

CHAPTER 4 EXISTING WATER USE

4.1 Current Water Use and Supply Systems

4.1.1 Villages

Village centres are supplied with water by Nam Water, and are called “Bulk Customer” and operate on a contract basis with a memorandum of agreement being exchanged. Village councils are responsible for the operation and maintenance of the feeder pipeline network as well as water supply in the villages. To maintain the facilities water fees from N\$2.35 to N\$2.96 /m³ are charged to beneficiaries which are composed of village centers, commercial farms and communal land which operate irrigation, livestock and tourism activities (refer to Table 4.1-1). However, it is reported that the fee collection ratio is not 100 %. Using the latest monthly abstraction data in the eight village centres, the total water use volume of about 562,000 m³/year is estimated in Table 4.1-2.

Table 4.1-1 Population and Areas Served

	1991	1999
Village centers	4,662	6,186
Commercial farms	13,349	16,780
Communal land	10,174	12,130
Total	28,185	35,096

Note. Estimated as of March 2000

Table 4.1-2 Water Supply Scheme by Nam Water

Village	Scheme's Capacity (m ³ /year)	Agreement (m ³ /year)	Amount Used (m ³ /year) 2001
Stampriet	111,600	61,200	64,479
Aranos	554,400	349,200	276,293
Gochas	108,000	91,800	68,724
Leonardville	108,000	122,400	81,234
Aminuis	24,120	16,920	39,125
Onderombapa	61,300	19,080	21,115
Kriess	31,320	18,720	11,126
Total	998,740	679,320	562,095

Source: Nam Water

4.1.2 Domestic Water in the Commercial Farms

Commercial farms have their own boreholes dug using their own investment and they do not pay any water fee to the village councils.

Domestic water for human consumption on commercial farms was calculated based on the hydro-census data. The average unit water consumption is about 400m³/capita/year. Using this data, the total domestic water consumption in this study area is estimated at 1,716,000 m³/year.

Table 4.1-3 Domestic Water Uses on the Commercial Farms

Area*	Farm Area (ha)	No. of Farm**	Domestic Usage (m ³ /y)	%	Averaged Domestic Use/Farm (m ³ /y)
Area I	173,929	36 (30)	87,162	5	2,905
Area II	285,716	69 (62)	141,182	8	2,277
Area III	112,403	23 (19)	26,426	2	1,391
Area IV	200,833	50 (41)	58,254	3	1,421
Area V	813,397	110 (85)	109,646	6	1,290
Area VII	4,719,973	929 (905)	1,292,991	75	1,429
Total	6,306,250	1,212 (1142)	1,715,661	100	1,502

Note: Analysis of JICA Study Team based upon Hydro-census data

*refer to Fig.4.1-1

**() real figures of respondents

4.1.3 Domestic Water in the Communal Lands

The Hydro-census survey did not cover most of the farm information (including number of residence, stock, and water consumption, etc.) in the communal land. The detailed data in those areas could not be obtained. Accordingly using population census obtained from the National Statistic Office, the total population in the communal lands of Aminuis, Corridor, Hoachanas and Namaland was estimated at 11,588 as of 1999. Unit water demand of 30 litre/capita/day results in 126,889m³/year (30 litre/capita/day x 365 day x 11,588/1,000 litre).

4.1.4 Industries

Though there is one abattoir (slaughterhouse) in the Study Area, which disposes 850 to 1,100 heads of sheep per day and consumes 150 m³/day, this plant is supplied with water from the Hardap scheme.

4.1.5 Tourism

There are 11 lodges in the Study Area. Assuming that 29,700 tourists stay in a lodge a year (the tourism season is from March to November), the total water use in the tourism sector in the Study Area was estimated at 4,445 m³/year (29,700 x 0.15 m³).

4.1.6 Stock Watering

As a result of analysis using the hydro-census data, the total stock watering volume was estimated at 5.678 million m³ /year. In addition, stock watering volume per farmer ranged from 5,000 to 7,000m³ /year.

Table 4.1-4 Stock Watering

Area*	No. of Farm	Grazing Area	Large Stock	Small Stock	Stock Watering (m ³ /y)	Stock Watering /farm (m ³ /y)
Area I	26	142,243	1,190	39,396	131,107	5,043
Area II	48	209,391	2,588	63,255	219,656	4,576
Area III	16	88,248	1,678	31,100	113,473	7,092
Area IV	33	177,199	2,851	610	222,705	6,749
Area V	100	718,099	9,610	135,585	525,691	5,257
Area VII	730	3,918,411	96,894	1,081,149	4,465,509	6,117
Total	953	5,253,591	114,811	1,351,095	5,678,141	5,958

Note: Analysis of JICA Study Team based upon Hydro-census data

*refer to Fig.4.1-1

4.1.7 Irrigation

(1) Irrigation Area

Commercial farms that operate irrigation farming are mainly located along the Auob River. The Stampriet area is particularly concentrated with 76% of irrigation farms in that area (refer to Fig 4.1-1 and Table 4.1-5).

According to DWA data the permitted irrigated area is 399.5 ha (as of 2000). There is a big difference between the permitted area and the actual irrigation area (refer to Table 4.1-5) calculated using hydro-census data. This is because the figure includes the farmers who illegally over irrigate more than the permitted area and irrigation farmers whose farm areas are less than one hectare.

As shown in Table 4.1-6 crops cultivated in the study area are very diverse. The main crops are Lucerne, Maize and vegetables. In particular, Lucerne is a dominant crop and the cultivated area amounts to the half of the total irrigation area.

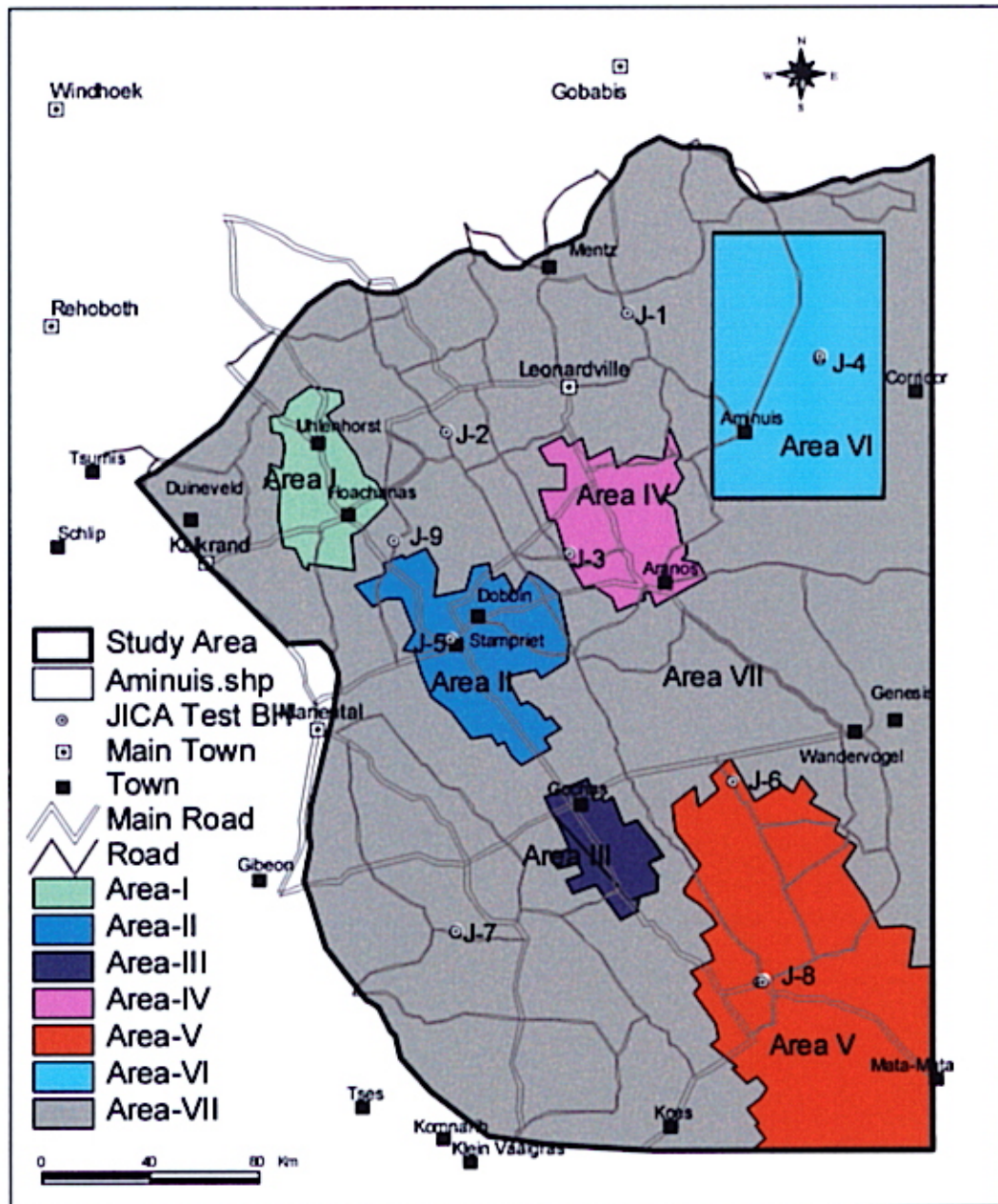


Fig.4.1-Division for Socio-economic Analysis

Table 4.1-3 Irrigation Area and Irrigation Water Use

Area	Farm area (ha)	No. of irrigation farm	Irrigation area (ha)	Irrigation use (m ³ /y)	%	Irrigation use (m ³ /ha/yr)	Irrigation use ratio (%)	Irrigation area /irrigation farm (ha)
Area I	173,929	22	22	224,840	3	10,220	51	1.00
Area II	285,716	38	412	5,334,341	78	12,947	94	10.84
Area III	112,403	6	11	112,420	2	10,220	45	1.83
Area IV	200,833	10	24	394,119	6	16,422	58	2.40
Area VII	4,719,973	83	77	810,712	12	10,598	12	0.92
Total	6,306,250	163	546	6,876,432	100	60,407	48	3.35

Note: Analysis of JICA Study Team based upon Hydro-census data

Table 4.1-6 Irrigation Area by Crop Types

unit:ha

Crop types \ Area	Area I	Area II	Area III	Area IV	Area VII	Total	%
Lucerne	8.6	167.8	4.3	42.0	10.1	232.8	48.0
Vegetable	2.9	82.0			2.6	87.5	18.0
Maize		61.0		2.0	21.5	84.5	17.4
Grapes		15.0				15.0	3.1
Citrus	6.5	4.2			4.2	14.9	3.1
Sorghum		13.5				13.5	2.8
Oranges		4.0			1.1	5.1	1.1
Water melon		5.0				5.0	1.0
Cabbage		4.5				4.5	0.9
Fruit	0.4			0.5	3.0	3.9	0.8
Oats	0.2			3.0		3.2	0.7
Sweet melon		3.0				3.0	0.6
Mealies		1.0	0.3		1.3	2.5	0.5
Pumpkin		2.0				2.0	0.4
Sweet potatoes		2.0				2.0	0.4
Tomatoes		1.5				1.5	0.3
Barley		1.0				1.0	0.2
Carrot		1.0				1.0	0.2
Prickly pears					1.0	1.0	0.2
Collen					1.0	1.0	0.2
Garden					0.5	0.5	0.1
Guavas					0.1	0.1	0.0
Total	18.6	368.5	4.5	47.5	46.3	485.4	100.0

Note: Analysis of JICA Study Team based upon Hydro-census data

(2) Irrigation Permission

According to Water Act, farmers who intend to operate irrigation farming over areas greater than one hectare have to get permission for water allocation from DWA. At present 54 irrigation permissions are approved for the commercial farms in the Stampriet Artesian Basin amounting for 8,266,560 m³/year. They are given various water allocations according to the designated areas (refer to Table 4.1-7 and Fig. 4.1-2). Permission is valid for five years.

Table 4.1-7 Permitted Water Use

Area *	Allocated water volume (m ³ /ha/ year)
Area 1	19,000
Area 2	54,000
Area 3	45,000

Source: DWA

*Refer to Fig.4.1-2

(3) Irrigation Water Use

Total irrigation water used in the Study area is 6.88 million m³/ year (refer to Table 4.1-5). Table 4.1-10 indicates that the total water extraction volume is under the permitted volume, however there are many farmers who illegally drafted and use groundwater in the Study Area. The numbers are nine in Area II and three in Area VII. Totally twelve farmers extracted much more groundwater than the allocated volume (refer to Table 4.1-8 and Table 4.1-9).

Table 4.1-8 and 4.1-9 also indicates the following things:

- A farmer in Area VII used about five times of allocated water quantity by sprinkler irrigation.
- Most of illegal farmers are operating irrigation farming using drip or sprinkler etc. that enables more efficient water use than flood irrigation.

Table 4.1-8 Illegal Farms in Area II

Farms	Actual water use (m ³ /y)	Permitted water use (m ³ /y)	Irrigation use (m ³ /ha/y)	Irrigation method	Times
1	659,980	288,000	N/A	N/A	2.3
2	442,015	120,000	17,681	Drip	3.7
3	384,000	200,000	N/A	N/A	1.9
4	282,109	126,000	17,632	Pivot	2.2
5	431,011	290,000	N/A	N/A	1.5
6	182,500	90,000	18,250	Drip	2.0
7	116,800	75,000	23,360	Sprinkler, Drip	1.6
8	379,600	350,000	21,089	Drip	1.1
9	103,660	90,000	17,277	Drip	1.2

Times = Irrigation use (m³/ha/y) / Permitted water use (m³/ha/y)

Table 4.1-9 Illegal Farms in Area VII

Farms	Actual water use (m ³ /y)	Permitted water use (m ³ /y)	Irrigation use (m ³ /ha/y)	Irrigation method	Times
1	292,000	54,000	97,333	Sprinkler	5.4
2	659,980	288,000	N/A	N/A	2.3
3	59,819	36,000	29,910	Sprinkler	1.7

Times = Irrigation use (m³/ha/y) / Permitted water use (m³/ha/y)

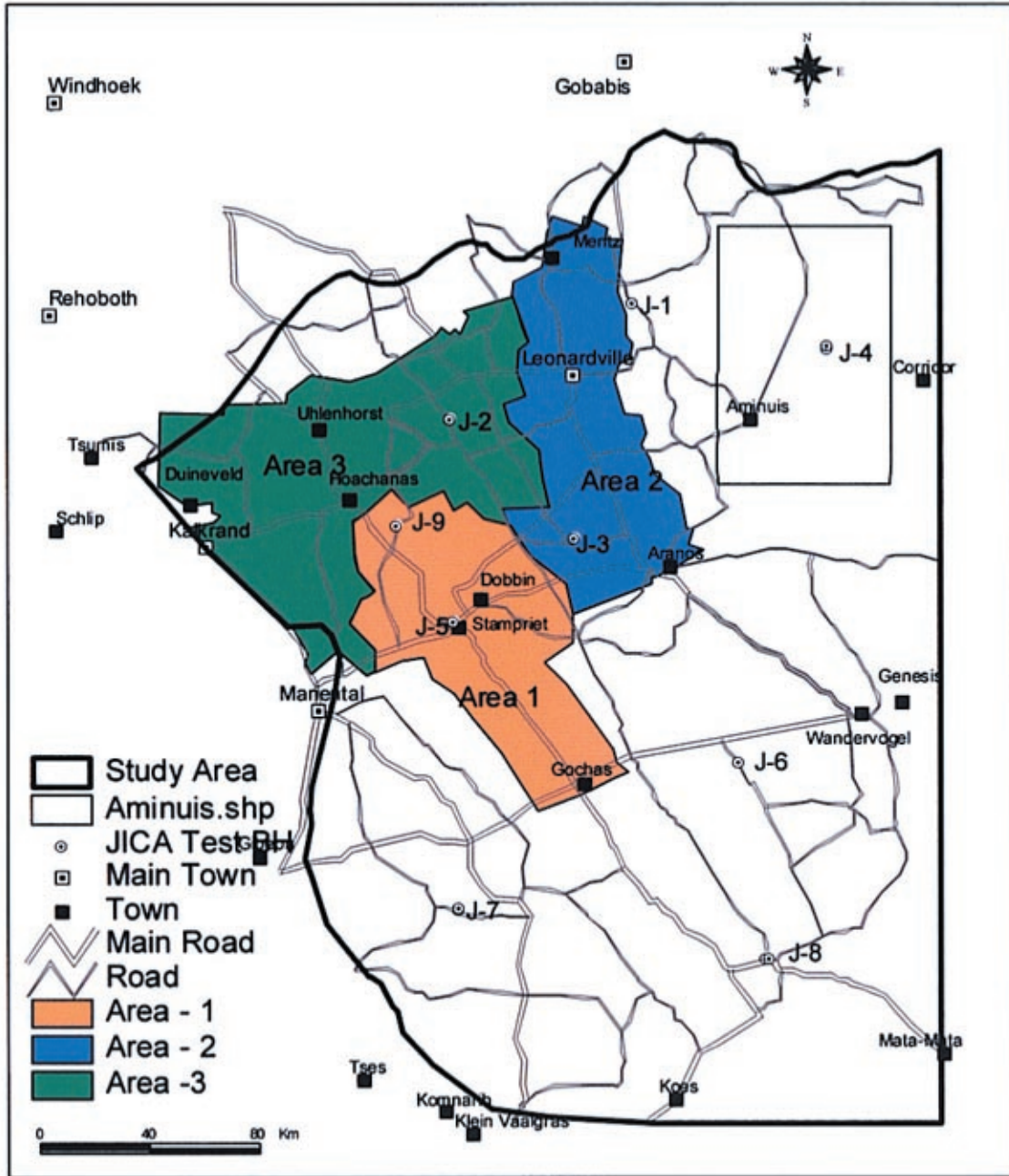


Fig. 4.1-2 Monitoring Area for Permission Holder

Table 4.1-10 Comparison Between Actual Water Use and Permitted Water Use

No.	Actual Water use (m ³ /y)	Permitted water use (m ³ /y)	Actual water use (m ³ /ha/y)	Methods	Irrigation area (ha)
1	89,060	90,000	4,453	Drip	20.0
2	182,500	90,000	18,250	Drip	10.0
3	442,015	120,000	17,681	Drip	25.0
4	119,720	165,000	7,981	Drip	15.0
5	379,600	350,000	21,089	Drip	18.0
6	103,660	90,000	17,277	Drip	6.0
7	55,298	126,000	9,216	Flood	6.0
8	55,298	90,000	9,216	Flood	6.0
9	38,873	90,000	15,549	Flood	2.5
10	129,575	145,000	43,192	Flood, Drip	3.0
11	219,000	237,000	16,846	Flood, Drip	13.0
12	32,906	54,000	N/A	N/A	N/A
13	21,900	124,000	2,738	N/A	8.0
14	659,980	288,000	N/A	N/A	N/A
15	431,011	290,000	N/A	N/A	N/A
16	36,230	81,000	N/A	N/A	N/A
17	49,242	54,000	3,517	Pivot	14.0
18	282,109	126,000	17,632	Pivot	16.0
19	292,000	54,000	97,333	Sprinkler	3.0
20	59,819	36,000	29,910	Sprinkler	2.0
21	4,380	54,000	1,460	Sprinkler	3.0
22	4,380	150,000	548	Sprinkler	8.0
23	117,165	180,000	11,717	Sprinkler	10.0
24	71,905	90,000	23,968	Sprinkler	3.0
25	116,800	75,000	23,360	Sprinkler, Drip	5.0
26	40,880	110,000	3,407	Sprinkler, Drip	12.0
27	73,000	100,000	6,083	Sprinkler, Drip	12.0
28	10,585	200,000	1,059	Sprinkler, Drip	10.0
29	27,375	180,000	913	Sprinkler, Drip	30.0
30	18,250	126,000	2,607	Sprinkler, Drip	7.0
31	13,140	144,000	1,195	Sprinkler, Drip	11.0
32	65,335	275,000	5,940	Sprinkler, Drip	11.0
33	655,000	655,000	10,917	Sprinkler, Drip, Flood	60.0
34	103,660	275,000	5,183	Sprinkler, Drip, Flood	20.0
35	371,935	792,000	37,194	Sprinkler, Flood	10.0
36	35,040	576,000	1,752	Sprinkler, Flood, Drip	20.0
37	15,108	55,000	N/A	N/A	N/A
38	384,000	200,000	N/A	N/A	N/A
39	12,188	90,000	N/A	N/A	N/A
Total	5,819,922	7,027,000	-	-	399.5

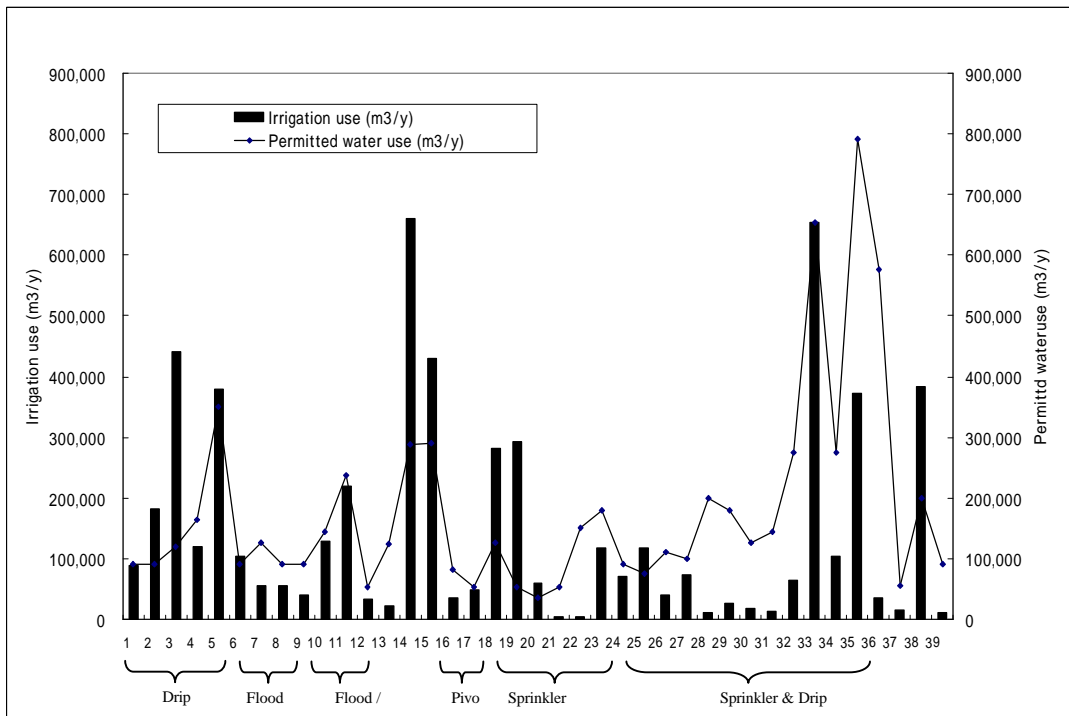


Fig.4. 1-3 Comparison Between Actual Water Use and Permitted Water Use

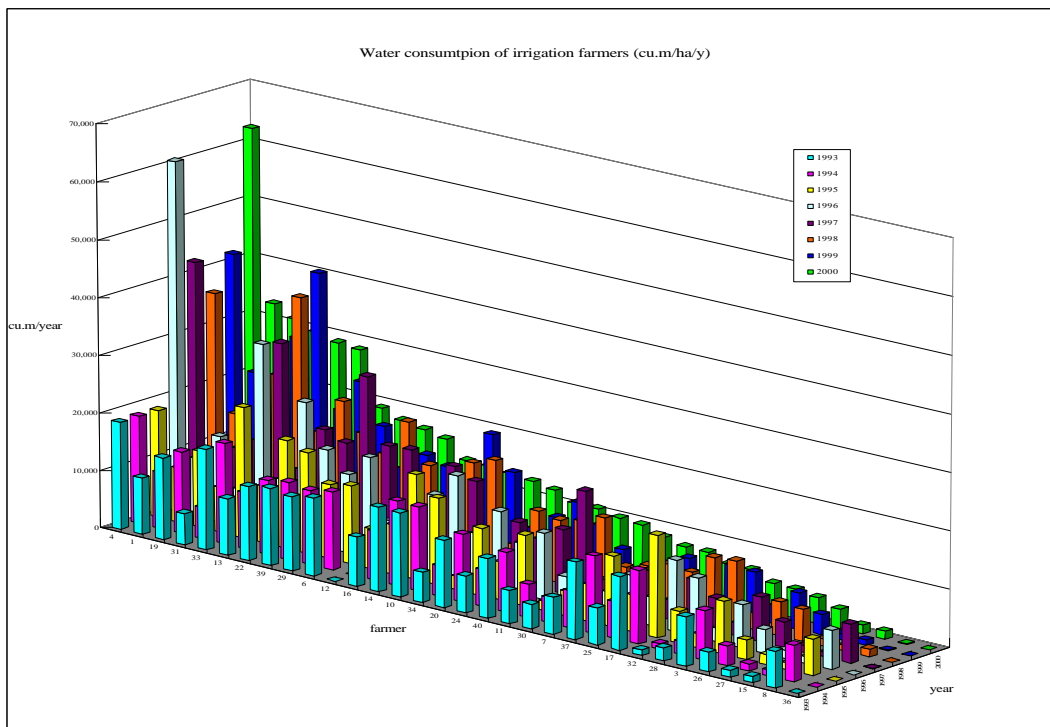


Fig. 4.1-4 Irrigation Water Use by Permitted Farms (1994-1999)

(4) Irrigation method

As Table 4.1-11 indicates, drip irrigation is widely applied in the study area and it is the area under this method amounts to 104.6 ha, which is 23% of the total irrigated area. Sprinkler and mixed application with sprinkler, drip and other methods comes after this in term of coverage.

Including mixed application with drip and sprinkler, 58.9% of farm areas are applied efficient irrigation methods. The areas that apply only the flood method are quite few, and the total area amounts to about 30.5 ha (6.8%). As the result of this, conversion of irrigation method cannot expect a drastic water saving.

Table 4.1-11 Irrigation Area by Applied Methods in the Study Area

Unit: ha

Area	I	II	III	IV	VII	Total	%
Irrigation method							
Drip		98.5		2.0	4.1	104.6	23.8
Sprinkler		56.0	1.0	20.0	6.0	83.0	18.9
Sprinkler, Flood, Drip		77.0				77.0	17.5
Sprinkler, Drip	2.0	62.5				64.5	14.7
Flood	3.0	17.5	4.0		6.0	30.5	6.9
Flood, Drip					21.0	21.0	4.8
Pivot		15.0				15.0	3.4
Micro sprayer	1.0	12.0			1.0	14.0	3.2
Sprinkler, Flood	1.0	10.0			2.0	13.0	3.0
Sprinkler, Drip, Micro sprayer	12.5					12.5	2.8
Flood, Micro sprayer	2.0					2.0	0.5
Micro sprayer, Drip					2.0	2.0	0.5
Hose				0.5		0.5	0.1
Total	21.5	348.5	5.0	22.5	42.1	439.6	100.0

Source: Analysis of JICA Study Team based upon Hydro-census

4.1.8 Estimated Present Water Consumption in the Study Area

The following table shows estimations of water usage by sector in the Study Area as of March 2000.

Sectors	Water Usage (million m ³ /year)	Proportion (%)
1. Domestic water		
1.1 Village centres	0.635	4.26
1.2 Commercial farms	1.594	10.69
1.3 Communal land	0.127	0.85
Sub-total	2.356	15.80
2. Industries	0	0.00
3. Tourism	0.004	0.03
4. Stock watering	5.678	38.07
5. Irrigation	6.876	46.10
Total	14.914	100.00