and further comprehensive study will be required. The secondary roads would have two lanes in principle with double bituminous surface treatment, and the feeder roads one lane with gravel pavement.

Table 13.1 Existing Roads of YAR

<u>Name of Road</u>	<u>Type of Surface</u>				<u>Total</u> (km)
	<u>Dirt track</u> (km)	<u>Graded track</u> (km)	<u>Gravel</u> (km)	<u>Paved</u> (km)	
<b>Main Road</b>					
Sana'a - Taiz	-	-	-	256.0	256.0
Sana'a - Sa'dah	-	-	-	242.0	242.0
Sana'a - Al Hodeidah	-	-	-	226.0	226.0
Km.16 - Km.63	-	-	-	191.0	191.0
Km.63 - Taiz	-	-	-	63.0	63.0
Sana'a - Al Wadi	-	-	-	14.0	14.0
Sana'a - Haddah	-	-	-	8.0	8.0
Sana'a - Airport Road	-	-	-	10.3	10.3
Airport Road - Arhab	-	-	14.0	15.0	29.0
Al Maraba - Manakha	-	-	-	5.0	5.0
Hodeidah - Port	-	-	-	5.0	5.0
Hodeidah - Airport	-	-	-	4.0	4.0
Sana'a - Al Rawda					
<u>(Sub-Total)</u>			<u>(14.0)</u>	<u>(1039.3)</u>	<u>(1053.3)</u>
<b>Secondary and Feeder Road</b>	958.2	428.9	662.2	-	2049.3
<b>Total</b>	958.2	428.9	676.2	1039.3	3102.6

Source: 1976/77 Statistical  
Year Book, C.P.O.



Table 13.2 Roads Under Construction

<u>Name of Road</u>	<u>Total</u> (km)	<u>Gravel</u> (km)	<u>Paved</u> (km)
Sana'a - Marib	172	-	172
Dhamar-Radaa-Al Baida	168	-	168
Taiz - Sharjah	59	-	59
Sana'a - Jhana	31	-	31
Taiz - Al Turbah	70	-	70
Amran - Hajjah	77	-	77
Sana'a - Shibam	34	-	34
Sana'a/Shibam Junct.-Thula	9	-	9
Al Ribat - Al Jaaby	27	27	-
Hodeidah - As Salif	69	69	-
Hodeidah - Ras Alkathib	15	15	-
Al Ahgor - At Tawilah	10	10	-
Al Hommady - Al Sharqi	11	11	-
<b>Total</b>	<b>752</b>	<b>132</b>	<b>620</b>

Table 13.3 Proposed Secondary Roads

<u>Route</u>	<u>Length</u> (km)	<u>Remarks</u>
Amran — Hajjah	50	under construction
Hajjah — Khashim — Al Zuhra	60	improvement
Al Zuhra — Abs	45	improvement
Abs — Al Mahabisha	35	improvement
Al Mahabisha — Hajjah	45	under construction
Abs — Harad	70	improvement
Harad — Washha — Huth	125	under planning
<b>Total</b>	<b>430</b>	

Table 13.4 Design Standards for Secondary Roads

	<u>Unit</u>	<u>Terrain</u>		
		<u>Flat</u>	<u>Hilly</u>	<u>Mountainous</u>
<u>Geometric design Standards</u>				
<u>Speed</u>	(km/h)			
Normal		100	60	30
Minimum		-	30	20
<u>Horizontal Radius</u>	(m)			
Normal		400	100	35
Minimum		-	35	20
<u>Gradient</u>	(%)			
Normal		3	5	9
Maximum		-	7	12
<u>Roadway Features</u>				
<u>Width</u>	(m)			
Total Roadway		8.5	7.5	6.5
Pavement		6.5	6.0	5.5
-----				
<u>Pavement Type</u>		Double bituminous surface treatment		

Table 13.5 Design Standards for Feeder Roads

<u>Geometric Design Standards</u>	<u>Unit</u>	<u>Terrain</u>		
		<u>Flat</u>	<u>Hilly</u>	<u>Mountainous</u>
<u>Speed</u>	(km/h)			
Normal		70	40	25
Minimum		-	20	10
<u>Horizontal Radius</u>	(m)			
Normal		200	50	25
Minimum		-	20	10
<u>Gradient</u>	(%)			
Normal		3	6	10
Maximum		-	10	15
<u>Roadway Features</u>				
<u>Width</u>	(m)			
Total Roadway		6.0	5.0	4.5
Pavement		4.5	4.0	4.0
-----				
<u>Pavement Type</u>		Gravel		

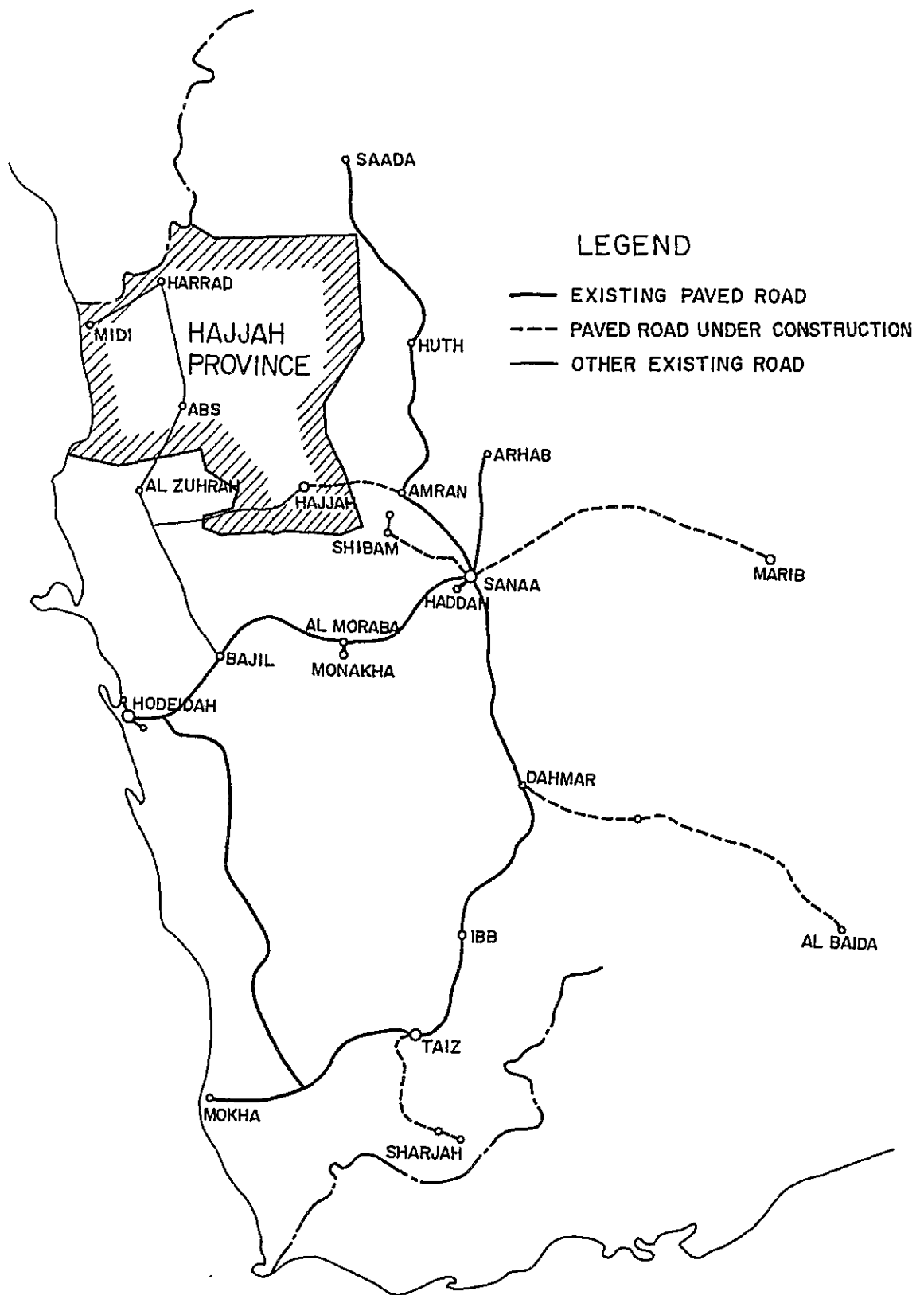


Fig.13.1 Existing Road Network of YAR

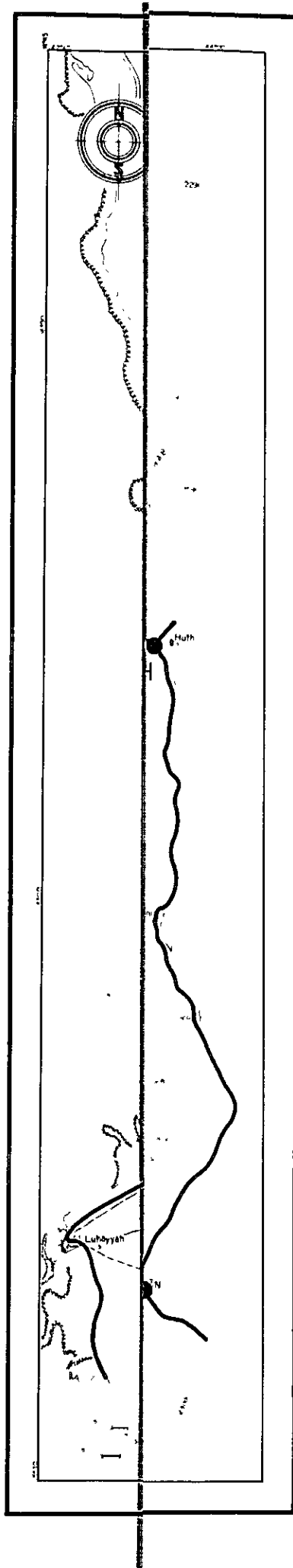


Fig.13.2 Existing  
Road Network in  
Hajjah Province

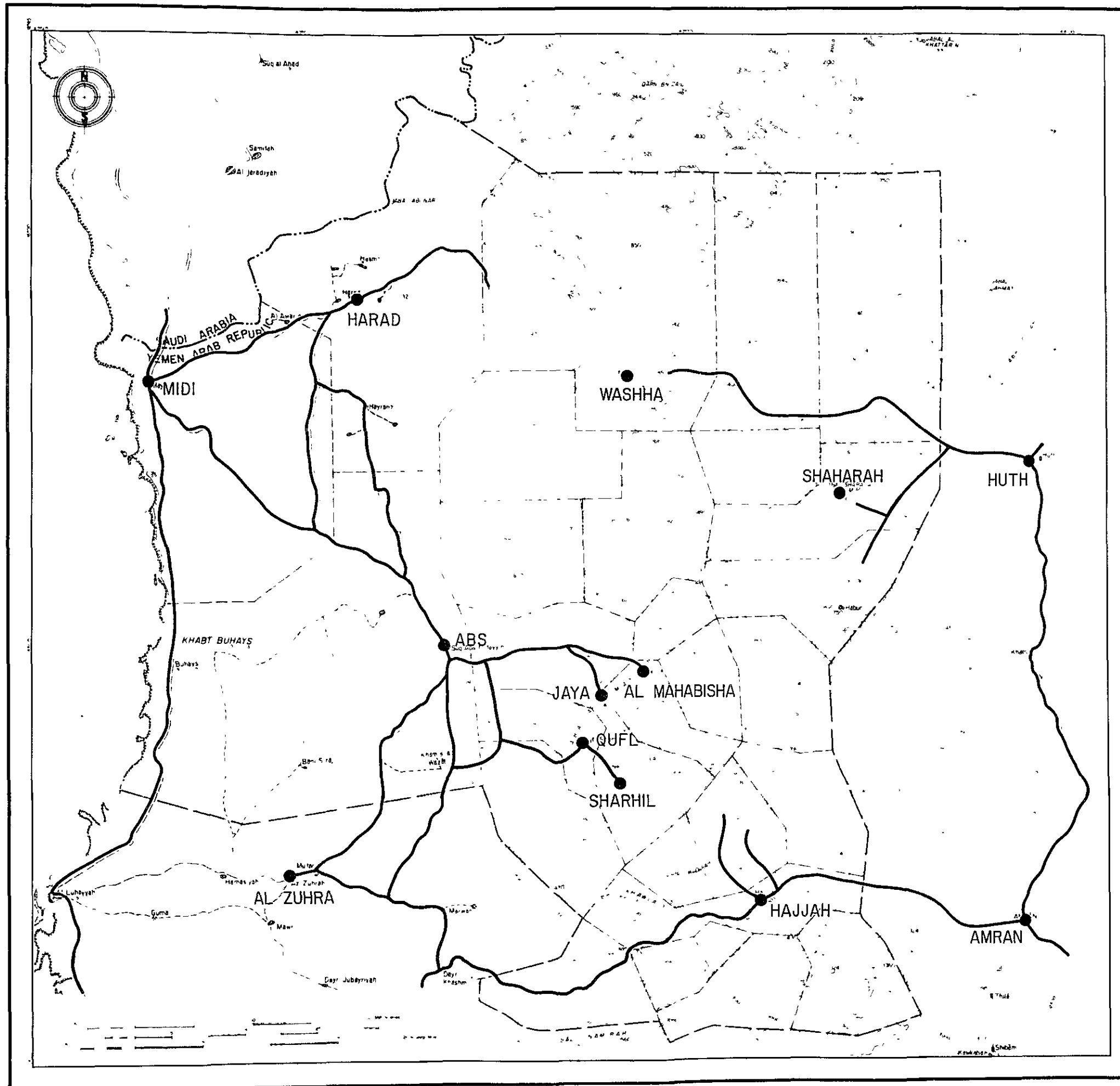


Fig.13.2 Existing Road Network in Hajjah Province

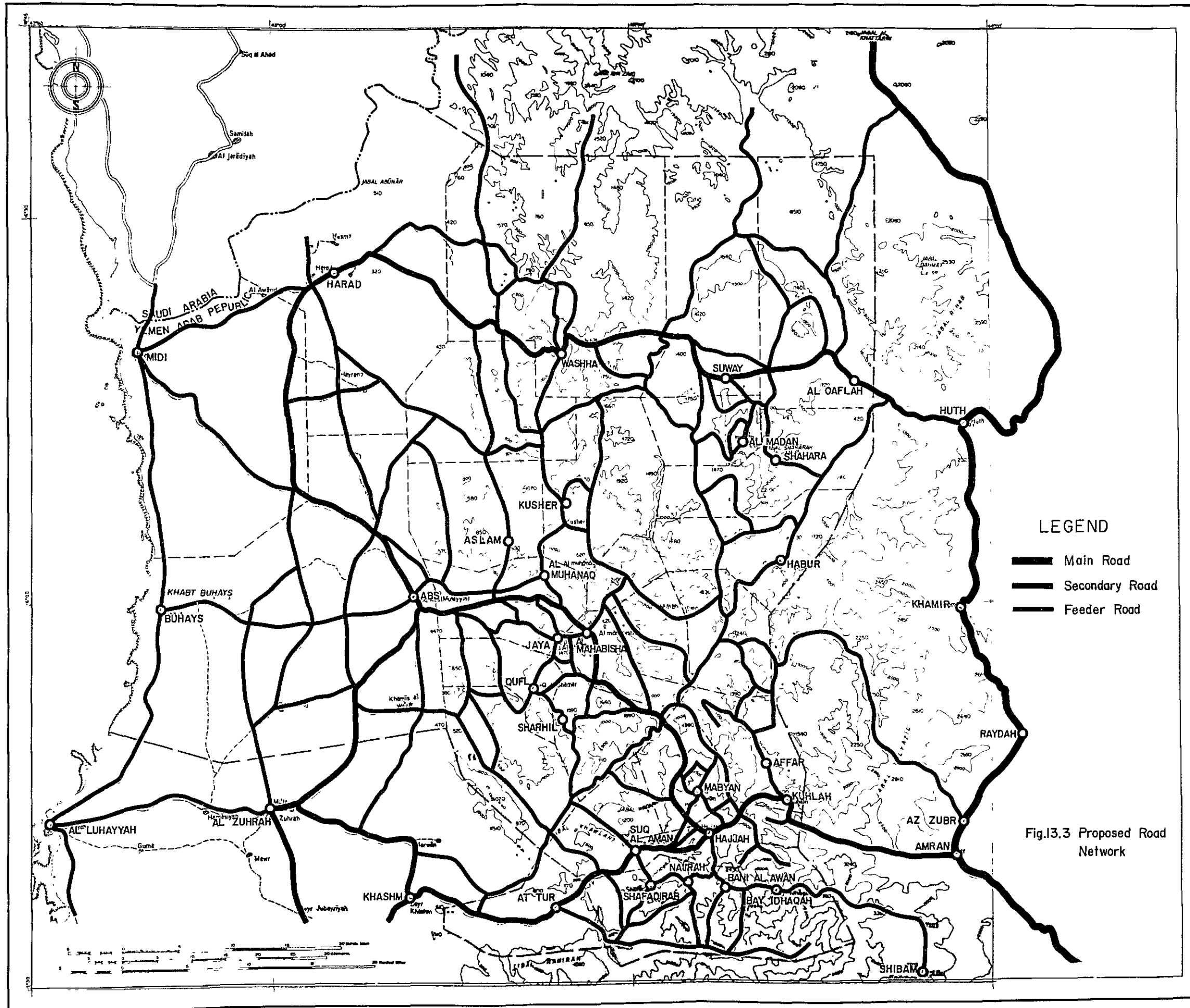


Fig.13.3 Proposed Road Network





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## XIV AGRICULTURAL DEVELOPMENT

1.	Present Situation	XIV - 1
2.	Development Potential	XIV - 2
3.	Development Constraints	XIV - 5
4.	Proposed Measures for Improvement of Agricultural Production	XIV - 7
	Comprehensive implementation body	XIV - 8
	Agricultural Research Station	XIV - 9
	Research and Training Center for Irrigation and Mechanization	XIV-11
5.	Selection of Suitable Crops and Proposed Farming Pattern	XIV-13
	Selection of suitable crops	XIV-13
	Proposed farming pattern	XIV-15
6.	Future Agricultural Production	XIV-17

### Tables

14.1	Land Use and Rainfall	XIV-19
14.2	Land Class and Rainfall	XIV-20
14.3	Evaluation of Selected Crops	XIV-21
14.4	Future Crop Production	XIV-22

### Figures

14.1	General Layout of Agricultural Research Station	XIV-25
14.2	General Layout of Research and Training Center for Irrigation and Mechanization	XIV-26
14.3	Present and Future Cropping Patterns	XIV-27

INTERNATIONAL ORGANIZATION

CHAPTER I

ARTICLE 1

1. The Organization shall be known as the International Organization for the Advancement of Science.

2. The Organization shall have as its objective the promotion of international cooperation in the field of science and technology.

3. The Organization shall be open to all States without distinction of race, sex, or religion.

4. The Organization shall be a permanent organization.

5. The Organization shall be a non-profit-making organization.

6. The Organization shall be a self-financing organization.

7. The Organization shall be a non-political organization.

8. The Organization shall be a non-religious organization.

9. The Organization shall be a non-racial organization.

10. The Organization shall be a non-sexist organization.

11. The Organization shall be a non-religious organization.

12. The Organization shall be a non-political organization.

ARTICLE 2

1. The Organization shall have as its headquarters the United Nations Secretariat Building in New York.

2. The Organization shall have as its principal office the United Nations Secretariat Building in New York.

3. The Organization shall have as its principal office the United Nations Secretariat Building in New York.

4. The Organization shall have as its principal office the United Nations Secretariat Building in New York.

ARTICLE 3

1. The Organization shall have as its principal office the United Nations Secretariat Building in New York.

ARTICLE 4

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#### XIV - AGRICULTURAL DEVELOPMENT

(1) Present Situations (Chapter IX "AGRICULTURAL ECONOMY," to be referred)

14.01 Out of a total land area of 9,590 km<sup>2</sup>, only about 840 km<sup>2</sup> are regularly cultivated. An additional 570 km<sup>2</sup> of marginal agricultural land is cultivated only during high rainfall years. Woody vegetation or shrub growth covers 1,480 km<sup>2</sup>. About 6,700 km<sup>2</sup> are rocky mountains and semi-arid range lands with sparse vegetation. About 88 % (1,250 km<sup>2</sup>) of the cultivated land depends solely on low and erratic rainfall, 9 % (120 km<sup>2</sup>) is supplied with spate irrigation by seasonal flood flow, and 3 % (40 km<sup>2</sup>) is put under regular irrigation by wells.

14.02 The main rainfed crops are sorghum and bulrush millet in the lowland, and wheat, barley and sorghum in the midland and highland. Irrigated agriculture is limited due to the scarcity of water resources. Groundwater, very small perennial flow and seasonal floods coming down the wadi courses are generally the water sources for irrigation. Irrigation practices are still very limited in the mountain regions. Spate irrigation is common in the areas along the wadi courses mainly in the lowland. Groundwater irrigation (shallow wells) by pumps is practised in some areas in the lowland, but the commandable areas are generally very small. Maize, cotton and tobacco are grown on the irrigated lands in the lowland; coffee and gut are the main crops of the high rainfall areas in the mountain regions. Vegetables are cultivated on the irrigated sites on a limited scale.

14.03 Farming method is still very primitive. Seeds are provided locally and is of inferior quality. Fertilizer is used only in the irrigated fields. No pest and insect

control measures are applied. Crop yields are generally low. For example, sorghum and millet yields of 800 kg per ha, wheat yield of 800 kg per ha, barley yield of 1,000 kg per ha, maize yield of 1,500 kg per ha are among the lowest in the country.

14.04 There are a considerable number of domestic animals. It is estimated that over 340,000 goats and sheep, 88,000 cattle, 48,000 donkeys and 49,000 domestic fowls exist in the Province. Semi-nomadic husbandry is common. Animal diseases are widespread owing to the lack of health care and poor animal feeds.

14.05 There is no extension services in the Province. Agricultural research programme has not been initiated yet. A branch office of the Agricultural Credit Bank was opened only in March 1979 and has made very little achievement. There is no institutional support to the farmers for farm inputs supply. Harvested crops are stored in the villages and are subject to damages by rodents and insects. Surplus grains and other marketable products are transported by donkey or camel to the nearest local market.

## (2) Development Potential

14.06 The Hajjah Province is not richly endowed in agricultural resources. Definite limits to the agricultural development are set by the limited arable land and water resources. In areas where rainfall and irrigation water are adequate for crop production, available arable land is already in full use. In areas where unused arable land exists, additional water resources are not available for development (Tables 14.1 and 14.2, to be referred).

14.07 The absolute limit of the physical resources means that the prospect for expansion of agricultural production

lies in better utilization of land and water for the highest return crops under proper farm management. The present low level of agricultural productivity suggests considerable potential for development. Even under the limiting conditions of low and erratic rainfall, crop yields could be increased through the improvement of cultivation techniques including use of high yielding seeds, fertilizers and agrochemicals. Better animal husbandry and health care together with improvement of animal feeds can increase weight gains and improve eggs and milk production.

14.08 A large body of good crop research has been carried out by on-going research projects on the country basis. The fertilizer research results indicate a very substantial potential for increasing crop yields in high rainfall regions. In areas where rainfall is less than 400 mm per annum, the farmers may not be willing to take the financial risk of applying fertilizers. These low rainfall areas occupy about 59 % of total arable lands. In such low rainfall areas, crops do not respond well to fertilizers. The present meteorological study indicates that about 12 % of the total arable land is in areas with annual rainfall of over 600 mm. While these high rainfall areas already have the highest and most stable crop yields within the confines of traditional techniques, they also have the highest potential for still higher yields. The areas receiving marginal rainfall of 400-600 mm per annum, extend mainly on midland, occupying about 29 % of the total arable land. These marginal rainfall areas have also some potential.

14.09 In Ibb area, for example, the fertilizer trials under farmers' condition show an increase of 0.66 ton per ha of sorghum, 0.49 ton per ha of wheat and 0.52 ton per ha of barley, giving an increment of 26, 28 and 47 %,



respectively. In the Wadi Zabid Project area which represents the Tihama lowland, the trials on farmers' demonstration fields give an average yields of 3.52 tons of maize per ha which compared to the local average of 1.18 tons per ha. The cotton demonstration fields demonstrate an average yield of 2.99 tons of seed cotton per ha as compared to 1.11 tons per ha obtained by local farmers.

14.10 A further potential exists in crop diversification, a shift to higher-return crops. After centuries of subsistence farming, farmers are now faced with drastic social changes including labour shortage, high wages, relatively easy access of Sana'a and changing consumer tastes. These changes offer new opportunities for the shift to market-oriented agriculture. A trend in this direction is already apparent. Many farmers have already started planting new high-value crops like vegetables and fruits. With rising urban incomes, dietary habits are changing. The urban population increasingly consume a wide variety of vegetables and fruits. The Province has now very easy access to Sana'a by the completion of road between Hajjah and Amran. Continued increase in demand for vegetables and fruits will support the agricultural development in the Hajjah Province.

14.11 Livestock also has the potential for a greater contribution to the rural economy. The demand for livestock products is also increasing and the Province will have better position as the supplier because of its favourable location. However, this will require an improvement of range lands, use of crop by-products and growing of fodder crops in rotation with other crops. In addition to these improvement of animal feeds, better veterinary care would be essential for livestock development. Dairy farming and poultry production would have

some potential in the Hajjah-Mabyan area.

### (3) Development Constraints

14.12 The agricultural development plan will have to aim at increasing crop and livestock production and raising farm incomes of the rural inhabitants. To achieve an increase in production, a number of constraints have to be eliminated. The major constraints involved in the exploitation of agricultural potential are summarized as follows:

#### a. Human Factors

- i. Most of the farmers are not knowledgeable or experienced in modern farming practices. They are unlikely to take financial risks of adopting new practices.
- ii. A large number of the rural inhabitants who should carry out the task of agricultural development have left their villages due to higher wages offered by the neighbouring oil-producing countries. This brought about serious labour shortage problem in rural area and pushed the rural wages up to relatively high level (rural wages have risen about 20-25 times since 1972 compared with 3.6 times for the general price index).
- iii. The large cash remittances sent to rural villages by the migrant workers are reducing the incentives to continue cultivating the marginal agricultural lands.
- iv. Higher costs of production due to higher labour wages led to a reduction in area planted in low-value crops, mainly cereals and abandonment of marginal lands, and have jointly resulted in a overall decline in food grain outputs.

b. Institutional Factors

- i. Nearly all the institutions to serve agricultural development have not been put operation in the Province.
- ii. Most farms are tenant-operated. The traditional 50/50 sharing system does not give the share-cropper an incentive or the means to adopt more costly farm practices, especially use of fertilizers and insecticides.
- iii. The share-cropper cultivates the lands under a verbal agreement with the landowner on the terms and conditions that are determined by tradition. Even if both owners and tenants have an interest in long-range farm improvement like irrigation work, soil erosion protection measures, land reclamation, etc., the cooperation between the two can hardly expected on such a year-to-year verbal understanding.
- iv. There is an extreme shortage of professional staff and technician required for new agricultural institutions and services.

c. Physical Factors

- i. The expansion of agricultural production is definitely limited by the all-important factor "water" as already mentioned.
- ii. Secondary and feeder roads connecting the farming areas have not been developed. Many villages are not accessible by motorized transport. Construction of infrastructural facilities, institutional agricultural services and marketing activities are largely constrained by the lack of motorized rural roads.

iii. Many of the rural inhabitants are living in a harsh environment where the people's basic needs are not yet satisfied, especially in social services like clean drinking water, health facilities, elementary education and electricity. The rural inhabitants have more serious concerns for the immediate improvement of their living environment than the long-range on-farm improvement.

(4) Proposed Measures for Improvement of Agricultural Production

14.13 Although the exploitation of agricultural potential is presently constrained by a number of human, institutional and physical factors, the development prospects of the Province will heavily rely on the agricultural sector. In the long run, the agricultural development will have to be promoted, in spite of the limits set by a number of constraints, on the basis of a) crop diversification, b) use of better farm inputs, c) improvement of irrigation practices (to make the best possible use of limited irrigation water available, d) agricultural mechanization, and e) better marketing arrangement. In other words, the present subsistence agriculture should be replaced with the market-oriented one which would realize higher productivity and guarantee the higher incomes to the farmers.

14.14 To achieve such prospective agricultural development, the introduction of institutional agricultural services will be the first need, because nearly all the institutions to serve the agricultural development, including extension services, credit facilities, farm input supply services, research, etc., are lacking in the Province.

14.15 Although these institutional services are pre-requisites for agricultural development, it would be very difficult to consolidate the needed institutions and services at once under the present low level of manpower resources in the Province. The agricultural development should therefore be considered on the long term basis.

14.16 In implementing agricultural development, opinions may differ as regards the scale, phasing and the requirements of various other sectors. In due consideration of the constraints involved in the agricultural development, it is proposed that, among others, small scale development schemes be established initially, which will be gradually expanded as more trial results become known and more experience is obtained together with building of skilled manpower.

#### Comprehensive Implementation Body

14.17 Considering all these, the basis for the promotion of agricultural development will be a comprehensive implementation body, which will carry out the following tasks necessary for the rural development:

- a. Physical resources survey
- b. agricultural census and statistics
- c. collection of meteorological and hydrological records through the establishment of observation network
- d. comprehensive agricultural research on crops, livestock, irrigation and mechanization
- e. agricultural extension services
- f. agricultural credit services
- g. farm inputs supply services
- h. demonstration and training
- i. rural water supplies

- j. Feeder roads construction
- k. improvement of other rural infrastructural facilities
- l. coordination with Local Development Association

The proposed set-up of this comprehensive implementation body will be discussed in Chapter XX, "Organization and Management." The activities to be carried out under the proposed set-up will be comprehensive and directed towards overall improvement of the rural incomes and welfare.

14.18 A constant flow of field-tested knowledge relevant to crop and livestock production will be a pre-condition for the success of agricultural development. Many of the rural inhabitants are living in a harsh environment where investment will produce very little extra income until technical discoveries create reliable new opportunity. In this view, it is proposed that the following specific schemes be established within the Hajjah Province:

- a. agricultural research station for development of midland agriculture
- b. Research and training center for mechanization and irrigation, particularly for development of lowland

#### Agricultural Research Station

14.19 The midland region occupies 42.6 % of the total land area or 4,090 km<sup>2</sup> in the Hajjah Province. Although its soil condition is not very favourable, the midland region will continue to be important for crop and livestock production, receiving relatively high rainfall of about 400 - 600 mm per annum. However, there is no research institution to serve the development of midland agriculture in this country, while a large body of agricultural research for both lowland and highland zones

has been carried out by the existing research institutions.

14.20 The proposed agricultural research station will be established around Al Mahabisha where irrigation water is available. The agricultural research station will carry out, in close coordination with the Central Agricultural Research Station in Taiz, various field trials and basic meteorological observation necessary for agricultural development of midland region. The technical information to be obtained through the field trials will have to form an integral part of the extension services. The research station will also serve the advanced training of extension workers who will be recruited from the local community and offered a basic training in the existing training facilities. In the light of special importance of afforestation in the mountain regions, a forest nursery will be included in the proposed research station.

14.21 The agricultural research to be carried out will mainly be confined to:

- a. Field trials of crop varieties selected elsewhere in the country for their adaptability to the local condition,
- b. field trials of fodder crops and trees for improvement of animal feeds,
- c. veterinary studies for cattle, domestic fowls, sheep and goats,
- d. demonstration and research for irrigation method and crop water requirement by using small pumps,
- e. farm economy survey and study on farm management

14.22 The agricultural research station will have the following sections in its organizational set-up.

- a. Crop research
- b. Livestock

- c. Irrigation improvement
- d. Farm management
- e. afforestation
- f. Information and administration

The organizational set-up will be discussed in Chapter XX, "ORGANIZATION AND MANAGEMENT."

14.23 The proposed size of the agricultural research station will be 10 ha including the sites for offices and laboratories. The general layout is shown in Fig. 14.1. The proposed site is located on the Jaya area, about 3 km southeast of Al Mahabisha.

14.24 The agricultural research station will be gradually expanded and at the stage which all the activities will get on the right track, the following branch stations will be established:

- a. stock seed farms for keeping pure-line seeds of recommendable varieties
- b. seed multiplication fields to be managed by the progressive farmers under the contract with the agricultural research station
- c. veterinary service station to be attached to each branch office (refer to Chapter XX)
- d. demonstration fields for small scale pump irrigation and new horticulture technique
- e. pilot afforestation schemes (refer to Chapter XVI)

#### Research and Training Center for Irrigation and Mechanization

14.25 The lowland agriculture is characterized by relatively large farm holding, cereal-single-cropping, rainfed cultivation under tropical climate with scant rainfall, extreme labour shortage and relatively low agricultural incomes. According to the soil studies, there exist 2,690 km<sup>2</sup> of



arable land in the lowland, out of which only 790 km<sup>2</sup> are presently under cultivation. Expansion of cropland will be the essential basis for promotion of agricultural development in the lowland. The labour shortage and the limited availability of water will be the limiting factors for the expansion of cropland.

14.26 In order to make the best possible use of water available, crop water requirement will have to be re-studied. If the water consumption could be saved, more areas of arable lands would be put under irrigation, resulting in the increase of total output. Water losses in the water conveyance system should be kept as low as possible. Irrigation structures and land levelling have to be improved in view of an efficient water distribution and it will have to be studied which irrigation methods can best be applied.

14.27 The labour constraint can only partly be removed by a greater emphasis on mechanization. Quick land preparation by mechanization will make the timely sowing of crop possible. Mechanization will also be effective for catching seasonal flood water under spate irrigation. However, mechanization will have to be carefully introduced. The gradual introduction of intermediate technology will be a valuable solution in a situation in which skilled manpower, maintenance facilities and capital resources are lacking.

14.28 With this in view, it is proposed to establish a research and training center for irrigation and mechanization. The proposed site will be within the Abs area where about 1,300 ha of the spate-irrigated land will possibly be improved by constructing headworks on the Wadi Qur and canal system. The size of the proposed center will be