

Postal service office is located in Achacachi City. The post office is responsible for receiving and sending mail, but the home delivery service exist only in the city area. Therefore, residents in the rural area must go to the post office to get their mail.

(5) Meeting Facility

Meeting among the inhabitant is the important system to decide the will of the community. The facility to hold a meeting is indispensable to make the enough discussion among the inhabitants. But, only eight communities have a meeting facility in the study area. The playground of school, an open space and an individual house are being used as a meeting place in the communities which doesn't have a meeting facility. So, it is being asked strongly that the establishment of the meeting facility which can be used multipurpose without physical difficulty.

(6) Agricultural Facility

Within the study area, there are no agricultural related facilities such as collecting and shipping of products, agricultural extension or meeting.

3.8.4 Assessment of Present Condition

The present conditions of basic infrastructure of each community are summarized as follows:

Comunidad	Education	Health Care	Water Supply	Electricity	Meeting	Transportatio	Road
Kerani	4	2	4	2	2	4	2
Chachacomani	4	2	1	1	1	3	1
Corpáputu	3	1	1	1	1	2	1
Coromata Alta	4	1	2	2	2	3	1
Coromata Media	2	1	2	2	2	3	1
Coromata Baja	2	1	2	2	2	1	1
Berenguela	2	1	1	1	2	1	2
Pongon Huyo	4	1	1	2	1	2	1
Palrumani	2	1	4	1	1	1	1
Icrana	2	1	4	3	1	3	2
Pajchani Grande	3	1	3	1	1	3	2
Pajchani Molino	3	1	3	3	1	2	2
Cala Cala	3	1	5	2	1	3	1
Barco Cala Cala	2	1	5	2	1	3	1
Jahuir Laca	2	1	1	3	2	4	2
Avichaca	3	1	5	3	1	4	2
Suntia Comun	1	1	3	3	2	1	2
Suntia Chico	1	1	3	3	2	1	2
Suntia Grande	2	1	3	1	1	2	2
Putuni	2	1	3	1	2	1	2
Marca Masaya	2	1	3	1	1	4	2
Kjasina	2	1	3	1	1	2	2
Tipampa	2	1	3	3	1	3	2
Cajon Pata	1	1	1	3	1	4	2
Taramaya	2	1	1	3	1	4	2
Arsaya Chico	1	1	3	3	2	3	2
Arasaya Kentuyo	1	1	3	3	2	3	2
Arasaya Patanivi	1	1	1	3	1	2	2
Belen	4	1	1	3	2	4	2
Barco Belen	2	1	1	3	1	3	1
Ciudad Achacachi	5	3	5	3	2	4	3

note: Education 5: E.Tecnica 4: Medio 3: Intermedio 2: Basico 1: No
 Health care 4: Hospital 3: Dispensary 2: Health Center. 1: No
 Water supply 5: Supply Sys. 4: Comuni. Tap 3: Manual Pump 2: Under Con. 1: No

Electricity	3:Electricity	2:Under Con.	1:No	
Melting Cent.	2:Existing	1:No		
Transportation.	4:Frequently	3:Daily	2:Week	1:No
Road	3:Enough	2:Not enough	1:Bad	

The Classter analysis was enforced by using the above 7 index to make clear the property of each community. The communities of the study area are classified in 6 type as a result of the analysis.

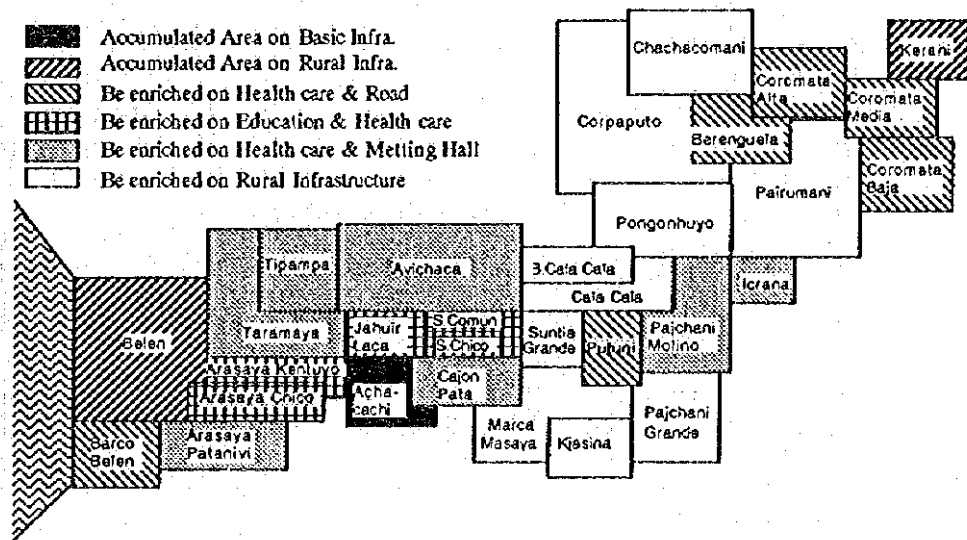
Achacachi City classifies to the first type of the Classter analysis which the basic infrastructure is fixed. The second type is Kerani and Belen that a rural infrastructure is almost fixed. The third type is six communities such as Coromata Alta, Coromata Media, Coromata Baja, Berengela, Putuni and Barco Belen that the priority has to set at improvement of road and medical care facilities.

The following 5 communities come under the fourth type - Jawir Laca, Suintia Comun, Suintia Chico, Arasaya Chico and Arasaya Kentuyo. Improvement target of this type is the educational and the medical care facilities. 7 communities such as Icrana, Pajchani Molino, Avichaca, Tipampa, Cajon Pata, Taramaya and Arasaya Patanivy belong to the fifth type. The goal of this type is the fulfillment of the meeting, road and medical care facilities.

The sixth type is required synthetic improvement of rural infrastructures. 10 communities belong to this type such as Chachacomani, Corpaputo, Pongonhuyo, Pairumani, Pajchani Grande, Cala Cala, Suintia Grande, Maraca Masaya and Kjasina.

The above result is illustrated are as follows.

Classification of Situation on Rural Infrastructure



The problems of the present conditions in each basin of Rio Keka are as follows:

1) Upper basin

Upper basin locates at the most upstream reach of Rio Keka and lags behind the improvement of fundamental infrastructure facilities. Therefore, the problems of this basin are the improvement of basic infrastructure such as establishment of road networks between other basins and each community, drinking water supply, electricity, meeting and agriculture related facilities.

The area is divided into two parts by Rio Keka. Since no bridge is available on the river course, traffic between the left and right banks of Rio Keka is occasionally cut off due to the flood occurred during the rainy season. This conditions arise blocking out the interchange of commodities and rural habitants and are the factor to obstruct the sound development of the basin as a whole.

On the other hand, consider from the geographical location, Chachacomani must be placed on the development nucleus of the basin. Strategic facilities should be established to accelerate the development in the area.

2) Middle basin

Middle basin locates at the central part of the study area. Since no bridge is available in the river course, the basin is also divided into two parts, right and left bank areas of the Rio Keka. Formerly, foot bridge to cross the Rio Keka had been constructed near Pairumani, however, the flood washed away the bridge and no facilities exist to cross the river at present. This condition takes place to obstruct the unity development of the right and left bank areas of the basin.

The trunk road is installed at the right and left bank areas respectively. However, the damage of the road surface is in progress and improvement is required to maintain the function of the trunk road in the area. Moreover, the area has problems that the facilities to care the health of inhabitant is not provided properly. Provision of water supply facility is also delayed. As the drinking water, most of inhabitants depend on the personal dug well at present.

To promote the development socially and economically, this basin has various problems due to wide area and scattered house arrangement. Therefore, improvement program on a stage-wise basis must be established.

3) Lower basin

This basin is located in the extreme lower reach in the Rio Keka and Achacachi City takes place as the core in the basin. The fundamental infrastructure are fixed because the area develops at the suburbs of the city. Therefore, it is important to enhance the quality of the basic infrastructure as the development target in the area.

Because the area extends fertile plain generated by the Rio Keka, possibility of the agricultural development is high. However, improvement of the facilities related to agriculture is behind. Improvement of agricultural related facilities is urgent subject.

Belen is the nucleus community at the rural areas in this basin. It is important to promote the agricultural development by installing the core facility for development at Belen.

3.9 Current Status of Environment

3.9.1 Environmental Administration

(1) Ministry of Sustainable Development and Planning

Ministry of Sustainable Development and Planning (Ministerio de Desarrollo Sostenible y Planificación) superintends a environmental department. The Ministry is the organization for all matters concerned harmonious national development, human resources, quality of environment, restoration and maintenance of natural environment, and national economy. The Ministry consists of six vice-ministry i.e., Planning and Land Demarcation, Sustainable Development and Environment, Populace Participation and

Fortification of Municipality, Gender/Generation and Family Issues, Indigenous and Aborigines Issue, Protection Area.

(2) Laws Concerned Environment

It is as follows as an important law that affects the environment.

1) The law of environment

The law of environment (Ley General del Medio Ambiente, DL1333 del 27/4/1992) contains the enactment of the standards and principles concerning the organization of environment and the protection and environmental control. This law is placed as the nucleus law related to the environment in the nation. And the law consists of each regulation that is shown in the following. It is decided the general guide line of application and interpretation of a policy, law and regulation about the protection, conservation, exploitation and control of the natural resources.

- Regulation of Environment control
- Regulation of Environment conservation
- Regulation of air pollution material
- Regulation of water pollution material
- Regulation of radioactive dangerous object

2) Other laws related environment

- The law of mine: promulgation in 1925
- The forest law: promulgation in 1930 (Revised in 1996)
- The law of agrarian reform: promulgation in 1953
- The law of decentralization of authority: promulgation in 1996

3) International treaty concerning natural environment conservation in Bolivia

- Ramsar Treaty (Convention on Wetland of International Importance Especially as waterfowl Habitat)
- Washington Treaty (Convention on International Trade in Endangered Species of Wild Fauna and flora - CITES-)

(3) System of Environment Impact Assessment (EIA)

Regarding environment impact assessment, it is prescribed in the Article 25 of the law of environment that all works and activities by any public and private body has to decide the category of the environment impact assessment before the investment is carried out. The four categories are as follows.

- Category I : Needs comprehensive EIA.
- Category II : Needs specific EIA
- Category III : Desirable to do conceptual examination though specific EIA is not necessary
- Category IV : No need any EIA.

It is required that environment investigation sheet (Ficha Ambiental) is made in all projects and submitted to the National Secretary of Natural Resources and Environment. The investigation to make FA is equivalent to the initial environment evaluation (IEE). The National Secretary of Natural Resources and Environment decides whether environmental impact assessment should be executed or not according to the content of FA.

According to the information of National Secretary of Natural Resources and Environment, the results of FA as of August, 1996 were as follows.

Number of accepted FA : 615
 category I : 8, category II : 175, category III and IV:209
 (Others: 273 were rejected or in examining of an alternative idea)

As for results of FA (1995/11-1996/2), concerning the projects of SNAG, the category was put on 25 out of 55 submitted FA. All of projects were categorized as III.

3.9.2 Natural Environment

(1) Location and Topography

The study area covers the area of approximately 8,000ha for the Achacachi municipality and its peripheral rural areas (middle and down stream reaches of Rio Keka). Topography is contained Altiplano in the typical Bolivian topography, and it is in the sub-tropical highland climate.

(2) National Park and Protection Area for Wildlife

The law of hunting and fishery of wildlife in national parks rules four protection area mentioned below;

- National park
- Evacuation area for wildlife
- Protection area for wildlife
- Sanctuary for wildlife

Each protection area is not included in the study area.

(3) Forest

Bolivian forests are classified into four types according to the climate zone such as Tropical forest, Sub-tropical forest, and Temperate forest. The greater part of forests in Altiplano including the study area has already disappeared. The dominant species in natural vegetation around the study area are consisted of "queñoa" (*Polylepis* spp.), "quishwara" (*Buddleja* spp.), "chachacoma" (*Escallonia* spp.), which are categorized as low mountain vegetation. As the shrub, "thola" (*Ribes*), *Berberis*, *Satureja*, *Minthostachys*, and "muña muña", *Agalinis* are present. These plants are seen unusually in the valley where is difficult to access and has high humidity. Since the study area is ecologically fragile, species such as "chachacoma" (*Escallonia myrtilloides*), *Ribes pentlandii* are on the verge of extinction.

(4) Water Quality

To grasp the present condition of water quality in the study area, investigation and analysis were entrusted to the local survey firm.

1) Sampling point

No.	Item	Place
M- 1	well	Kerani canton, Los Andes province
M- 2	well	Coromata baja
M- 3	Rio Keka	Coromata alta
M- 4	Rio Keka	Palrumanii
M- 5	Rio Keka	Vicullini hill, Omasyos province
M- 6	Springing water	Kalani hill, Pajchani Molino, Omasyos province
M- 7	Rio Keka	Putuni, Omasyos province
M- 8	well	Pajchani Molino, Omasyos province

to be continued

No.	Item	Place
M-9	Chiar Kala river	Cala Cala, Omasuyos province
M-10	Rio Keka	Chiar Keka community, Omasuyos province
M-11	Rio Keka	Achacachi province
M-12	Rio Keka	Arasaya Chiko, Omasuyos province
M-13	Rio Keka	Omasuyos province
M-14	well	Maruta Masaya, Omasuyos province

(Refer to Fig. 3.9.1)

2) The parameters analysis are the following:

- Hydrogen Concentration (pH)
- Suspended Sediment (SS)
- Biochemical Oxygen Demand (BOD)
- Nitrate Nitrogen (NO₃-N)
- Magnesium Ion (Mg²⁺)
- Ferrous Ion (Fe²⁺)
- Fluorine Ion (F⁻)
- Electric Conductivity (EC)
- Dissolved Oxygen (DO)
- Coliform Group
- Calcium Ion (Ca²⁺)
- Mangan Ion (Mn²⁺)
- Copper (Cu)
- Chlorine Ion (Cl⁻)

3) Sampling date

First sampling on December 12, 1996
 Second sampling on January 13, 1997

4) Result

Refer to Annex M.

(5) Water Quality Conservation of Titicaca Lake

When thinking about an environmental problem in an agricultural development of the Rio Keka basin, it is necessary to consider the water quality conservation of the Titicaca Lake to which Rio Keka is flowing in the final ahead.

The Andes is divided into West Andes and East Andes in the point of 14° south and form the plateau which is called Altiplano of 200,000 km² in the area, 3600-4500m above sea level, enclosed by Andes in the south of this turning point. Closing basin of Altiplano divides into two basins. One is the Titicaca Lake basin, which flows in the Poopó through the Desaguadero River. This Poopó Lake flows in the Coipasa salt lake further. Another, the Grande River flows in the Uyuni salt lake. The Titicaca Lake is world one from the point view of the area and the depth as the navigable lake. The Titicaca Lake divides into the small Titicaca Lake and the large Titicaca Lake, both of which are connected in the Tiquina strait having 800m width. The large Titicaca Lake has 285m as maximum depth and the small Titicaca Lake has only 40m. 2/3 or more of a large Titicaca Lake has the depth of 150m or more. The majority of the small Titicaca Lake has only the depth of 5-10m.

The Titicaca Lake basin is almost closed water system with only one exit. Because of high evaporation, a water stagnant rate is 63 years on an average. The total basin area of the Titicaca Lake is 57,500km² and the 1/4 is situated on a Bolivian side. 85% is an actual basin area (1/5 is Bolivian side and Peru is 4/5) and 15% is that of the water.

As for the water pollution in the Titicaca Lake, pollution around the Puno city and the Juliaca city which are located the Peruvian side is notable. Discharge from houses attributes to this pollution rather than that from agriculture and from Gold Mine Mountain. Puno and Juliaca possess the population of 100,000 persons or more respectively and an influence of improper domestic wastewater treatment is thought to be significant.

3.9.3 Social Environment

(1) Inhabitants

Inhabitants are Aymala tribe who live in the highland zone around Titicaca lake. And they speak Aymalan language. They run mainly agriculture and stock breeding, and hold the rich tradition of the folk dance, ethnic music, and so on.

(2) Life Environment

1) Maintenance on public health

The maintenance of the system of public health is delay in Achacachi City. Because the law of public participation and the law of decentralization does not still fulfill the function well. In the future, The Department of Public Health of Achacachi City will carry out the roll the maintain of the system.

2) Drainage system

There is no drainage system around the study area and the water used in the kitchen is processed with own garden etc.. The lavatory is not disposed to all homes and people are going in the relieve oneself in a public lavatory or outdoor. As for the filth of a public lavatory, disposal of laying underground is regularly done near the graveyard etc. Therefore, they don't throw the filth of a public lavatory.

3) Water supply system

As for the water supply system, they draw up groundwater in the city area. And the provinces secure the drinking water from shallow well.

4) Current status of use of chemicals and fertilizer

The current status of use of chemicals and fertilizer is not grasped in the Achacachi city so far. The products of chemicals and fertilizer mainly come from Peru and some of them used from Japan. The agricultural chemicals maker carry out to guide the farmers once in every six months. They guide about a use time limit, a place in the method and the warehouse, etc. And the guided number of farmers is uncertain.

5) Current status of natural disaster etc.

The current status of natural disaster is not grasped by the Achacachi city office. (Because there were only three staffs in charge when the flood occurred 10 years ago) Flood has not been occurred in the Achacachi city area although there has been occurred in every 10-20 years in this district. In the disaster occurred 10 years ago, there was damage of flooded houses in the each district Belen, Chijipina, Ajllata.

6) Endemic etc.

Pneumonia become popular in winter though there is no endemic. The past records are not grasped by the city office.

Table 3.1.1 Meteorological Parameter

Parameter	unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average	Total
Temperature Mean	°C	9.0	9.1	8.9	7.5	5.6	3.9	3.6	5.0	6.7	8.1	8.6	9.0	7.1	-
Temperature Mean Max.	°C	14.4	14.6	15.0	15.2	14.6	13.5	13.2	14.0	14.4	15.4	15.6	14.9	14.6	-
Temperature Mean Min.	°C	3.6	3.5	2.9	0.0	-3.5	-5.7	-6.0	-3.8	-1.0	0.8	1.5	3.1	-0.4	-
Temperature ABS Max.	°C	0.1	0.0	-0.9	-5.0	-8.2	-10.0	-10.3	-9.6	-5.7	-4.3	-3.2	-0.2	-4.8	-
Temperature ABS Min.	°C	17.5	16.9	17.5	17.4	16.9	15.8	15.5	16.8	17.1	18.2	18.6	18.1	17.2	-
Relative humidity	%	73	72	72	66	62	60	59	61	63	64	66	72	65.8	789.2
Evaporation Total	mm	115	103	115	112	110	95	107	126	134	155	148	114	119.5	1434.3
Sun Shine	hr	155.6	165.2	213.1	255.3	291.1	272.8	276.0	294.4	259.6	269.6	231.9	174.9	238.3	2859.4
Frost Days	day	1.0	1.3	3.2	15.2	26.0	27.8	29.2	27.1	17.4	11.3	7.9	2.6	14.2	170.0
Hailstone Days	day	0.5	0.3	0.4	0.1	0.3	0.1	0.2	0.1	0.2	0.3	0.4	0.8	0.3	3.6
Wind Velocity	km/hr	12.0	12.4	11.5	11.8	9.6	9.9	11.4	13.7	15.2	16.8	15.9	13.0	12.8	-

Table 3.1.2 Monthly Mean Discharge-1 (Achacachi)

Year	(unit:m ³ /sec)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	0.434	0.419	0.412	0.469	1.214	10.904
1968	8.568	13.967	13.535	5.231	2.737	1.384	0.643	0.553	0.496	0.851	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	19.582	12.729	5.805	1.666	1.124	0.562	0.386	0.367	0.381	1.658	5.263
1972	9.201	9.599	7.206	3.022	1.243	0.692	0.444	0.423	0.466	0.410	1.567	8.847
1973	16.399	16.416	14.893	9.228	3.261	0.982	0.862	0.464	0.686	1.305	2.686	6.529
1974	10.992	39.311	20.590	6.039	1.906	1.532	0.643	1.029	0.476	0.497	1.233	4.322
1975	7.535	23.806	14.030	4.502	2.123	0.894	0.524	0.366	-	-	1.497	7.306
1976	-	-	10.471	2.425	1.176	0.749	0.531	-	-	-	1.722	3.821
1977	6.449	4.978	15.678	4.911	1.920	0.936	0.565	-	-	-	3.033	4.356
1978	-	-	-	5.947	-	0.865	-	-	-	-	0.632	2.375
1979	-	14.739	13.922	7.644	2.235	1.030	0.789	-	-	-	5.311	8.936
1980	8.884	8.174	13.521	6.599	1.694	0.878	0.695	-	-	-	2.571	5.612
1981	-	15.517	9.304	6.331	1.809	0.724	0.487	-	-	-	2.320	7.166
1982	14.767	9.781	11.123	5.881	2.258	0.600	0.568	-	-	1.549	3.983	4.165
1983	7.092	10.470	9.019	7.433	2.860	1.292	0.402	0.392	1.744	1.786	2.986	5.343
1984	-	-	-	-	4.732	1.472	0.807	0.612	-	-	-	-
1985	-	-	-	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-	-	-	-	-	-
1988	-	-	13.528	15.324	9.577	4.699	3.337	1.276	0.913	0.874	1.632	4.018
1989	7.205	9.596	13.353	16.984	9.917	1.747	-	-	-	0.589	1.570	2.373
1990	10.068	8.005	3.417	2.388	2.134	1.414	0.791	-	-	0.711	1.540	-
1991	-	-	-	31.584	13.784	9.517	1.718	0.809	0.625	4.814	10.265	32.017
1992	11.993	23.548	5.591	3.238	1.677	0.963	0.535	0.818	0.589	0.690	2.442	5.968
1993	8.491	5.434	9.867	5.841	3.204	1.609	1.195	0.760	0.479	0.511	4.761	9.386
1994	17.038	15.450	9.667	5.159	1.416	0.749	0.543	0.420	0.332	0.349	-	-
1995	-	9.095	4.437	2.457	1.255	0.585	0.343	0.335	0.342	1.898	5.586	5.811
1996	5.995	5.439	4.189	1.495	0.608	-	-	-	-	-	-	-
Mean	10.045	13.837	10.956	7.194	3.269	1.584	0.792	0.604	0.610	1.105	2.867	7.226

Table 3.1.2 Monthly Mean Discharge-2 (Upper Intake)

Year	(unit:m ³ /sec)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	0.336	0.387	0.382	0.386	0.996	9.244
1968	7.200	11.891	11.472	4.369	2.257	1.141	0.513	0.521	0.465	0.727	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	16.787	10.776	4.858	1.354	0.919	0.445	0.354	0.336	0.308	1.379	4.412
1972	7.748	8.082	6.003	2.486	0.997	0.551	0.344	0.391	0.436	0.333	1.300	7.482
1973	13.974	14.027	12.646	7.775	2.698	0.798	0.698	0.432	0.656	1.133	2.265	5.496
1974	9.297	33.989	17.568	5.057	1.556	1.267	0.513	0.997	0.445	0.411	1.012	3.606
1975	6.307	20.470	11.900	3.747	1.739	0.724	0.412	0.335	-	-	1.239	6.162
1976	-	-	8.825	1.977	0.940	0.600	0.418	-	-	-	1.433	3.177
1977	5.368	4.054	13.324	4.096	1.567	0.759	0.447	-	-	-	2.564	3.636
1978	-	-	-	4.979	-	0.699	-	-	-	-	0.493	1.939
1979	-	12.564	11.806	6.425	1.833	0.839	0.637	-	-	-	4.528	7.558
1980	7.474	6.840	11.460	5.535	1.377	0.710	0.557	-	-	-	2.166	4.711
1981	-	13.243	7.816	5.306	1.474	0.579	0.380	-	-	-	1.949	6.043
1982	12.562	8.241	9.388	4.923	1.852	0.473	0.449	-	-	1.351	3.383	3.472
1983	5.924	8.842	7.570	6.245	2.361	1.062	0.309	0.360	1.714	1.562	2.523	4.480
1984	-	-	-	-	3.939	1.215	0.651	0.580	-	-	-	-
1985	-	-	-	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-	-	-	-	-	-
1988	-	-	11.466	12.972	8.025	3.963	2.794	1.244	0.883	0.748	1.356	3.346
1989	6.022	8.080	11.315	14.386	8.312	1.449	-	-	-	0.493	1.303	1.937
1990	8.498	6.693	2.730	1.945	1.748	1.166	0.638	-	-	0.602	1.276	-
1991	-	-	-	26.831	11.573	8.063	1.424	0.777	0.595	4.266	8.798	27.327
1992	10.163	20.245	4.608	2.669	1.363	0.782	0.422	0.786	0.559	0.583	2.054	5.016
1993	7.134	4.451	8.303	4.888	2.650	1.332	0.981	0.728	0.449	0.424	4.054	7.944
1994	14.526	13.184	8.130	4.307	1.143	0.600	0.428	0.389	0.301	0.279	-	-
1995	-	7.643	3.611	2.004	1.007	0.460	0.259	0.303	0.312	1.662	4.764	4.882
1996	4.975	4.456	3.397	1.185	0.461	-	-	-	-	-	-	-
Mean	8.478	11.778	9.243	6.042	2.706	1.311	0.639	0.572	0.579	0.954	2.421	6.094

Table 3.1.2 Monthly Mean Discharge-3 (Middle Intake)

Year	(unit:m3/sec)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	0.140	0.192	0.185	0.191	0.820	9.112
1968	7.183	11.951	11.468	4.232	2.081	0.951	0.317	0.326	0.268	0.533	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	16.846	10.772	4.721	1.178	0.730	0.249	0.159	0.139	0.113	1.203	4.280
1972	7.731	8.142	5.999	2.349	0.822	0.362	0.149	0.196	0.239	0.139	1.124	7.351
1973	13.958	14.086	12.642	7.638	2.523	0.608	0.502	0.237	0.459	0.938	2.089	5.365
1974	9.280	34.049	17.565	4.920	1.381	1.077	0.317	0.802	0.248	0.217	0.836	3.475
1975	6.290	20.530	11.896	3.610	1.563	0.534	0.216	0.139	-	-	1.063	6.031
1976	-	-	8.821	1.840	0.765	0.410	0.222	-	-	-	1.257	3.045
1977	5.351	4.113	13.320	3.959	1.392	0.570	0.251	-	-	-	2.388	3.504
1978	-	-	-	4.842	-	0.509	-	-	-	-	0.317	1.807
1979	-	12.624	11.802	6.288	1.658	0.650	0.441	-	-	-	4.352	7.427
1980	7.457	6.900	11.456	5.398	1.201	0.521	0.361	-	-	-	1.989	4.580
1981	-	13.302	7.812	5.169	1.299	0.389	0.185	-	-	-	1.773	5.911
1982	12.546	8.301	9.384	4.786	1.677	0.283	0.254	-	-	1.156	3.207	3.341
1983	5.907	8.902	7.566	6.108	2.185	0.873	0.113	0.165	1.517	1.367	2.347	4.349
1984	-	-	-	-	3.764	1.026	0.456	0.385	-	-	-	-
1985	-	-	-	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-	-	-	-	-	-
1988	-	-	11.462	12.834	7.850	3.773	2.598	1.049	0.686	0.553	1.180	3.214
1989	6.005	8.140	11.311	14.249	8.137	1.260	-	-	-	0.299	1.127	1.806
1990	8.482	6.753	2.726	1.808	1.572	0.977	0.443	-	-	0.407	1.100	-
1991	-	-	-	26.694	11.398	7.874	1.228	0.582	0.398	4.071	8.622	27.195
1992	10.147	20.305	4.604	2.532	1.188	0.593	0.226	0.590	0.362	0.389	1.878	4.885
1993	7.117	4.510	8.299	4.751	2.475	1.143	0.785	0.533	0.252	0.229	3.877	7.812
1994	14.510	13.244	8.126	4.170	0.967	0.411	0.232	0.193	0.104	0.084	-	-
1995	-	7.703	3.607	1.867	0.831	0.271	0.063	0.108	0.115	1.467	4.588	4.750
1996	4.959	4.515	3.393	1.048	0.286	-	-	-	-	-	-	-
Mean	8.462	11.838	9.240	5.905	2.530	1.121	0.443	0.377	0.383	0.760	2.245	5.962

Table 3.1.2 Monthly Mean Discharge-4 (Lower Intake)

Year	(unit:m3/sec)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967	-	-	-	-	-	-	0.036	0.087	0.081	0.087	0.715	9.008
1968	7.079	11.846	11.364	4.127	1.977	0.847	0.213	0.221	0.164	0.428	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	16.742	10.668	4.617	1.074	0.626	0.145	0.055	0.035	0.009	1.098	4.176
1972	7.627	8.038	5.895	2.244	0.717	0.257	0.044	0.091	0.135	0.034	1.019	7.246
1973	13.853	13.982	12.537	7.534	2.418	0.504	0.398	0.133	0.354	0.834	1.984	5.260
1974	9.176	33.944	17.460	4.816	1.276	0.973	0.213	0.697	0.144	0.112	0.731	3.370
1975	6.186	20.425	11.792	3.506	1.459	0.430	0.112	0.035	-	-	0.959	5.926
1976	-	-	8.716	1.735	0.660	0.306	0.118	-	-	-	1.153	2.941
1977	5.247	4.009	13.215	3.854	1.287	0.465	0.146	-	-	-	2.283	3.400
1978	-	-	-	4.737	-	0.405	-	-	-	-	0.213	1.703
1979	-	12.519	11.698	6.184	1.553	0.545	0.336	-	-	-	4.247	7.322
1980	7.353	6.795	11.352	5.293	1.097	0.416	0.257	-	-	-	1.885	4.475
1981	-	13.198	7.708	5.065	1.194	0.285	0.080	-	-	-	1.668	5.806
1982	12.441	8.196	9.280	4.681	1.572	0.179	0.149	-	-	1.051	3.102	3.236
1983	5.803	8.797	7.461	6.004	2.081	0.768	0.009	0.061	1.412	1.263	2.243	4.244
1984	-	-	-	-	3.659	0.921	0.351	0.281	-	-	-	-
1985	-	-	-	-	-	-	-	-	-	-	-	-
1986	-	-	-	-	-	-	-	-	-	-	-	-
1987	-	-	-	-	-	-	-	-	-	-	-	-
1988	-	-	11.358	12.730	7.745	3.669	2.494	0.945	0.581	0.449	1.075	3.110
1989	5.901	8.035	11.206	14.145	8.032	1.155	-	-	-	0.194	1.022	1.701
1990	8.377	6.648	2.621	1.704	1.468	0.872	0.338	-	-	0.303	0.996	-
1991	-	-	-	26.589	11.293	7.769	1.123	0.477	0.293	3.967	8.518	27.091
1992	10.042	20.200	4.499	2.428	1.083	0.488	0.122	0.486	0.257	0.284	1.773	4.780
1993	7.013	4.406	8.194	4.647	2.370	1.038	0.680	0.428	0.148	0.125	3.773	7.708
1994	14.406	13.139	8.021	4.065	0.863	0.306	0.128	0.089	0.000	-0.020	-	-
1995	-	7.599	3.503	1.763	0.727	0.166	-0.041	0.004	0.010	1.363	4.484	4.646
1996	4.854	4.411	3.288	0.943	0.181	-	-	-	-	-	-	-
Mean	8.357	11.733	9.135	5.800	2.426	1.017	0.339	0.273	0.278	0.655	2.140	5.858

Table 3.6.1 Family and its Holdings

Community Question No. Unit	Numero de Familia	Edad d Cabesa Familia	Labores Familiares Extral	Parcela m ²	Tierra Cultiv Des- 122+; 123+ 124+ Propia: ha	Pasto ha	Comun Renta ha	Riego ha	Riego / Tierra	Piedra Sapa Inund ha	Forc.d Tierra	Obeja Toro Vacca 147	Obeja Toro Vacca 148	Toro Vacca Lama 147
Average*	4.7	48.5	229	879	3.2	1.4	0.2	1.6	48%	0.5	0.3	10.5	2.1	2.1
	229	229	229	229	229	229	229	229	229	229	229	229	229	229
BEENGUELA	4.6	49.0	19	218	4.6	2.4	0.4	1.8	45%	0.4	0.2	15.1	1.9	1.3
CHACHACOMANI	4.3	49.1	2.1	240	4.0	1.9	0.1	2.0	41%	0.4	0.1	29.3	3.0	0.5
COROMATA ALTA	5.1	42.1	2.4	195	4.1	1.4	0.0	2.7	51%	1.3	1.4	15.6	1.6	1.0
COROMATA BAJA	4.3	45.8	2.1	263	5.2	1.1	0.4	3.6	19%	0.6	0.1	13.4	3.3	2.4
COROMATA MEDIA	6.1	46.0	2.1	232	5.8	1.5	0.2	4.2	45%	0.5	0.1	18.8	3.0	3.0
CORPAPUTO	6.1	37.9	2.4	197	4.9	2.1	0.6	2.2	70%	0.2	0.5	28.8	2.9	1.6
KERANI	3.9	43.8	2.3	174	2.8	1.3	0.0	1.5	50%	0.5	0.3	14.3	2.0	1.3
PATAMANTA	4.8	56.5	2.3	533	4.0	1.0	0.3	2.8	72%	1.0	0.0	17.8	2.0	1.3
ALTO	4.9	45.9	2.2	231	4.5	1.6	0.2	2.6	43%	0.6	0.5	19.0	2.5	1.6
	61	61	61	61	61	61	61	61	61	61	61	61	61	61
CALA-CALA	3.5	53.1	1.8	136	2.1	1.1	0.2	0.8	65%	0.6	0.2	14.4	1.9	1.5
ICRANA	5.6	54.1	2.1	217	5.1	1.8	0.4	2.9	49%	1.3	0.6	21.4	4.1	1.8
PAIRUMANI	5.1	48.0	2.6	209	4.9	1.9	0.3	2.6	33%	3.2	0.7	15.0	1.6	1.6
MEDIO-ALTO	4.8	51.8	2.2	192	4.0	1.6	0.3	2.1	45%	1.7	0.5	16.9	2.5	1.6
	24	24	24	24	24	24	24	24	24	24	24	24	24	24
AVICHACA	4.9	47.6	2.3	163	2.2	1.1	0.3	0.8	56%	0.5	0.3	6.6	3.0	3.6
CAJON PATA	4.9	54.1	2.1	136	1.6	1.2	0.1	0.1	61%	0.1	0.1	0.4	1.4	0.6
JAWIR LACA	4.6	56.4	2.3	243	1.7	1.2	0.0	0.5	87%	0.1	0.0	1.1	1.9	2.9
KIASINA	5.9	43.9	2.4	198	3.0	1.1	0.1	1.9	52%	0.1	0.9	11.0	1.5	1.6
MARCA MASAYA	6.0	46.4	2.6	236	3.6	1.8	0.1	1.8	32%	0.1	0.4	9.3	2.8	2.6
PAJCHANI GRANDE	5.1	46.3	2.1	261	2.7	1.1	0.0	0.5	17%	0.1	0.1	12.8	1.5	1.9
PAJCHANI MOLINO	4.1	50.0	2.8	207	4.1	1.6	0.4	2.4	29%	1.2	0.6	15.3	2.6	3.0
PUTUNI	4.6	50.8	2.3	228	2.4	1.4	0.2	0.8	24%	0.3	0.2	2.1	2.0	1.8
SUNTIA CHICO	4.8	50.8	2.6	203	3.4	1.6	0.2	1.6	53%	0.1	0.1	4.9	1.4	2.4
SUNTIA COMUN	3.8	55.8	2.1	241	2.5	1.2	0.1	1.1	45%	0.6	0.4	5.4	2.0	2.4
SUNTIA GRANDE	4.0	48.8	2.0	174	2.5	1.7	0.0	0.8	75%	0.1	0.0	5.4	1.4	1.6
TIPAMPA	4.9	35.4	1.9	164	2.5	1.3	0.1	1.1	61%	0.1	0.0	0.9	2.0	3.3
MEDIO-BAJA	4.8	48.8	2.3	205	2.8	1.4	0.1	1.3	45%	0.3	0.3	6.3	1.9	2.3
	96	96	96	96	96	96	96	96	96	96	96	96	96	96
ARASAYA CHICO	5.3	42.9	2.0	299	2.5	1.4	0.3	0.9	55%	0.2	0.0	4.0	2.3	3.1
ARASAYA KENTUYO	3.6	51.8	2.1	195	1.3	0.9	0.1	0.5	64%	0.0	0.0	5.5	0.9	1.9
ARASAYA PATANTVI	5.4	45.1	2.5	211	3.1	1.6	0.3	1.2	20%	0.2	0.0	7.1	1.6	2.9
BARCO BELEN	4.4	51.1	2.1	186	1.5	1.0	0.1	0.4	71%	0.0	0.0	9.4	2.1	3.8
BELEN	4.1	54.5	2.0	190	2.4	1.2	0.5	0.7	83%	0.0	0.3	0.6	2.5	2.5
TARAMAYA	3.5	52.8	1.6	175	1.4	0.8	0.0	0.6	93%	0.0	0.0	2.3	1.5	1.8
BAJA	4.4	49.7	2.1	210	2.0	1.2	0.2	0.7	59%	0.1	0.1	4.8	1.8	2.6
	48	48	48	48	48	48	48	48	48	48	48	48	48	48
ACHACACACHI	3.3	50.8	1.8	80	2.5	0.8	0.0	1.7	94%	0.0	0.1	2.6	0.5	1.1
	17	17	17	17	17	17	17	17	17	17	17	17	17	17

*ACHACACACHI excluded.
**Each community: n=8, except CHACHACOMANI(n=7), PATAMANTA (n=6) and ACHACACACHI(n=17)

Table 3.6.3 Major Sources of Income

Sources*1	1	2	3	4	5	55	6	7	8	9	0	NO	Total
Community*2 n=	114	24	19	16	13	10	11	7	3	2	9	1	229
Percentage*3	49.8%	10.5%	8.3%	7.0%	5.7%	4.4%	4.8%	3.1%	1.3%	0.9%	3.9%	0.4%	100%
BERENGUELA	6	2	0	0	0	0	0	0	0	0	0	0	8
CHACHACOMANI	6	1	0	0	0	0	0	0	0	0	0	0	7
COROMATA ALTA	5	0	2	0	0	0	0	1	0	0	0	0	8
COROMATA BAJA	5	1	1	1	0	0	0	0	0	0	0	0	8
COROMATA MEDIA	5	2	0	0	1	0	0	0	0	0	0	0	8
CORPAPUTO	3	1	1	2	0	1	0	0	0	0	0	0	8
KERANI	5	0	1	1	0	0	0	0	1	0	0	0	8
PATAMANTA	3	0	1	0	1	0	0	1	0	0	0	0	6
ALTO n=	38	7	6	4	2	1	0	2	1	0	0	0	61
Percentage	62.3%	11.5%	9.8%	6.6%	3.3%	1.6%	0.0%	3.3%	1.6%	0.0%	0.0%	0.0%	100%
CALA CALA	3	0	1	1	0	2	1	0	0	0	0	0	8
ICRANA	4	3	0	1	0	0	0	0	0	0	0	0	8
PAIRUMANI	2	0	1	1	1	0	0	3	0	0	0	0	8
MEDIO-ALTO n=	9	3	2	3	1	2	1	3	0	0	0	0	24
Percentage	37.5%	12.5%	8.3%	12.5%	4.2%	8.3%	4.2%	12.5%	0.0%	0.0%	0.0%	0.0%	100%
AVICHACA	5	0	0	0	0	0	1	0	0	0	2	0	8
CAJON PATA	1	0	0	0	2	2	0	0	1	0	1	1	8
JAHUIR LACA	6	0	0	1	1	0	0	0	0	0	0	0	8
KJASINA	5	1	0	1	0	0	0	1	0	0	0	0	8
MARCA MASAYA	4	0	2	0	1	1	0	0	0	0	0	0	8
PAJCHANI GRANDE	1	1	1	2	3	0	0	0	0	0	0	0	8
PAJCHANI MOLINO	5	1	2	0	0	0	0	0	0	0	0	0	8
POTUNI	2	4	0	1	0	1	0	0	0	0	0	0	8
SUNTIA CHICO	3	0	2	0	0	1	1	0	0	0	1	0	8
SUNTIA COMUN	4	1	0	2	0	0	0	0	0	1	0	0	8
SUNTIA GRANDE	5	1	0	0	0	1	1	0	0	0	0	0	8
TIPAMPA	5	0	0	0	0	0	1	0	0	1	1	0	8
MEDIO-BAJA n=	46	9	7	7	7	6	4	1	1	2	5	1	96
Percentage	47.9%	9.4%	7.3%	7.3%	7.3%	6.3%	4.2%	1.0%	1.0%	2.1%	5.2%	1.0%	100%
ARASAYA CHICO	5	1	0	0	0	0	1	0	0	0	1	0	8
ARASAYA KENTUYO	4	0	0	1	1	1	0	0	1	0	0	0	8
ARASAYA PATANIVI	3	1	1	0	0	0	1	1	0	0	1	0	8
BARCO BELEN	5	0	1	0	0	0	2	0	0	0	0	0	8
BELEN	1	2	1	0	2	0	1	0	0	0	1	0	8
TARAMAYA	3	1	1	1	0	0	1	0	0	0	1	0	8
BAJA n=	21	5	4	2	3	1	6	1	1	0	4	0	48
Percentage	43.8%	10.4%	8.3%	4.2%	6.3%	2.1%	12.5%	2.1%	2.1%	0.0%	8.3%	0.0%	100%
Second Sources n=	18	23	14	14	22	9	4	6	2	2	3	112	229
Percentage	7.9%	10.0%	6.1%	6.1%	9.6%	3.9%	1.7%	2.6%	0.9%	0.9%	1.3%	48.9%	100%
ACHACACHI n=	2	7	1	1	2	3	0	0	0	0	1	0	17
Percentage	11.8%	41.2%	5.9%	5.9%	11.8%	17.6%	0.0%	0.0%	0.0%	0.0%	5.9%	0.0%	100%
Second Sources n=	0	2	1	1	1	2	0	0	0	0	0	10	17
Percentage	0.0%	11.8%	5.9%	5.9%	5.9%	11.8%	0.0%	0.0%	0.0%	0.0%	0.0%	58.8%	100%

*1: 1: Livestock, 2: Commerce, 3: Sale of Deriving of the Milk, 4: Agriculture, 5: Bricklayer, 55: Other Works, 6: Sale of Milk

7: Artesan, 8: Labour, 9: Transport, 0: Salary/ Worthy

*2: Each Community: n=8, except CHACHACOMANI(n=7), PATAMANTA (n=6) and ACHACACHI(n=17)

*3: ACHACACHI excluded,

Table 3.7.1 Existing Irrigation Systems (1/2)

Serial No.	Irrigation System No.	Water source	Related Community	Related Purposes	Irrigation Area (ha)						Canal Section at the Intake (m)			Canal Capacity (m ³ /sec)			Canal Length (km)				
					Total Area	Net	III	IV	V	VI	Obem	Full Section	Max. Flow	Trace	Width	Height	Q1	Q2	Q3	Main Canal Length	Division Number
1	1	Rio Kala	Barro Belen		20	253	215	153	0	0	0	62	2.00	0.80	0.50	0.80	0.211	0.538	4.7	21	
2	2	Rio Kala	Belen		140	672	571	280	40	0	23	228	1.40	1.10	1.00	1.10	0.069	1.428	12.9	29	
3	3	Rio Kala	Taramaya		220	249	212	0	125	4	83	1.00	0.80	0.50	0.80	0.211	0.530	3.4	11		
4	4	Rio Kala	Haurilaca		25	606	515	118	41	196	5	155	0.70	0.65	0.50	0.65	0.023	1.288	6.5	17	
5	5	Rio Kala	Hauhuata, Suanis Comun		20	172	146	133	0	4	9	0.80	0.60	0.80	0.60	0.045	0.365	3.0	10		
6	6	Rio Kala	Suanis Grande		30	9	8	0	0	0	8	0.50	0.50	0.50	0.50	0.109	0.020	1.3	2		
7	7	Rio Kala	Suanis Comun		25	38	32	0	0	0	32	0.50	0.70	0.50	0.50	0.109	0.080	2.3	3		
8	8	Rio Kala	Nere		287	506	430	155	77	22	0	176	1.00	1.40	1.00	1.40	0.115	1.075	21.7	30	
9	9	Rio Kala	Punua, Pajehani Grande	Included in (9)	8	7	3	1	0	0	0	0	0.60	1.00	0.60	1.00	0.021	0.018	0.8	3	
10	10	Rio Kala	Punua		16	14	0	0	0	0	0	14	1.00	1.00	0.50	1.00	0.022	0.035	1.6	2	
11	11	Rio Kala	Pajehani Molino	Included in (11)	22	19	7	0	0	0	0	12	1.00	1.00	0.50	1.00	0.297	0.048	4.4	5	
12	12	Rio Kala	Pajehani Molino	Included in (11)	50	43	11	0	0	0	0	32	0.50	0.30	0.50	0.30	0.022	0.108	2.1	6	
13	13	Drainage water of No. 14	Cala Cala	Included in (11)	63	54	0	35	19	0	0	0	0.40	0.70	0.40	0.70	0.023	0.135	2.8	7	
14	14	Rio Kala	Ikroa		32	88	75	29	46	46	0	0	0.40	1.70	0.40	1.70	0.075	0.188	2.3	4	
15	15	Rio Kala	Ikroa		65	56	48	0	21	0	23	4	0.70	0.90	0.50	0.90	0.239	0.120	3.9	5	
16	16	Rio Kala	Ikroa		142	31	26	0	0	0	26	0	0.50	1.00	0.50	1.00	0.148	0.065	2.9	6	
17	17	Rio Kala	Pungunyu		125	6	5	0	5	0	0	0	0.60	0.80	0.60	0.80	0.130	0.013	1.1	2	
18	18	Rio Kala	Pyrumani		30	7	6	0	6	0	0	0	0.40	0.50	0.40	0.50	0.022	0.015	1.1	2	
19	19	Rio Kala	Pyrumani		184	156	0	156	0	0	0	0	0.40	0.80	0.40	0.80	0.016	0.390	5.2	8	
20	20	Rio Kala	Pungunyu	Included in (7)	42	131	111	0	80	31	0	0	0.50	0.50	0.50	0.50	0.126	0.278	3.5	10	
21	21	Rio Kala	Pyrumani		20	10	9	0	9	0	0	0	0.55	0.50	0.55	0.50	0.021	0.220	1.0	2	
22	22	Rio Kala	Pyrumani		7	6	0	0	0	0	6	0	0.30	0.40	0.55	0.50	0.004	0.045	1.0	2	
23	23	Rio Kala	Comata Media		13	11	11	0	0	0	11	0	0.30	0.50	0.30	0.50	0.018	0.028	0.7	2	
24	24	Rio Kala	Berengera		60	31	26	0	0	0	0	0	0.30	0.30	0.30	0.30	0.007	0.041	0.000	0.6	2
25	25	Rio Kala	Berengera		25	3	3	0	0	0	26	0	0.4	0.4	0.4	0.4	0.008	0.059	0.65	2	4
26	26	Rio Kala	Berengera		170	530	451	0	0	63	388	0	1.0	1.6	1.0	1.6	0.035	1.462	1.128	14.9	46
27	27	Rio Kala	Comata Media, Baja		3	3	3	0	0	0	3	0	0.3	0.5	0.3	0.5	0.018	0.008	0.4	2	2
28	28	Rio Kala	Comata Alta	Included in (26)	19	16	0	0	0	0	16	0	0.4	0.6	0.4	0.6	0.084	0.040	1.2	3	3
29	29	Rio Kala	Comata Alta	Included in (26)	38	32	0	0	0	0	32	0	0.6	0.7	0.6	0.7	0.174	0.080	2.8	5	5
30	30	Sub Total			1567	3821	3250	889	518	506	606	777							112.3	251.0	

Note : Numbers of related farmers are employed the survey results of local consultants
 Irrigation area was estimated by the stereo-photo and topographic map compiled by the study team.
 Canal section and discharge shown as Q1 was surveyed by the study team during June 1 to June 7, 1997.
 Q2 was estimated by Manning's formula using the maximum canal capacity and gradient of the existing canal.
 Q3 was estimated by multiplying the net irrigation area and the unit diversion water requirement of 2.5 l/sec.

Table 3.7.1 Existing Irrigation Systems (2/2)

Serial No.	Irrigation System No.	Water source	Related Community	Related Farmers	Irrigation Area (ha)						Canal Section at the Intake (m)			Canal Capacity (m ³ /sec)			Canal Length (km)	
					Total Area	III	IV	V	VI	Obtain	Height	Width	Max. Flow	Height	Width	Q1	Q2	Q3
30	31	Rio Kela Khan Pampa	Coronata Alva	90	77	0	0	0	0	0	0	0.50	0.60	0.090	0.223	0.193	1.2	2
31	32	Rio Kela Khan Pampa	Coronata Alva	13	40	0	0	0	0	0	0	0.40	0.50	0.090	0.097	0.100	4.1	6
32	33	Rio Kela Khan Pampa	Kerani	27	105	33	0	0	0	0	0	0.90	1.50	0.105	1.256	0.263	1.5	6
33	34	Rio Corpa Jabura	Berengera	20	113	96	0	76	0	20	0	0.30	0.70	0.046	0.171	0.240	3.0	6
34	35	Rio Corpa Jabura	Chachacamani	5	4	0	0	0	0	4	0	0.20	0.80	0.035	0.038	0.010	0.4	7
35	35-1	Rio Corpa Jabura	Coronata Alva	39	33	0	0	0	0	33	0	0.30	0.70	0.006	0.086	0.083	2.8	7
35	35-2	Rio Corpa Jabura	Chachacamani	5	4	0	0	0	0	4	0	0.30	0.70	0.006	0.086	0.010	0.5	7
36	36	Rio Corpa Jabura	Berengera	160	8	0	0	0	0	8	0	0.45	0.60	0.022	0.177	0.020	2.2	3
37	37	Rio Char Jobho	Suñta Grande	56	48	48	0	0	0	0	0	1.50	0.30	0.012	0.050	0.120	2.1	5
38	38	Rio Char Jobho	None															
39	39	Rio Char Jobho	Suñta Grande, Chico	160	66	36	0	0	0	24	7	1.00	0.40	0.162	0.162	0.165	3.1	4
40	40	Rio Char Jobho	Avichaca	275	234	63	0	0	0	0	171	0.50	1.10	0.020	0.302	0.585	4.8	8
41	41	Rio Char Jobho	Calu Calu	70	96	0	17	0	0	72	7	0.50	1.30	0.015	0.088	0.240	4.3	12
42	42	Rio Char Jobho	None															
43	43	Rio Char Jobho	Calu Calu	19	16	7	8	0	0	1	0	0.30	1.10	0.055	0.191	0.040	1.6	3
44	44	Rio Char Jobho	None															
45	45	Rio Char Jobho	Supplemental Intake of No. 47															
46	46	Rio Char Jobho	Calu Calu	175	149	48	46	3	43	9	0	0.40	0.50	0.085	0.294	0.373	0.6	2
47	47	Rio Char Jobho	Pungunyu, Ranco Calu Calu	163	139	93	0	0	0	46	0	0.50	1.00	0.057	0.318	0.348	5.2	15
48	48	Rio Char Jobho	Same as No. 47															
49	49	Rio Char Jobho	Pungunyu	50	7	0	0	0	0	0	7	0.40	0.80	0.012	0.104	0.018	1.4	-
49-1	49-1	Rio Wila Wilani	Pungunyu	44	37	0	0	0	0	37	0	0.50	0.50	0.072	0.093	0.072	0.3	3
50	50	Rio Char Jobho	Pungunyu	3	8	7	0	0	0	7	0	0.50	0.30	0.007	0.047	0.018	0.3	3
51	51	Rio Char Jobho	Pungunyu	4	16	14	0	0	0	14	0	0.70	0.50	0.070	0.151	0.035	0.5	3
52	52	Rio Char Jobho	Pungunyu	70	53	45	0	0	0	45	0	0.30	0.40	0.076	0.039	0.113	4.7	-
53	53	Rio Char Jobho	Pungunyu	40	25	21	0	0	0	21	0	0.40	0.50	0.076	0.133	0.053	0.5	2
53-1	53-1	Rio Char Jobho	Pungunyu		31	26	0	0	0	26	0	0.40	0.60	0.032	0.222	0.065		
54	54	Rio Char Jobho	Unused															
55	55	Rio Char Jobho	Unused															
56	56	Rio Jalpa	Corpapuo	350	450	383	0	0	0	383	0	0.50	2.50	0.130	1.599	0.958	6.0	2
57	57	Rio Jalpa	Corpapuo	250	130	111	0	0	0	111	0	0.50	0.80	0.080	0.373	0.278	3.0	-
58	58	Rio Kallhuani	Chachacamani	520	442	0	0	0	0	442	0	0.50	0.80	0.105	0.229	1.105	3.9	-
59	59	Rio Kallhuani	Chachacamani	80	240	204	0	0	0	204	0	0.30	0.50	0.033	0.152	0.510	3.0	3
Sub-Total				1,608	2,835	2,412	327	147	3	197	1,237						64.4	105
Total				3,175	6,656	5,662	2,216	665	509	803	2,515						176.7	356.0

Note : Numbers of related farmers are employed the survey results of local consultants
 Irrigation area was estimated by the aero-photo and topographic map compiled by the study team.
 Canal section and discharge shown as Q1 was surveyed by the study team during June 1 to June 7, 1997.
 Q2 was estimated by Manning's formula using the maximum canal capacity and gradient of the existing canal.
 Q3 was estimated by multiplying the net irrigation area and the unit diversion water requirement of 2.5 /haec.

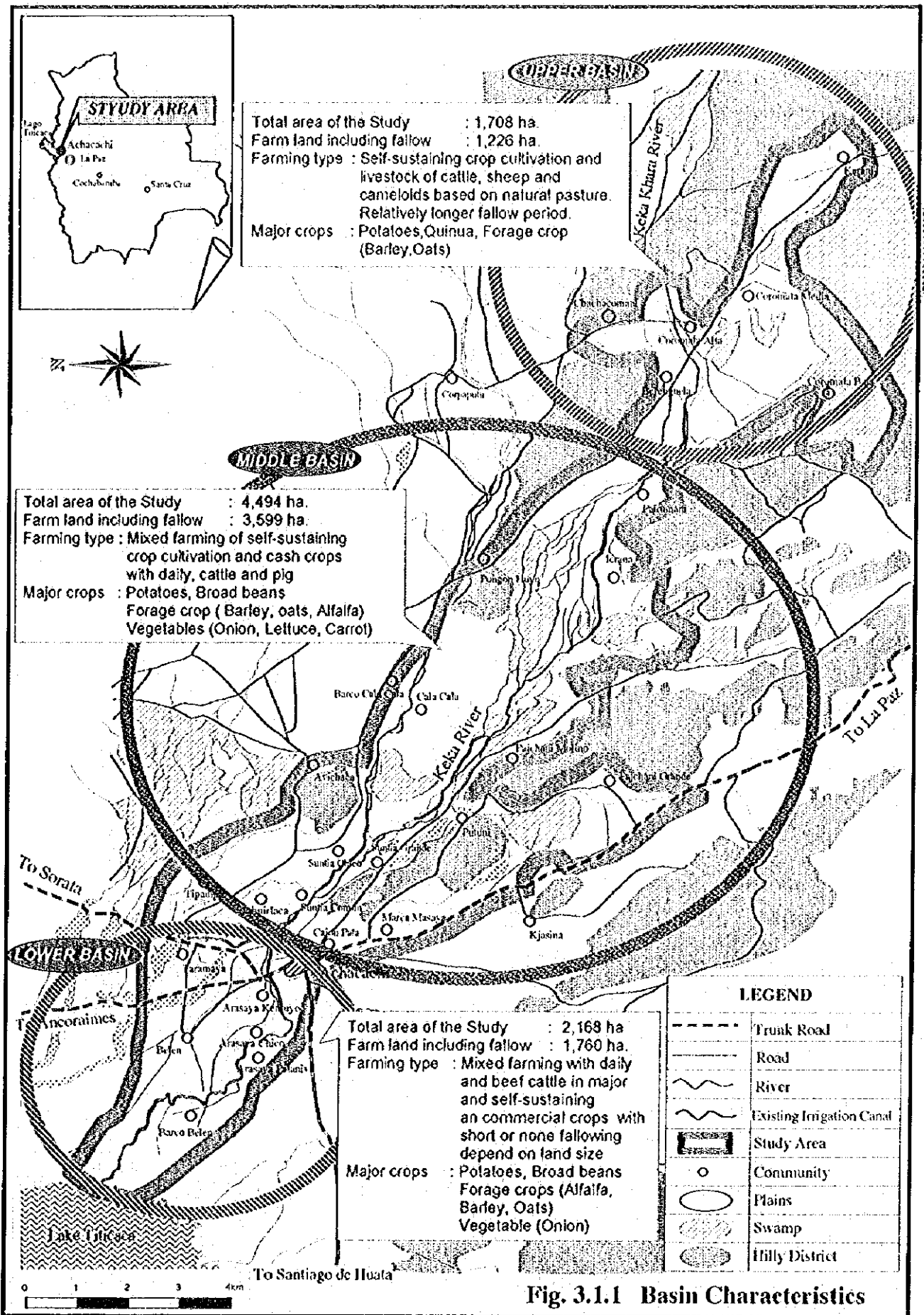


Fig. 3.1.1 Basin Characteristics

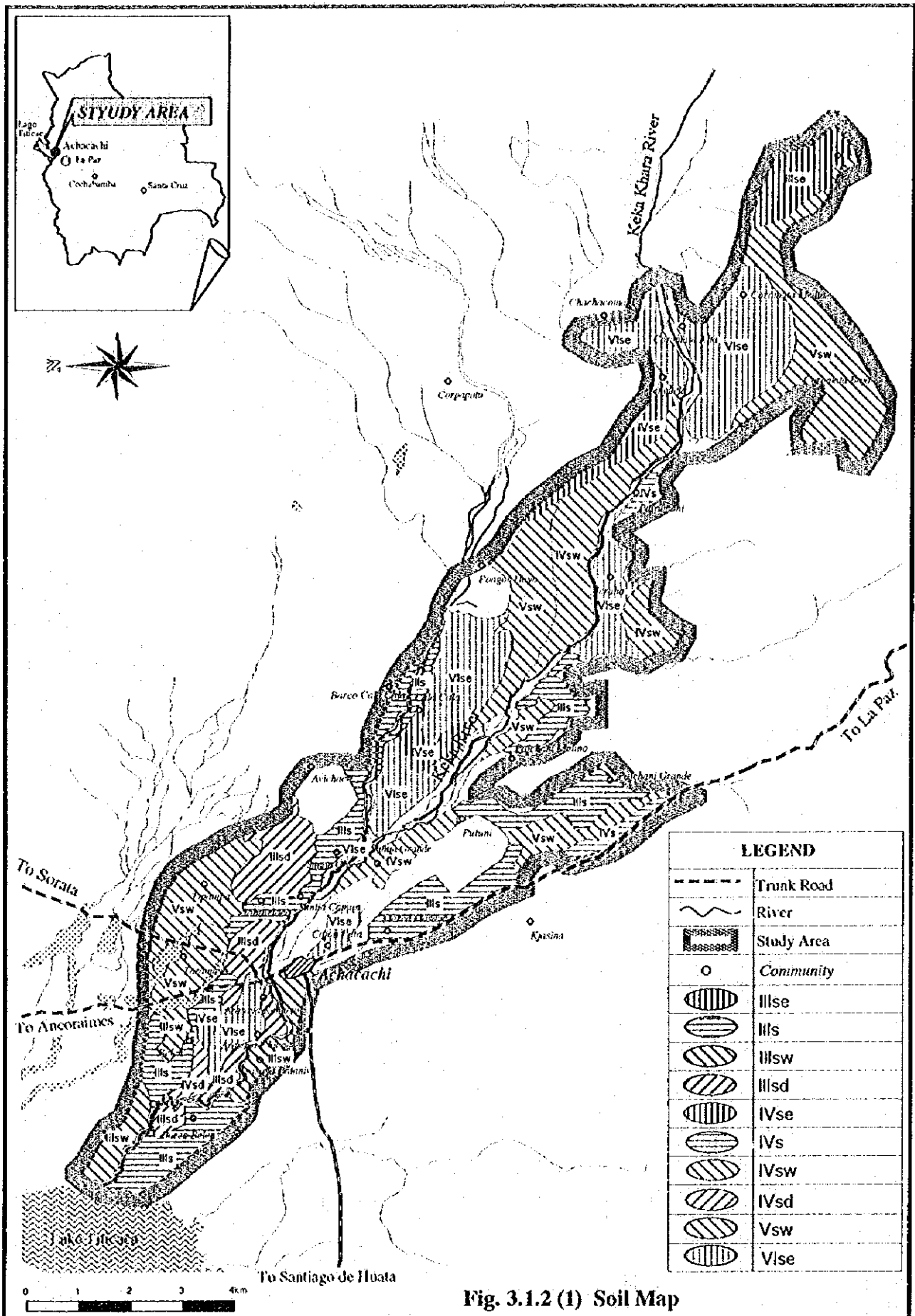


Fig. 3.1.2 (1) Soil Map

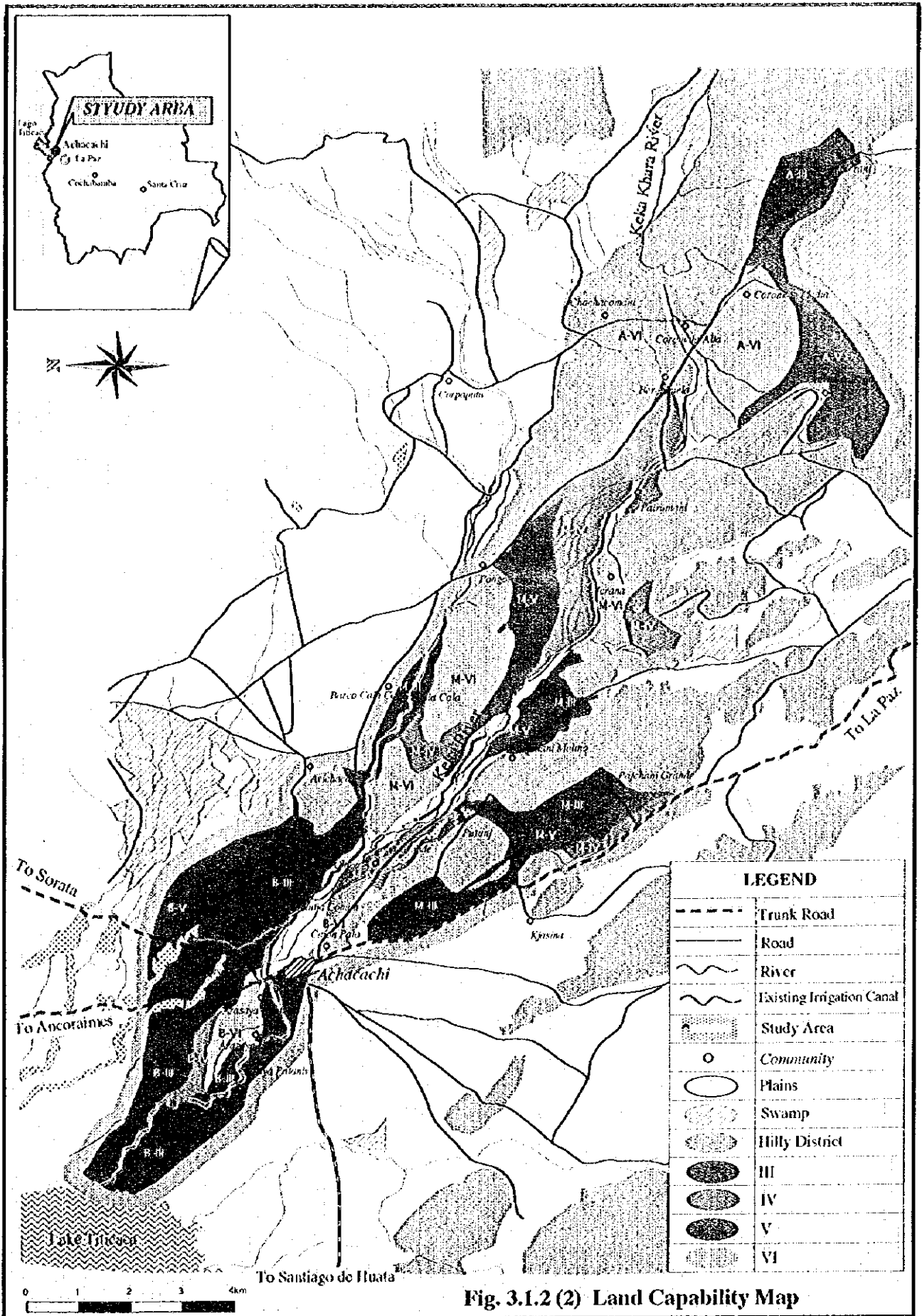


Fig. 3.1.2 (2) Land Capability Map

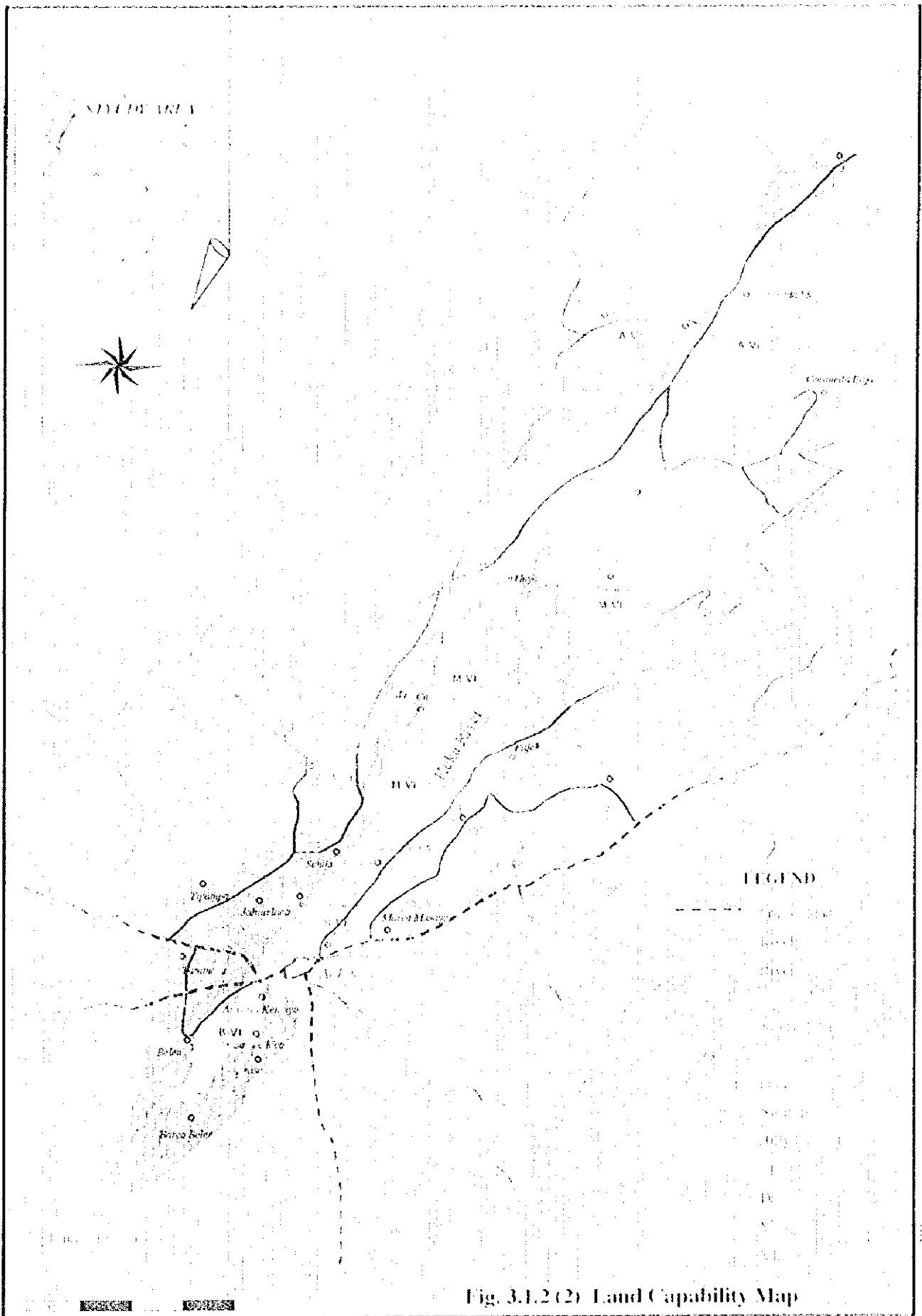
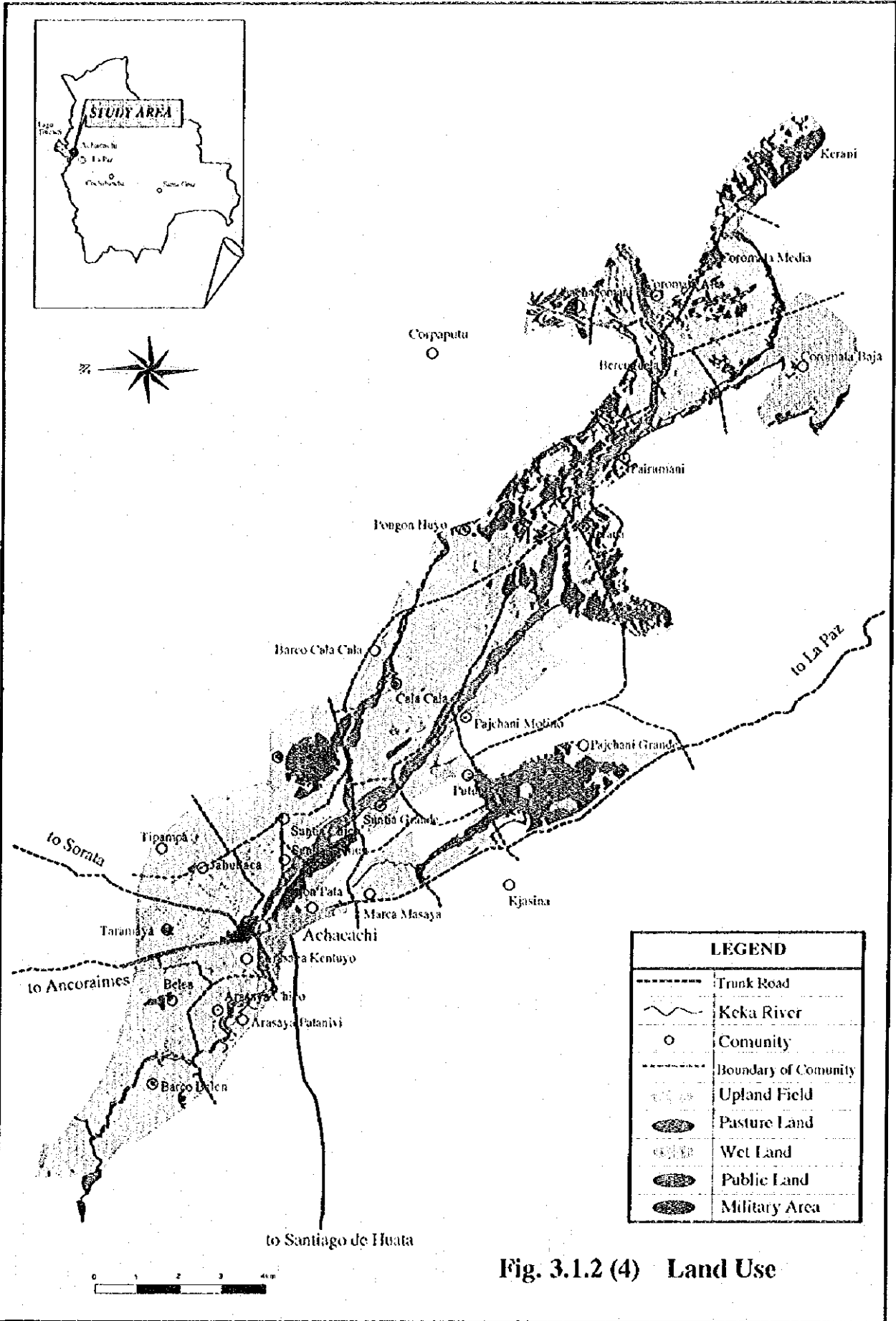


Fig. 3.1.2 (2) Land Capability Map



LEGEND	
	Trunk Road
	Keka River
	Community
	Boundary of Community
	Upland Field
	Pasture Land
	Wet Land
	Public Land
	Military Area

Fig. 3.1.2 (4) Land Use

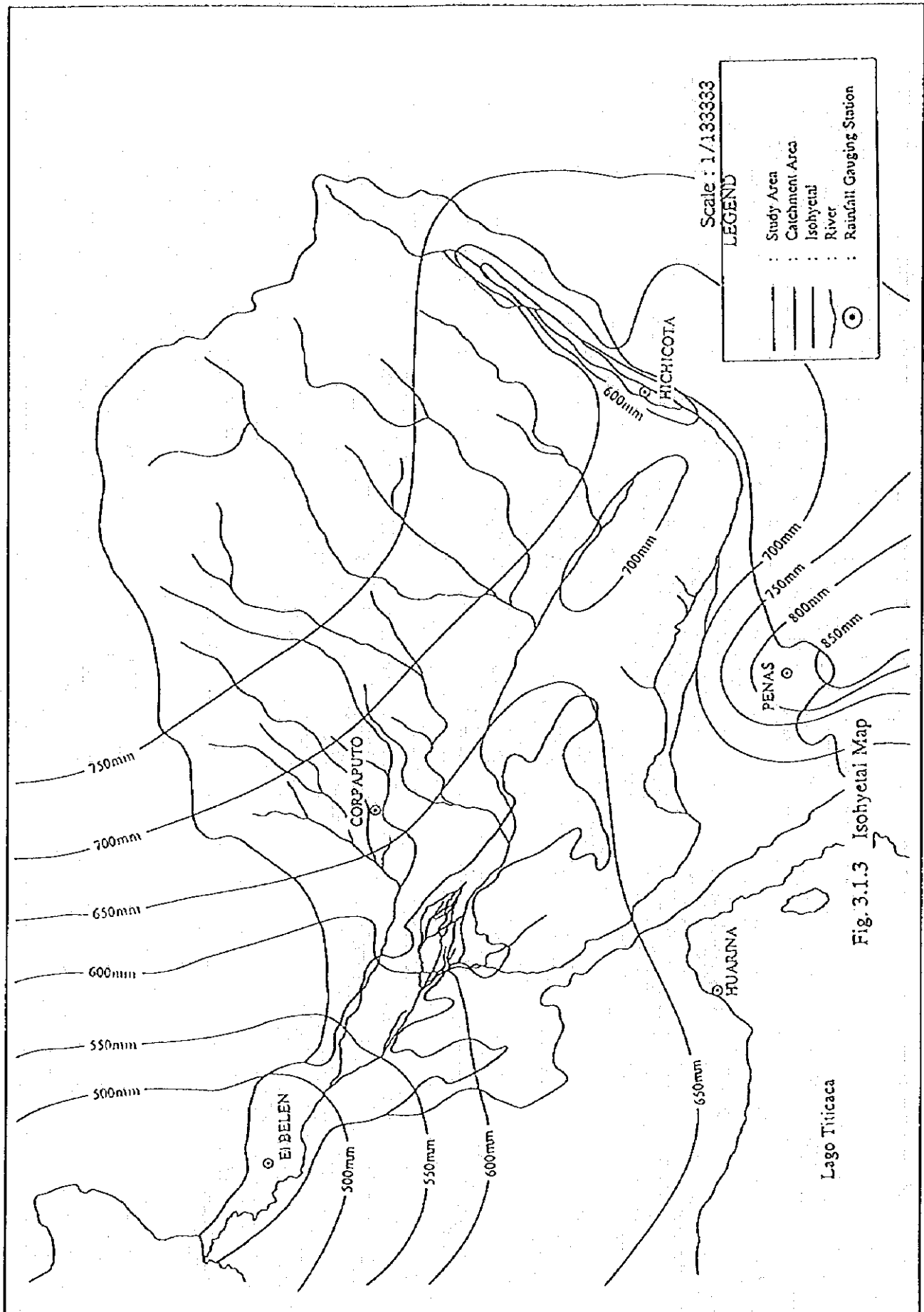


Fig. 3.1.3 Isohyetal Map

Lago Titicaca

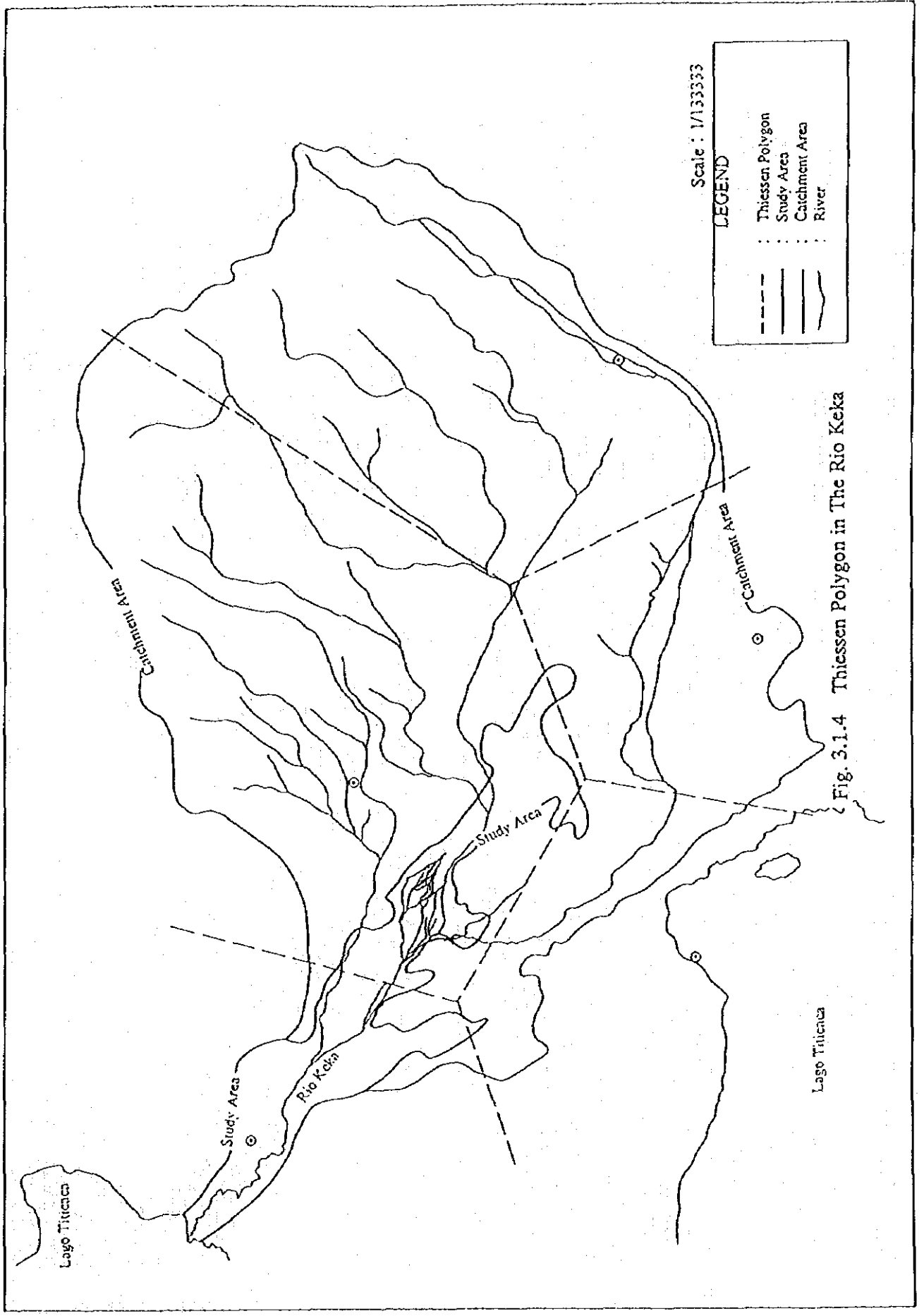


Fig. 3.1.4 Thiessen Polygon in The Rio Keka

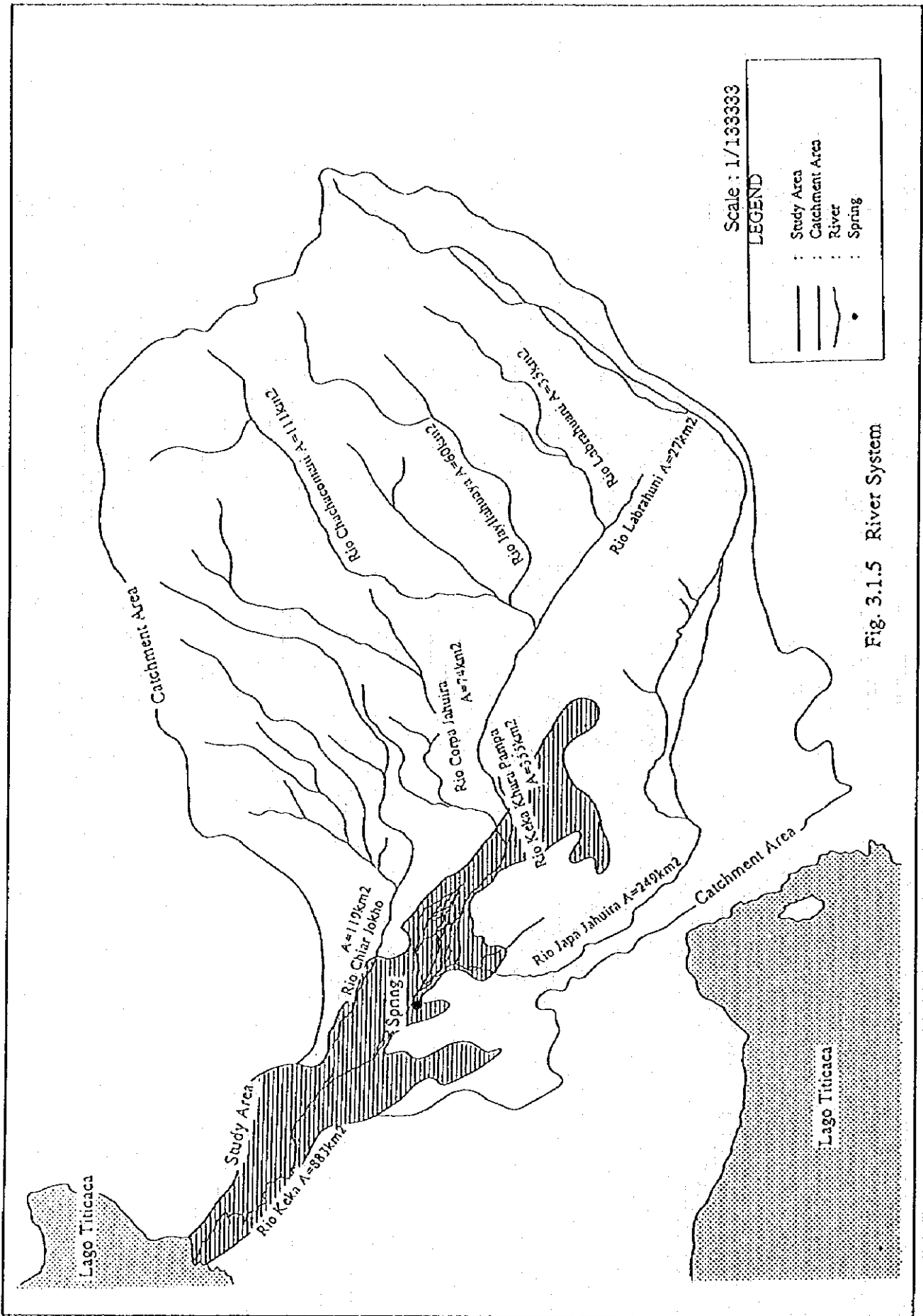


Fig 3.1.5 River System

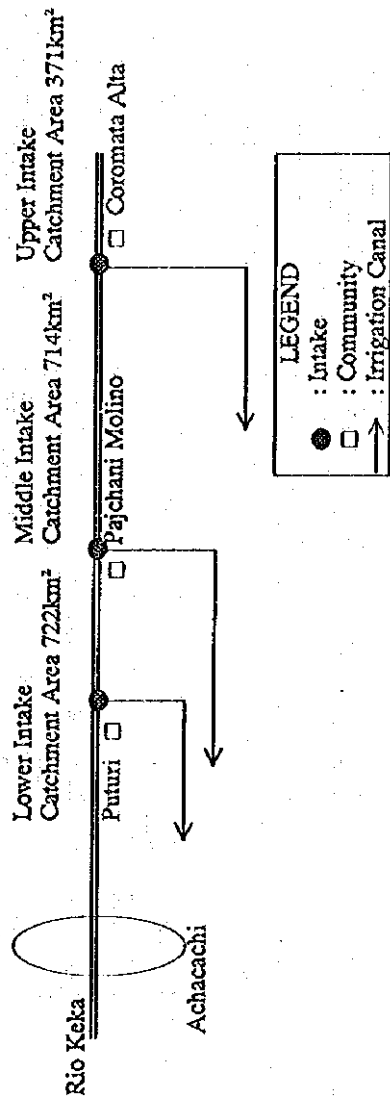


Fig. 3.1.6 Intake System

Fig 3.2.1 Organization of Prefecture

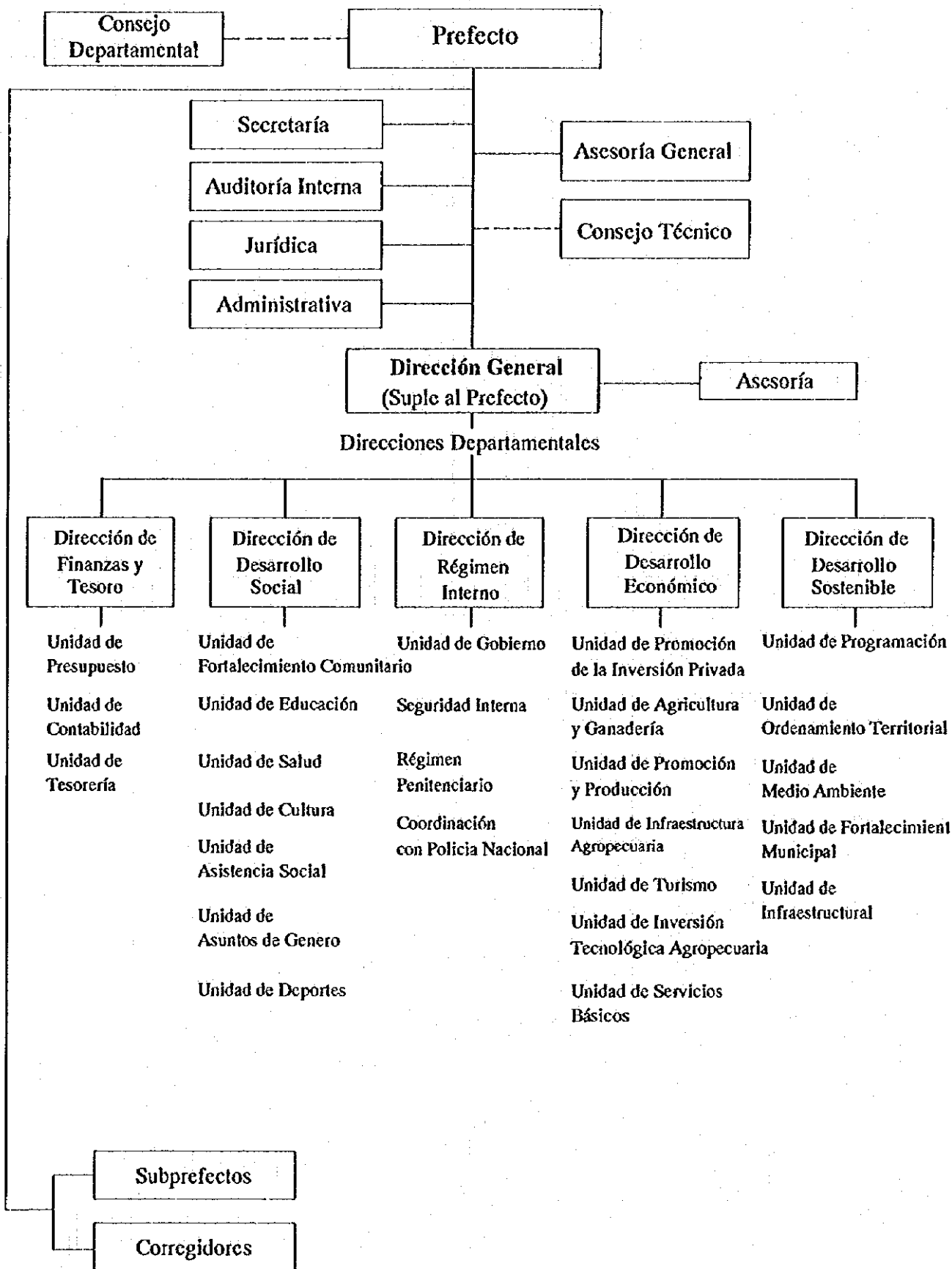
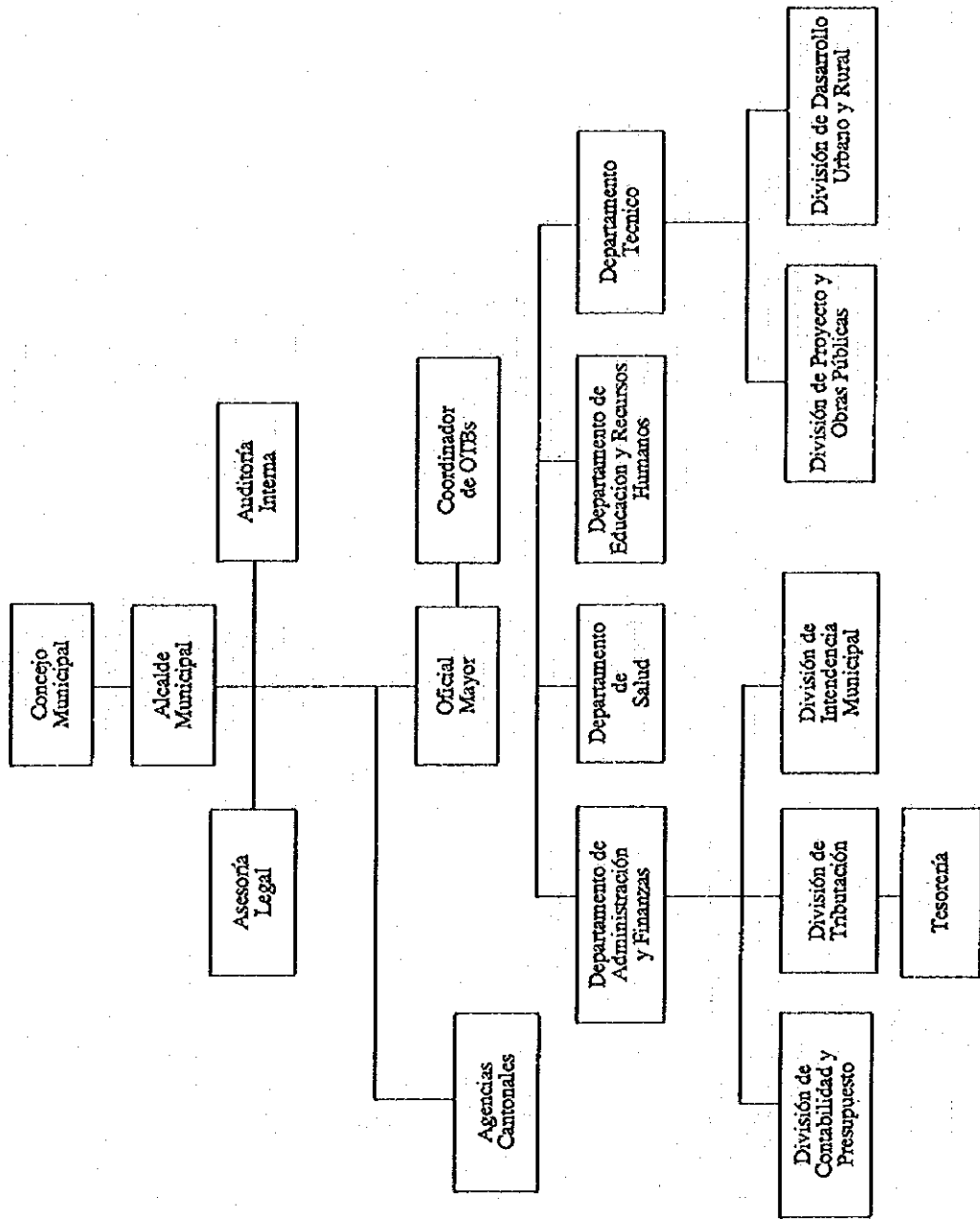


Fig. 3.2.2 Organization of Municipality



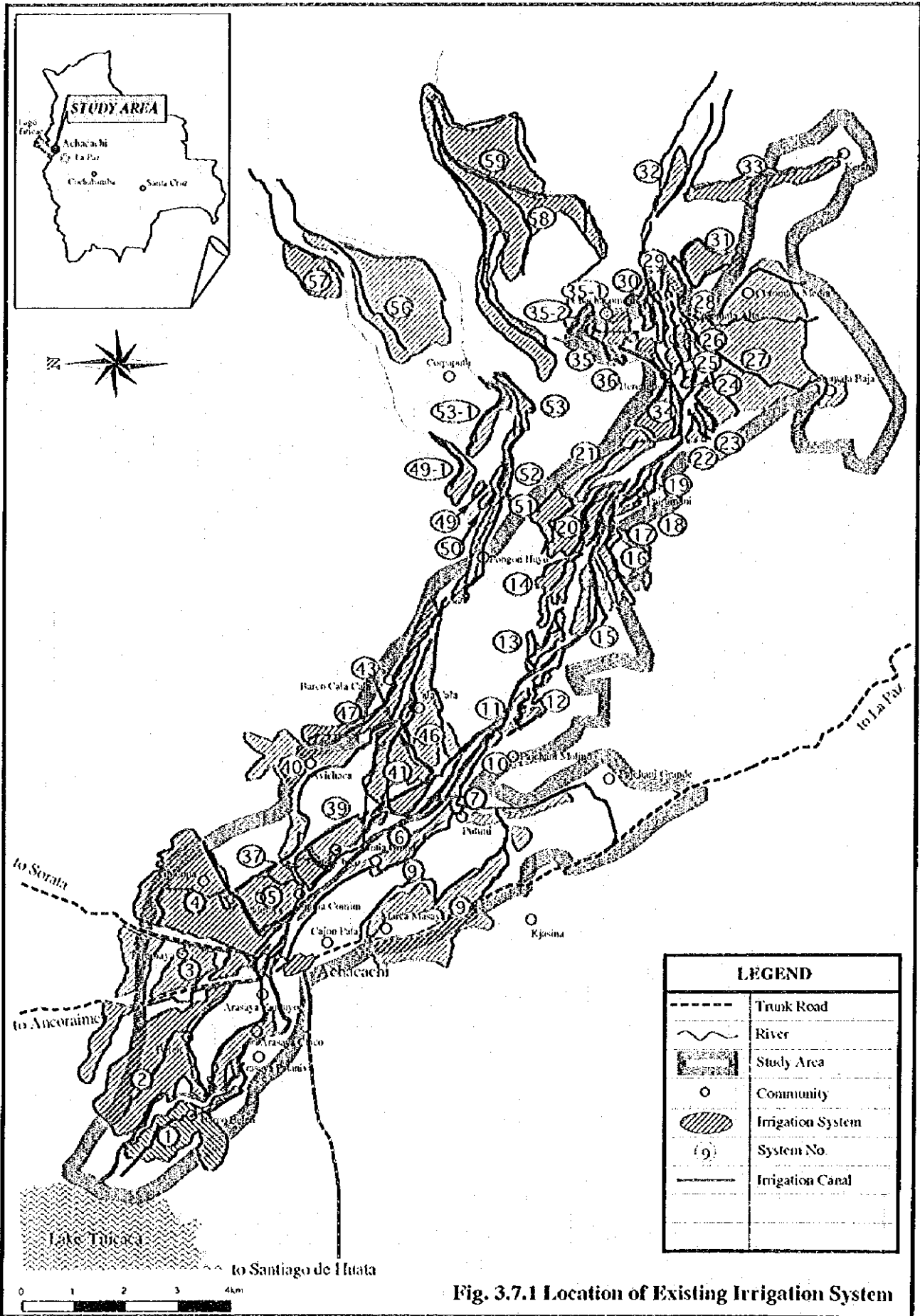


Fig. 3.7.1 Location of Existing Irrigation System

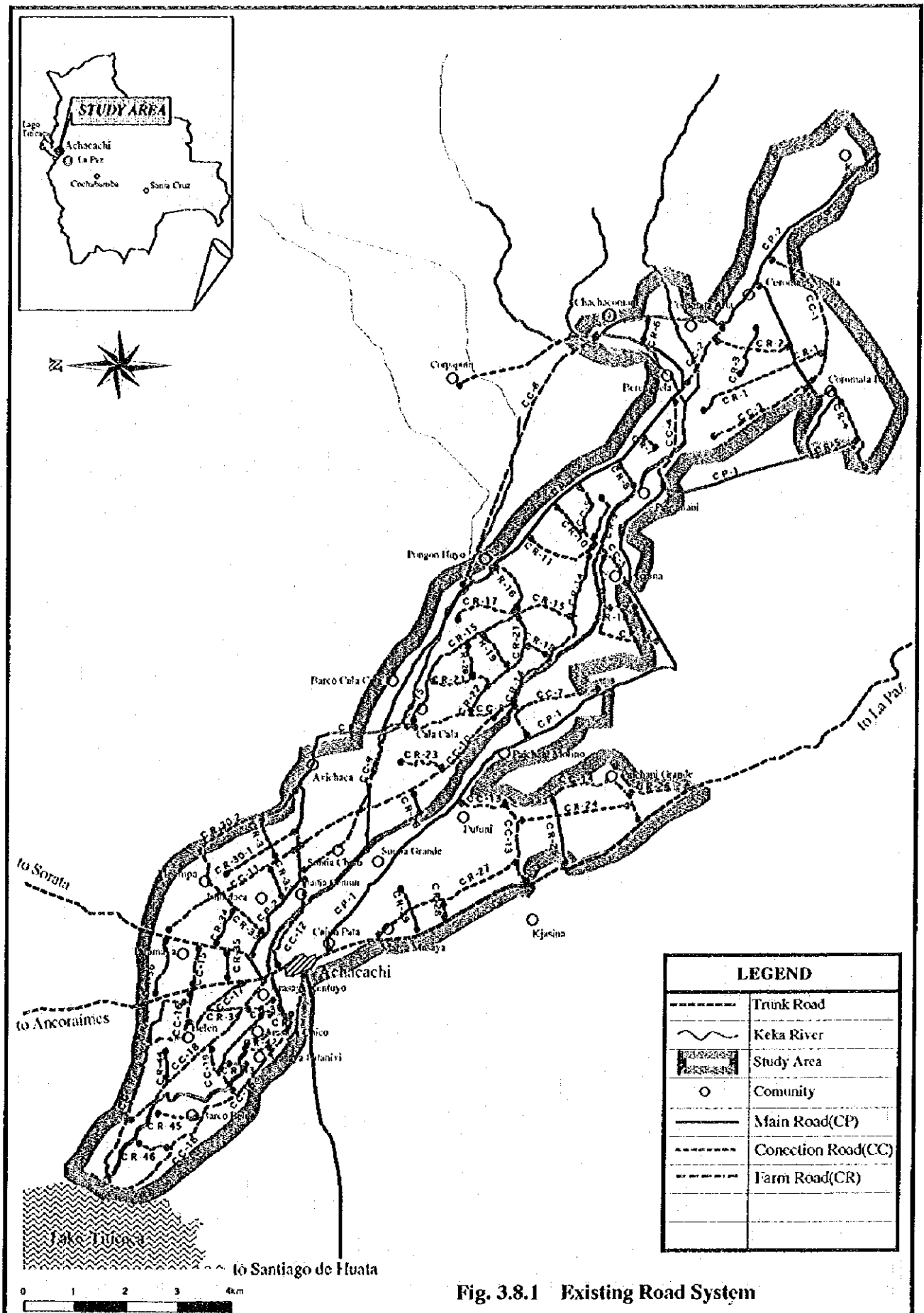


Fig. 3.8.1 Existing Road System

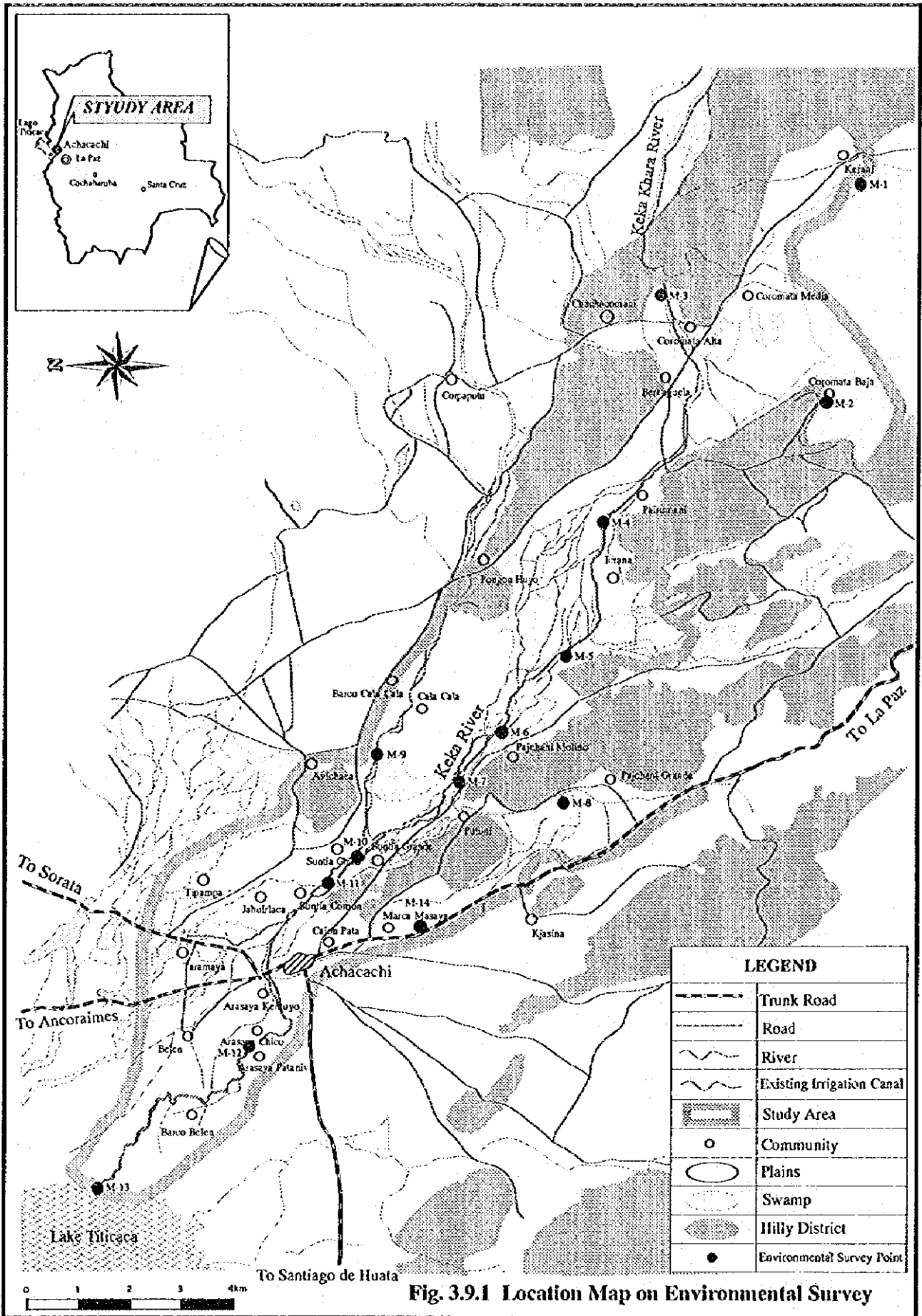


Fig. 3.9.1 Location Map on Environmental Survey

CHAPTER 4

CONSTRAINTS AND POTENTIALS



CHAPTER 4 CONSTRAINTS AND POTENTIALS

4.1 Development Constraints

4.1.1 Physical Constraints

(1) Poor soils and Marginal Land Use

Soils in the Study area mostly derived from sedimentary materials. Generally plow layer in soil is shallow, little accumulation of organic matter and very stony in many places. Reflected these soil conditions and the mixed farming system composing crop cultivation and livestock raising, agricultural land use in the Study area expands over not only the alluvial plains but also hill slopes as the cropped, pasture or fallow. No areas exist to newly reclaim as the farm land with certain extents.

(2) Severe Meteorological Conditions for Crop Cultivation

Annual mean temperature in the Study area is 7 degrees. From April to September, mean minimum temperature shows 0 to -6 degrees on an average. These air temperature suggest that crop growing conditions would be difficult though the low temperature is compensated by high values of radiation. In addition, the frequency of night frosts counts over 170 days on an average in a year and hailstorm hits seasonally over the Study area. The frost causes injury to potatoes and grain crops in the flowering stage.

(3) Unsettled River Course

Due to the meandering river course, erosion of farm land located adjacent the river bank is normally occurred at flooding time. Over fifty irrigation systems intake the irrigation water from Rio Keka and its tributaries. All systems are provided training levee in the river course to take water surely to the connecting irrigation canal. These training levee is made of pebbles insitu and periodical maintenance of levee is required due to the unstable water route and flooding.

(4) Remarkable Change of River Runoff between Rainy and Dry Seasons

From May to October, monthly average precipitation in the river basin of Rio Keka counts less than 50 mm though over 50 to 150 mm of precipitation occurs remaining months. In concert with these phenomenon, mean monthly runoff of Rio Keka at the Achacachi observatory shows less than 10 MCM from May to November. Around 20 MCM or over river runoff counts in other months. In August and September, mean monthly river runoff of Rio Keka shows only 1.6 MCM. Those seasonal runoff difference causes competitive water utilization especially in the dry season.

(5) Incoherence between Available Irrigation Water and Commanding Area

Because existing canal systems in the Study area has been constructed by the farmers' themselves and/or the lord of manor during the colonial age, no technical aspects such as water requirement, water balance, etc. for canal capacity and commanding area could be considered. After construction of canal, water users of each canal were increased and commanding areas were also expanded. Present water utilization for each plot is prevailed not the water requirement of crops but hourly limitation basis.

4.1.2 Infrastructural Constraints

(1) Lack of Irrigation and Drainage Facilities

Unlined earth canal (dug by manpower) is the general features of the existing

canal systems. No consolidated diversion structures of rivers for intake and off-take structures from the canal to farm plots can be seen in the Study area. These present structural conditions of canals allow preferential water use of upstream reach and free intake though regulation of water use is prevailed among the water users. Provision of gate facilities for diversion and crossing structures for roads are indispensable to use limited irrigation water effectively, especially in the dry season.

(2) Non-establishment of Road Network

The trunk road of the area is installed in both banks of Rio Keka. The point where passing becomes impossible appears in the rainy season because the damage of the road surface is remarkable. These present conditions cause easily division of the area and the isolation of the community. Furthermore, because there is no bridge which crosses the Rio Keka, the person's relationship and the circulation of the necessity of the both banks are also obstructed. In the annual flooding of the rainy season, the folk bus which is the only means of transportation in the area becomes impossible to pass the river. The daily life of inhabitant in the area is being much influenced. Moreover, interrelation within the areas is obstructed since it hasn't been fixed that the contact road which connects each community. This is the one of the factor that the synthetic development of the basin is precluded.

(3) Insufficient Drinking Water Supply Facilities

The provision of drinking water supply facility is advanced at the middle and lower basin in the Rio Keka. But, in most communities, there are still no drinking water supply facilities, and in those communities, streams and wells up water are being utilized as drinking water source. Therefore, uneasiness of taking the drinking water of the inhabitant increases because a sanitary environment is poor and the source is unstable. The stable supply of drinking water which protects the daily life of inhabitant must be promoted urgently as a fundamental condition for the area development.

(4) Defective Means of Electric Supply Facility

Though electrification proceeds most of the middle and downstream reach of Rio Keka, the provision of electric supply doesn't still proceed in upper reach of Rio Keka. The imbalance of such development, the area is decided to be torn up as a result, is the factor that the wholesome development of the Rio Keka basin is obstructed. The imbalance of the provision of the basic infrastructure must be eliminated for strengthen of the unity and the synthetic development of the basin.

(5) Lack of Health and Medical Facilities

The facility for the health and medical treatment is only installed the center of each Cantón. No health and medical facilities exist in most communities. The lack of the fundamental treatment facilities becomes increasing the uneasiness for sickness. It is the one of the factor to relinquish the settlement in the area. It is the subject that the establishment of the medical system and the improvement of the fundamental medical facilities in each community are urgent issues.

(6) Inadequacy of the Maintenance of Educational Facilities

The school of elementary education is established in each community. However, decaying of the facility and defect of the classroom are the fundamental problems in the area. Also long-distance schooling and the deficiency of advanced school bring the imbalance of the education opportunity in the area. The defect of these educational facilities prevents bringing up the youth who bears the next generation. The improvement of the educational facilities is, therefore, important requirement for development of the

future society.

(7) Lack of the Meeting Facility

Because mutual consent places the great emphasis on decision making, the meeting is often held among the community members in the Aymara society. A meeting facilities is installed in some communities, however, open space, playground, school or individual houses are generally used for the meeting due to not enough space and deterioration of existing facilities. The fulfillment of the meeting facility is a fundamental condition for activation of opinion exchange regarding the independent control and future development of the community.

4.1.3 Socio-economical Constraints

(1) Gap between Subsistence Economic Society and Market Economic Society

Economic activities in the Study area are basically self-sufficient production. Their production system was developed in a long history of the Aymara culture in due consideration of the natural and social circumstances. However, the progress of monetary economy in the Aymara society is inevitably required the changes for their socio-economical aspects to the external society.

The systematic and institutional administrations were not provided to the rural society in Altiplano such as social and economical infrastructures, socio-economic and technical information services and other necessary support or needed to adopt for the change. They are facing socio-economical difficulty to involve the present market economy and innovating technology.

(2) Lack of Assistance for Difficulties

Low income and severe living condition caused much difficulties in the community life. When the families tackle the emergencies such as natural calamities, food shortage, illness, etc., in many cases, those are in difficulties seem to be helped by relatives, or otherwise from neighbors. Furthermore, the attention concerning the difficulties should be given to the social disadvantaged in the community. It is considered that the access to the credit would contribute greatly to help those social disadvantaged.

(3) Lack of Access to Economic and Social Infrastructures

All the communities in the Study area except surroundings of the Achacachi municipality faced the limitation of the access to economic and social infrastructures such as potable water, medical cares, schools, roads and electricity.

(4) Lack of Agricultural Support Service System

The Government agricultural extension service is not reached to the rural communities. Only few Non Governmental Organizations (NGOs) are carrying out the agricultural assistance such as cultivation technique using a green house although some activities on dairy have been carried out by the public organization.

Farmers are lacking opportunity to obtain agricultural information and transfer of agricultural technologies. They are very little chance to obtain improved seeds and varieties for improving their production and farming. It has not seen any of the institutional credit services for agriculture and farming in the Study area.

(5) Immature Marketing System on Agricultural Products

Commercial farming and market economy is still immature in the Study area due to lack of market information, access of road, transportation for the agricultural products.

4.1.4 Agricultural Constraints

(1) Traditional Farming System

Traditional farming system has significance in view of diversification of risks on products and an conservation of ecosystem in the Study area. Such farming system in the Study area is the mixed farming based on self-sustaining. Cultivated crops and raising animals are principally subsistence in each household. The cultivation technique on crop selection, rotation, inputs as seeds and manure, and animal care and feeding are prevailed in traditional ways. On account of modern and improved technique are hardly introduced, agricultural commodity is only the surplus of their products and traditional farming system has marginal factors in the market economy.

(2) Minimized Land

The arable land is limited since the land in the Study area has been almost developed up to hill top. An equal inheritance of the land in the Aymara society has been divided individual land for cultivation into smaller.

(3) Lack of Information and Knowledge

The farmers are not utilized information and knowledge of modern and improved technique and management since institutional agricultural and rural support services are not properly provided.

4.2 Development Potentials

(1) Existence of Irrigation System

Over fifty communal irrigation systems are distributed along Rio Keka and its tributaries. These irrigation systems cover the farm lands in the entire Study area. Through the present irrigation practice, farmers recognize the importance and procedure of irrigated farming. Farmers can sufficiently be cope with the upgrading facilities of present irrigation system by the project implementation.

(2) Existence of O & M Structures of Each Canal System

Existing irrigation systems are operated and maintained by each community. Alcalde Agua is assigned as the leader of water utilization among the community members and has responsible for all aspects of water utilization such as clearing and repairing the canal, distribution of irrigation water, etc. O & M works after completion of the project, these existing O & M structures will be charged and could be managed the system well through the experience of existing system management.

(3) Existence of Well-established Community Organization

All of the communities in the Study area have their administrative organs and they are managing own matter with very democratic manners.

(4) Existence of Advanced Farmers in the Study Area

Advanced farmers who are managing farm and maintaining income source exist

in the Study area. Their farming are excellent on traditional crops and some of them cultivate new crops in the green house such as flower and vegetable. They are considering non-agricultural income such as handicraft of weaving and fish cultivation. Their practices and attitude on farm management could be a guideline and model for farmers in the area for motivation through agricultural extension and training.

(5) Existence of Marketing Organization on Dairy Product

Agricultural commodity producer's organization has been organized for dairy production by the assistance of official development cooperation 15 years ago. It is kept maintain their organization and facilities for collecting milk even after the privatization. This type of producer's organization could be applicable to the other commodity production for effective production and profitable marketing.

(6) Possibility of Expansion of Water Use during the Rainy Season

By improvement and extension of existing irrigation canals, irrigation area during the rainy season can be increased. Security of crop production is to be increased and crop diversification toward profitable crops is expected.

(7) Technical and Financial Supports through Public and Private Organizations

Some of technical and financial assistance for agriculture and livestock production improvement has been conducted by NGOs at present and in the past in the Study area. Many NGOs and some public institutions are implementing technical and financial support programs in Altiplano. However, the farmers are not familiar with access and preparation of proper planing to obtain their assistance. It is needed for farmers to know the information of existing support system.

(8) Effective Use of Communal Land

Various way of utilization is practiced on the communal land in each community. Such as a pasture land is generally used under the natural condition. Depend on condition, it is possible to increase grass production introducing the modernized farming technique for grazing more animal and cutting feed for winter season.

(9) Inland Fish Cultivation

A pond is considered as a supplemental water source at some area. It could be utilized for fish cultivation such as rainbow trout. Fish cultivation could provide a protein source on farmer's meal and also bring some cash income for farmers.

CHAPTER 5

**BASIC CONCEPT
OF THE DEVELOPMENT PLAN**

CHAPTER 5 BASIC CONCEPT OF THE DEVELOPMENT PLAN

5.1 Basic Development Concept

Taking the present issues in the Study area and regional characteristics of development requirements into account, the Study area is broadly divided into three zones along with the Rio Keka namely, upper, middle and lower basins based on the natural and social conditions, administrative boundary and present farm management. On the other hand, in view of present economic activities in the Study area, upper basin belongs to the Batallas and La Paz economic bloc, though middle and lower basins belong to the economic bloc centralized Achacachi city areas. These situations were formed by complex of administrative boundaries, conditions of location, historical process of formation of villages and lack of road network in the Study area.

The purpose of the Study is to alleviate the poverty situation, i.e. i) to contrive sufficiency of settlement condition and amelioration of farm household economy by promotion of regional agricultural production, ii) activation of regional economy and facilitation of farmers' settlement by promotion of agricultural production surrounding areas of intermediate cities expressed in the "Regional Agricultural Development Program joint to Intermediate Cities (PRODARCI)" which is the precedence political program of the Study.

With these present situation of the Study area and the purpose of the Study, development concept of the Study can be summarized as follows;

- 1) Amelioration of farm management, improvement of agricultural infrastructure and establishment of agricultural support system to promote agriculture in the Study area, and
- 2) Improvement of socio-economical infrastructure to contribute the establishment of economic bloc in the Rio Keka basin as a whole.

5.2 Development Strategies

The execution of the proposed development plan has to contribute for the alleviation of poverty situation and the satisfaction of needs on settlement condition of the inhabitants dwelled in the Study area. Following is the basic strategies to propel the achievement of these goal based on the survey and analyzed results of present conditions in the Study area.

(1) Development Goal

- i) Socio-economical aspects
 - realization of comfortable rural society
 - increase of farmers' income
- ii) Environmental aspects
 - harmonized development with natural conditions

(2) Development strategies for overall and each sphere of the study

- i) reflection of residents requirements in the Study area
- ii) formulation of real efficacious development plan
- iii) improvement level on proposed facilities taking the present situation of the Study area
- iv) consistency with the national development policy
- v) close cooperation with NGOs
- vi) solicitude for the "WID" and the disadvantaged

- vii) sustainable development
- viii) improvement of farm management to elevate farmer's income with proper agricultural support services,
- ix) to reduce of O & M works on irrigation canal and expansion of irrigation area in the dry season with the lining of major part of canal
- x) to contribute for establishment on the economic bloc of the Rio Keka basin as a whole with improvement of road network in the Study area,
- xi) to up-grade mutual communication sources among inhabitants and communities with provision of community center and road network.

5.3 Principal Approach to the Development Plan

Present farm management in the Study area is practiced by the traditional mixed farming consisting the self-sustaining crop cultivation and the livestock raising as the basic means. Much weight is given to the commodity production either crop farming or livestock raising based on the natural conditions such as climate and available water in the upper, middle and lower basins. The envisaged agricultural development plans will be emphasized for the increase of commodity production to elevate the farmer's income by amelioration of present farm management with the appropriate agricultural support services. Furthermore, PRODARCI which is the precedence policy of the Study intends to regulate the migratory flows from rural areas to large cities, facilities to contribute the establishment and/or activation of regional economic bloc centering the Achacachi municipal areas will be given the priority in the infrastructure development of rural facilities in the Study area.

Since proposed components to be improved through the Study cover various fields and numbers, it is proposed that the stage wised implementation strategy such as the short, middle and long term development. The terms of short, middle and long will be assumed by 5 years.

5.3.1 Agricultural Development

Principal idea of agricultural development in the Study area is to minimize the change of socio-economical basis and only approach to the part of farming in order to increase income of the farmers. It is therefore that the base of the subsistence farming will be kept and potential commodities production will be the point of improvement.

Amelioration measures of present farm management will be constructed taking the natural conditions on upper, middle and lower basins, marketability of the products, existing agricultural resource, efficiency of present farm management into account. The basic development approach of each basin is as follows;

Upper to upper middle basin

Crop cultivation in the upper basin are limited to self-consuming and forage crops due to poor soil and severe climatic conditions. Major agricultural income depends entirely on sheep and draft cattle produce using the private and/or public natural grass land. Major items to be developed are the increase of number of heads on sheep by improvement of natural grass land, and conversion from poor quality draft cattle raising to sheep raising.

Lower to lower middle basin

Agriculture in the lower to lower middle basin is characterized dairy farming and cash crop cultivation. Most of the farmers engage in dairy farming, however, farmers who cultivate cash crops such as onion and vegetables are omnipresence according to the soils and irrigation conditions. Agricultural development in these

areas aims to increase of milk production based on the improvement of dairy breed by artificial insemination. Promotion of cash crop cultivation on small-scale farmers will also be planned through effective utilization of irrigation and green houses.

Major technical aspects to realize the above mentioned are as follows;

- 1) Solution of feed shortage
 - 1) Enlarge of forage crop land; Improvement of natural pasture
 - 2) Supplementary feed of concentrate according to the necessity
- 2) Improvement of animal quality
 - 1) Maintaining of qualified bull in the area
 - 2) Practicing of artificial insemination
 - 3) Eliminating of poor quality animals
- 3) Improvement of livestock management system
 - 1) Effective feed planning in dry season
 - 2) Cattle protection from cold weather at night
- 4) Effective use of irrigation water
 - 1) Stable cultivation of cash crops such as Onion, Broad bean, etc.
 - 2) Round year cropping in green house
 - 3) Extension of perennial grasses such as Alfalfa
- 5) Improvement of material and produce marketing by community co-operatives
 - 1) Introduction of community co-operatives (association)

Because careful attention is paid to the traditional farming system and no drastic changes of present farming system is expected in the proposed agricultural development plan, both introduction of new farming technique and its results derived from the assistance by proposed agricultural assistance activities are intended to make gradual progress in the project area. From these view points, stage-wise production plan (short, middle and long term) in the agricultural development is also considered following the infrastructure improvement plan of the project.

5.3.2 Establishment of Agricultural Support System

Proposed agricultural development plan is the means to improve farm household economy and it needs technical and financial support on its implementation. However it is not able to consider practical involvement of official support services in the present Bolivian situation. The supports in the project area are carried on by only NGOs, which are approaching to a spot base. The plan of improvement of farming is formulated based on farming pattern of the upper, middle and lower basins of Rio Keka according to agricultural conditions in the project and a method of accept NGO's support by a base of extended area will be effective and efficient. Therefore a receptor's organization across the communities is indispensable as a basic factor for agricultural support services.

Agricultural development plan is also backed by hardware facility as agricultural and rural infrastructure. These facilities are to be improved in the extended area across the communities and the similar type of receptor's organization will be required for operation and management of the equipment provided for maintenance of the facilities.

A base facility is proposed as core organ of receptor's organization in order to utilize and manage equipment provided for maintenance facilities of both agricultural and rural infrastructure. This base facility is named "Community Re-vitalization Center" in the project.

"Community Re-vitalization Center (CRC)" is introduced as the base for providing the support system for all beneficiaries in the project area and for carrying out the support services effectively in order to achieve the objectives of the Study.

Background of an idea on CRC and its function are to contribute for fostering farmers and communities toward positive attitude and self-reliant, acquired farmer of reliable production and management technique and knowledge and socially and economically active women. Following functions will be essential, the function will be changed and applied by steps according to the situation and priority of needs of the area;

- i) Extension of production technique on agriculture and livestock
- ii) Improvement of farming and other economical activity
- iii) Dissemination of skill and knowledge for creating comfortable rural life
- iv) Management and maintenance of social and economical infrastructure of the area
- v) Providing the place for medical and health care services
- vi) The place of communication for community and residents in the area
- vii) The place of social and cultural activities for community and residents in the area.

The CRC should have facilities for meeting, training classroom, practical training and exercise, storage for equipment and farm products, demonstration plot, medical care space and others necessary to implement center's functions. Equipment are for maintain social and economical infrastructure, farming aid, training, artificial insemination and administration.

Since community in the area traditionally has their own system of administration and management, operation and management of the CRC should be handled by the communities and residents of the concerned area.

The concept, the purpose, the functions and the operation and management etc. regarding the CRC may not be familiar for the people in the area. It is desirable to support their activity at initial stage. Two types of support can be considered, one is operation and management of the CRC and the other is technical and financial for solving problem of the area. The support for operation and management of the CRC should be responsible by the coordination organ of the official institution of the project implementation.

5.3.3 Agricultural Infrastructure Development

Because basic irrigation system is aligned in the whole Study area and the commanding irrigation area of such systems extends more than the available river surface flow in the dry season, competitive irrigation water use of river flow arises among the irrigation systems during the dry season. To solve these competitive water use, new water source development such as construction of dam and reservoir, groundwater development by deep-well is the most general measures to increase the available water for irrigation. Development potential to construct the dam and to utilize aquifer is immanent in the Study area with technical point of view. Following point of view should, however, be attained to formulate the development plans;

- i) Dam construction plan is not included as the water source development in the Scope of Work of the Study. In addition, there are social, economical, political and environmental issues at the possible dam site in the Study area,
- ii) It should maintain a certain level of the economic viability from the viewpoint of the opportunity cost, though main purpose of the irrigation development plans do not intend to pursue the project economy,
- iii) Efforts should be given to decrease the initial project cost when no large incremental benefit of the project can be expected.

Increase of irrigation water use is, therefore, devised through effective use of presently available water mainly runoff of the Rio Keka. Rehabilitation of existing irrigation facilities, especially lining of canals on major reaches and construction of

concrete diversion facilities in the canal system, are the major development targets to increase available irrigation water under the condition of without new water source development.

5.3.4 Rural Infrastructure Development

The basic rural infrastructure to be provided in the Study area is the roads, drinking water supply, electric supply, schools, medical care and village community facilities. Presently, those facilities are provided and distributed unevenly among the communities in the Study area. To provide these facilities except the principal roads, community has to make application to the certain public sectors, however, applicant must bear the part of expenses to execute an application undertaking. On the other hand, local government bodies has responsible to provide and to maintain the principal roads in the areas under the jurisdiction.

Priority of the rural infrastructure development of the Study must be given to the development to contribute the establishment of economic bloc on the Rio Keka basin as a whole, amelioration of present farm management and establishment of agricultural support system in the Study area. Aspects to establish the economic bloc on the Rio Keka basin, improvement of existing principal road network fall into the key component of the development plan. As the structural approach to contribute the amelioration of farm management and the establishment of agricultural support system in the Study area, construction of "Community Re-vitalization Center (CRC)" is indispensable as the base to support and improve the agricultural activities and farmers' living. The CRC will be provided in the upper, middle and lower basins taking into considerations basin characteristics of natural condition and farming practice.

Since some communities had been provided basic rural infrastructure under their certain burden, provision of other rural infrastructure shall be made by the prevailing application system in Bolivia to avoid unequal condition among the communities for provision of basic infrastructure in the Study area.

CHAPTER 6

**AGRICULTURAL DEVELOPMENT PLAN
OF ACHACACHI AREA**

CHAPTER 6 AGRICULTURAL DEVELOPMENT PLAN OF ACHACACHI AREA

6.1 Land and Water Resources Development

6.1.1 Land Resources Development

Objective areas of the Study were concluded at 8,370 ha taking the area boundary shown in the Scope of Work and the topographic map of scale 1 to 5,000 compiled through the Study. Out of the total Study area, presently used for farm lands including fallow and grass lands are demarcated at about 6,580 ha. in gross. Other land use in the study area such as roads, rivers, residential areas, etc. is estimated at about 1,790 ha. Reflecting the present farm management in the Rio Keka basin, large expansion of upland field in lower basin can be found as well as glass land in upper basin .

The development potential of agricultural land in the Study area is assessed with land capability classification based on the results of soils, land use and crop suitability surveys. With these survey results, no land to be capable for new areas of agricultural land reclamation can be recognized. However, for the communal land of each community used as a pasture land under the natural conditions, efficient land use will be considered to increase grass production and cutting feed. Also, intensive agricultural land use will inevitably be the basic development strategies on agriculture from the available land resources in the Study area.

6.1.2 Water Resources Development

The Study area is developed in the Rio Keka basin. Around 670 mm of annual average basin precipitation generates around 156.0 MCM of annual average runoff at the Achacachi observatory located the downstream reach of the Study area. Only 12.4 MCM flow is available during the drought from June to October, of which monthly average runoff shows about 1.6 MCM in August and September. As for the low-water year with probability on return period of 5 years, runoff at the Achacachi observatory shows 87.7 MCM annually and 5.9 MCM during the drought from June to October.

Fifty-five irrigation systems with total net irrigation area of around 5,700 ha are now utilized surface flow of Rio Keka main stream and its tributaries. Most of the existing irrigation systems utilized river surface flow during the wet season mainly from November to May. From the theoretical peak water requirements of crop (2,500 m³/month) and average runoff of Rio Keka, irrigable areas by river surface flow can be estimated theoretically at 640 ha in August and at 13,400 ha in February as well as 25,000 ha annually. With these facts, the Study area has the potentials to irrigate all existing irrigation systems through the year when the annual runoff of Rio Keka can regulate by appropriate facilities such as reservoir.

As stated in the development concept, new water source development is not proposed in view of the required cost for new water source development and the economic viability of the development plan derived from the Study. Expansion of irrigation water use is, therefore, devised through effective use of presently available water mainly runoff of the Rio Keka.

6.2 Agricultural Development Plan

6.2.1 Basic Approach for Agricultural Development

(1) General

The project area is divided into two parts; upper basin (including upper-middle basin) composed of rather large communities with large land owners, and lower basin

(including lower-middle basin) of rather small communities with small land owners. This border line is situated at the end of small communities in the suburbs of Achacachi city. Out of the projected communities, Chachacomani, Corpaputu, and Kjasina hold their farmland mostly outside of the study area. While, Achacachi city farmers could not be identified in numbers. Those farmers were excluded from the study of farming.

1) Upper basin (including upper-middle basin)

In the upper and upper-middle basins, the major farming income is limited in animal husbandry of sheep and cattle with using the communal grassland as well as the private grassland, since the crop cultivation is only self-consuming foods and forage crops due to low fertility of soils and severe climate conditions.

Livestock heads are around 10 sheep by small and medium size of farm or 20 sheep by large size farm, with 2 cattle/ small size, 3-4 cattle/ medium size, and 6-8 cattle/ large size farm on the average. In large size farms, most cattle are beef cattle. Dairy cattle per farm show only 1-2 heads per farm, and this means that most of milk cows are milked for self-consuming purpose.

Agricultural development plan in these areas is to increase the sheep heads by the reclamation of waste land or grass-land in order to increase the production of grass and forage crops, through the tractor service by Community Re-vitalization Center (CRC) at Chachacomani, and by Area Center(AC) at Kerani and Cala Cala..

2) Lower basins (including lower-middle basin)

Farming in the lower and lower-middle basins is characterized by dairy and cash crops. Milk production can be seen in almost all the farmers in every community, however, the cash crops are practiced by only a few farmers, who hold the green house or the suitable land for vegetable crops with the irrigation water in limited communities.

Heads of milk cows count 1.8 in small size farm (less than 1.5 ha), 2.5 in medium/ large size farm (more than 1.5 ha) in lower-middle basin, and 2.8-3.0 in medium/ large size farm in lower basin, on an average. Dairy farming is developed with milk collection centers and branches in Belen, Avichaca, Taramaya and Jahuir Laca communities.

Cash crops are potato, broad bean, onion, lettuce, carrot, green peas, etc. In case of potato, some dairy farmers in Belen say they do not cultivate potato, but purchase it from other farmers. Onion cultivation can be seen in the suburbs of Achacachi city, mostly at small communities in the lower-middle basin. Avichaca is famous for vegetable cultivation such as lettuce and carrot. Lettuce is also cropped in green houses (approx. 30) in Suntia Grande and Suntia Chico.

Agricultural development plan in lower basin is to increase the milk production with improving of the cows quality by artificial insemination, and to improve the cash crop cultivation with irrigation and/or green houses. CRC at Belen and AC at Jahuir Laca and Putuni will play an important role in carrying the execution of the plan.

(2) Proposed Farming Types

Agricultural development plan is formulated for the three categories of the beneficiaries by basins and land size of farming or by the actual farming types;

- 1) Sheep development by land reclamation of natural grassland (CANAPA),
- 2) Dairy development by the quality improvement of cows, and
- 3) Cash crop development by irrigation and green houses.

They will be designed for the classified beneficiaries of land sizes by every basin as follows;

- 1) Sheep development: all sizes of farmers in upper and upper-middle basins.
- 2) Dairy development: all sizes of farmers in lower and lower-middle basins.
- 3) Cash crop development: some farmers in lower and lower-middle basins

They are also classified into actual farming types mentioned in chapter 3.

- 1) Sheep development type:
Type A, B and C; Sheep and/or Beef cattle specialized farm
- 2) Dairy development type:
Type D, E and F; Dairy specialized farm; Represented by Type D and E
- 3) Cash crop development type:
Potato/Onion specialized farm and Green House specialized farm, Some farms in Type D, E and F; Represented by Type F.

Land use and animal holding on the average in each farming development type is summarized for the types at present. In these classification, Type D and E at present are grouped in Dairy type, and Cash crop type is represented by Type F at present.

Farm planning type	Sheep Dev. Type			Dairy Dev. Type			Cash Crop Dev. Type		
Farm type at present	Type A, B, and C			Type D and E			Type F		
Basin	Upper and Upper middle)			Lower and lower middle					
	Present	(1)	(2)	Present	(1)	(2)	Present	(1)	(2)
(a) Food crops extent (ha)	0.6	0.6	0.6	0.7	0.6	0.6	0.3	0.3	0.3
(b) Forage crops extent (ha)	0.6	0.8	0.8	0.5	0.8	0.8	0.2	0.35	0.35
(c) Waste land / Fallow (ha)	1.0	1.0	1.0	0.1	0.1	0.1	-	-	-
(d) Grassland * (ha)	1.5	0.6	-	1.4	0.9	0.4	0.1	-	-
(e) Improved Grassland (ha)	-	0.7	1.3	-	0.3	0.8	-	-	-
(f) Heads of Sheep	14.5	32.0	38.0	4.6	4.6	4.6	1.0	1.0	1.0
(g) Heads of Cows	1.6	1.6	1.6	2.7	2.7	2.7	1.8	1.8	1.8
(g) Heads of draft (beef) Cattle	2.5	1.7	1.2	3.0	2.5	2.0	1.8	1.3	1.3

* Grassland in Sheep type is natural grassland with "Stipa", gravel or wet land.
Grassland in Dairy type and Cash crop type is improved sown pasture.
(1) : 5 years later, (2) : 10 and 15 years later

(3) Basic Plan for Farming Types

1) Sheep development type (Type A,B,C at present)

Most of the communities in upper and upper-middle basins requested the development of both sheep and cattle. Chachacomani requested cattle development rather than sheep, while, Coromata area of three communities requested sheep rather than cattle development.

In the plan, the breeding efficiency will be improved from 30% at present to 56% in 5 years later and to 64% in 10-15 years later through the technical guidance on the effective management of sheep raising. The improvement of grassland by tractor plowing with supply of grass seeds is planned for 1 ha every farm. With this improvement, the increment of sheep heads is proposed for ten heads / ha. Other improvements in sheep raising are;

- (a) Introduction of castration for male sheep,
- (b) Shifting from the poor quality of cattle to the increase of sheep heads, and
- (c) Introduction of high quality sheep from other area.

2) Daily development type (Type D,E,F at present)

Almost all the communities in lower and lower-middle basins requested the development of dairy farming. Successful dairy farming can be seen at Belen and Taramaya, where they have a little better quality of cows, and the milking capacity per head is 1,500 liters per year, or 7 liters/head per day. Commonly the milking capacity in all the lower and lower-middle basins is 700 liters per year, or 3- 5 liters/ head per day on an average mainly due to the poor quality of cows.

In the plan, the milking capacity will be improved to 900 liters/heads per year in 5 years later, 1,200 liters/h./yr. in 10 years later, and 1,500 liters/h./yr. in 15 years later, with the quality improvement of cows by artificial insemination. The improvement of grass by tractor plowing with supply of Alfalfa and other grass seeds is planned for the intensive management in pasture. Additional feed by the concentrate feed will be introduced in order to increase the milking capacity. Other plans of improvements in dairy farming are;

- (a) Improvement of high mortality of calving,
- (b) Arrangement of credit for the cow shed or the stall, and
- (c) Introduction of ensilage feed.

3) Cash crops development type (Some farmers in Type D,E,F at present)

Cash crops are planned for Potato, Onion and green house (Lettuce). The cash crop potato farmers count approx. 300 farmers with the crop extent of 160 ha, and those farmers are designed to improve the management with a little intensive way in manure and fertilizer application.

Onion cultivation is planned to enlarge the crop extent by 40% (20ha) with the same numbers of farmers (approx. 200). The green house extension is planned for farmers in small size land holders at lower-middle basin (Type F at present), in particular. This plan will be collaborated with an existing NGO.

6.2.2 Proposed Crop Plan and Crop Rotation

The main points of the crop plan for each farming type are the improvement of natural grassland with introduction of high quality of grass and increase of the crop extent in forage crops such as barley (oats) and alfalfa for the sheep type in upper basin, and enlarge the forage crops by the decrease of potato extent and intensive use of the grassland for the dairy type in lower basin.

For these crop increase or intensive use of the land, tractor plowing, through the service by CRC and AC, is planned. As for the cash crop type farms, which are scattering in the dairy type farms, yield increase in potato, increased extent in onion, and introduction of plastic green houses are proposed. (In this report, Type F is represented as cash crop type.)

(1) Crop Plan in Sheep Development Type (Type A, B, and C at present)

(ha / farm)	Present	5 years later	10 years later	15 years later
1) Potato	0.37	0.37	0.37	0.37
2) Vegetable	0.10	0.10	0.10	0.10
3) Quinoa	0.10	0.10	0.10	0.10
4) Barley(Oats)	0.50	0.67	0.67	0.67
5) Alfalfa	0.05	0.15	0.15	0.15
6) Natural grassland	1.50	0.56	0.03	0.03
7) Improved grassland	-	0.67	1.20	1.20

(2) Crop Plan in Dairy Development Type (Type D and E at present)

(ha / farm)	Present	5 years later	10 years later	15 years later
1) Potato	0.34	0.24	0.24	0.24
2) Broad bean	0.20	0.20	0.20	0.20
3) Onion	0.02	0.03	0.03	0.03
4) Vegetable	0.08	0.07	0.07	0.07
5) Quinoa	0.04	0.04	0.04	0.04
6) Barley(Oats)	0.40	0.62 *	0.62 *	0.62 *
7) Alfalfa	0.10	0.20	0.20	0.20
8) Grassland (pasture)	1.38	0.68	0.18	0.18
9) Intensive grassland	-	0.50	1.00	1.00

* 0.02 ha is double cropping with onion

(3) Crop Plan in Cash Crop Development Type (Type F at present)

(ha / farm)	Present	5 years later	10 years later	15 years later
1) Potato	0.20	0.20	0.20	0.20
2) Onion	0.05	0.07	0.07	0.07
3) Vegetable	0.05	0.03	0.03	0.03
4) Green house (lettuce)	-	40 sq.m	40 sq. m	40 sq.m
5) Barley(Oats)	0.10	0.15 *	0.15 *	0.15 *
6) Alfalfa	0.10	0.20	0.20	0.20
7) Grassland (pasture)	0.10	-	-	-

* 0.05 ha is double cropping with onion

(4) Manure Application and Crop Rotation Plan

Generally the previous crops of potato cultivation are broad bean or forage crops (barley/oats) by the typical rotation system. Therefore, enough application of manure (3,000-4,000 kg/ha) by cow dung or sheep drop for the previous crops is planned. With this application the increased yield will be expected for potato as well as the previous crops. After the potato, cropping of alfalfa is designed with application of manure (2,000-3,000 kg/ ha/year). Alfalfa can be harvested continuously and occupies the land at least for three years. It is also proposed for mixed seeding with graminaceous grass such as *Festuca (Festuca arundinaceae)* or *Pasto Ovillo (Dactylis glomerata)*.

In the preferable land, where the irrigation is available in July or August, if the short term crops of lettuce or onion can be started in July or August, these crops will be able to be harvested in December, and the double cropping with forage crops (barley/oats) is possible by seeding before the onion harvest. Some farmers have been operating in practice in lower middle basin. This double cropping rotation is proposed since onion is usually cropped at irrigable land, and the extent of irrigation will be enlarged with effective water use after the canal rehabilitation.

6.2.3 Livestock Development

(1) Improvement Indicator on Livestock

Indicators of the improvement plan on livestock farming are shown below. Those are prepared based on the present agriculture and livestock management and the results of Belen Experimental Station.

Development indications on sheep

	Unit	At present	5 years	10 years	15 years
a) Live weight/male	Kg	30	40	50	50
b) Live weight/female	Kg	25	30	40	40
c) Breeding age	Month	20	18	18	18
d) Maternity age	Month	25	23	23	23
e) Birth rate/adult sheep	%	60	80	90	90
f) Procreative age	Year	4	5	6	6
g) No. of lamb prod./sheep	No.	2	4	5	5
h) Mortality rate/adult	%	5	3	2	2
i) Mortality rate/lamb	%	25	20	10	10
j) Wool prod./yr./head	Kg*	2.5	4.0	5.0	5.0

Note: * Row wool not washed

Development indications on dairy cow

	Unit	At present	5 years	10 years	15 years
a) Live weight of cow	Kg	350	400	450	500
b) Breeding age	Month	26	24	22	22
c) Maternity age	Month	38	36	34	34
d) Birth rate/adult cow	%	65	75	80	80
e) Procreative age	Year	6	8	8	8
f) No. of calf prod./sheep	No.	3	5	5	5
g) Mortality rate/adult	%	5	3	2	2
h) Mortality rate/calf	%	40	20	15	10
i) Milk prod./yr./head	Liter	700	900	1200	1500

(2) Livestock Raising Plan

Livestock raising plan for each farming type is as follows;

1) Sheep type (Type A, B and C at present)

Item	Present	5 years later	10 years later	15 years later
1) Heads of sheep	14.5	32.0	38.0	38.0
2) Heads of Cows	1.6	1.6	1.6	1.6
3) Heads of draft (beef) Cattle	2.5	1.7	1.2	1.2

2) Dairy type (Type D, E and F at present)

Item	Present	5 years later	10 years later	15 years later
1) Heads of sheep	4.6	4.6	4.6	4.6
2) Heads of Cows	2.7	2.7	2.7	2.7
3) Heads of draft (beef) Cattle	3.0	2.5	2.0	2.0

3) Cash crop type (Type F at present)

Item	Present	5 years later	10 years later	15 years later
1) Heads of sheep	1.0	1.0	1.0	1.0
2) Heads of Cows	1.8	1.8	1.8	1.8
3) Heads of draft (beef) Cattle	1.8	1.3	1.3	1.3

6.2.4 Anticipated Yield

The increase of crop yield is proposed for all the crops by around 10% within the first 5 years of short term plan, and another 10% within the middle/long term plan (in 10 and 15 years), with application of more manure of cow-dung and/or sheep drop. The increased application of manure by cow-dung or sheep drop is summarized as follows;

< Manure Increase >	at present	5 yr. later	10 yr. later	15 yr. later
Potato(lower-middle)	4,000 kg/ha	5,000 kg/ha	6,000 kg/ha	6,000 kg/ha
Potato(lower basin)	5,000 kg/ha	6,000 kg/ha	7,000 kg/ha	7,000 kg/ha
Broad bean	2,000 kg/ha	3,000 kg/ha	4,000 kg/ha	4,000 kg/ha
Onion	3,000 kg/ha	4,000 kg/ha	5,000 kg/ha	5,000 kg/ha
Quinoa	-	2,000 kg/ha	3,000 kg/ha	3,000 kg/ha
Barley(Oats)	-	2,000 kg/ha	3,000 kg/ha	3,000 kg/ha
Alfalfa	-	2,000 kg/ha	3,000 kg/ha	3,000 kg/ha

The yield standard in potato cultivation for cash crop in lower and lower-middle basins is estimated at 5,000 kg/ha at present. In the plan, this yield is proposed to raise up to 7,000 kg/ha in the first 5 years, and 7,700 kg/ha in the middle and long term plans (in 10 and 15 years). These yields are 60% and 65% of the minimum level of the yield by PROSEMPA (Programa Semilla de Papa; National potato seed program), being carried out by Belen Experimental Farm. The program recommends 12-18 t/ha of the yield with fertilizer application by 217 kg of Phosphate compound (18:46:0) and 67 kg of Urea (46:0:0). The recommendation of fertilizer application is adopted to the plan of cash crop potato cultivation.

The anticipated yields are listed as follows. The increase of yield and manure after 11 years are not planned.

< Anticipated Yield >	at present	5 yr. later	10 yr. later	15 yr. later
Potato(Upper/U.-middle)	2,500 kg/ha	2,700 kg/ha	3,000 kg/ha	3,000 kg/ha
Potato(lower-middle)	2,700 kg/ha	3,000 kg/ha	3,300 kg/ha	3,300 kg/ha
Potato(lower basin)	3,600 kg/ha	4,000 kg/ha	4,400 kg/ha	4,400 kg/ha
Potato(cash crop farms)	5,000 kg/ha	7,000 kg/ha	7,700 kg/ha	7,700 kg/ha
Broad bean	700 kg/ha	750 kg/ha	800 kg/ha	800 kg/ha
Onion	15,000 kg/ha	16,000 kg/ha	17,000 kg/ha	17,000 kg/ha
Quinoa	500 kg/ha	550 kg/ha	600 kg/ha	600 kg/ha
Barley(Oats)	2,000 kg/ha	2,200 kg/ha	2,500 kg/ha	2,500 kg/ha
Alfalfa	2,500 kg/ha	3,000 kg/ha	3,500 kg/ha	3,500 kg/ha
Improved/Intensive grass	-	5,000 kg/ha	5,000 kg/ha	5,000 kg/ha

6.2.5 Production Plan

(1) Crop Budget

In the crop budget of the plan in 5 years later, the increase of the cash outlay can be seen for fertilizer cost in cash crop potato, for tractor plowing cost in onion and forage crops (barley/oats, alfalfa), and for seed cost in alfalfa, as shown in 1). The crop budget of the plan in 10 years later is planned for 10% of yield increase without increase of cash outlay but with increased manure application. The crop budget of the plan in 15 years later is planned as same as that in 10 years later.

1) Cash outlay

Potato (Cash crop farms)	Present	Plan (5 years later)
(a) Seed potato	Bs2,000/1000kg	Bs2,080/800kg
(b) Tractor	Bs150/3hrs.	Bs150/3hrs.
(c) Fertilizer	Bs450/150kg	Bs 840/280kg
(d) Chemicals	Bs100	Bs100
(e) Hired labor	Bs500/50m.d.	Bs500/50m.d.
(f) Miscellaneous(10%)	Bs320	Bs370
Cash outlay total	Bs3,520	Bs4,040

Other crops	< Onion >		< Barley >		< Alfalfa >	
	Present	5 yrs later	Present	5 yrs later	Present	5 yrs later
(a) Seed/ Seedlings	Bs830/83kg	Bs830/83kg	Bs200/100kg	Bs200/100kg	Bs336/8kg	Bs504/12kg
(b) Tractor plowing	-	Bs300/4hrs.	-	Bs150/2hrs.	-	Bs150/2hrs
(c) Fertilizer	Bs132/44kg	Bs132/44kg	-	-	-	-
(d) Miscellaneous(10%)	Bs96	Bs126	Bs20	Bs35	Bs34	Bs65
Cash outlay Total	Bs1,058	Bs1,388	Bs220	Bs385	Bs370	Bs719

2) Crop budget of potato in 5 years later (per ha)

Potato	Cash crop potato (lower/lower middle)	Self-consuming potato (upper/upper middle)	Self-consuming potato (lower/lower middle)
(a) Cash outlay	Bs 4,040	Bs 754	Bs 1,595
(b) yield	7,000 kg	2,700 kg	2,900 kg
(c) price(f.g.p.)	Bs 1.8/ kg	Bs 2 / kg	Bs 1.6/ kg
(d) Gross income	Bs14,000	Bs 5,400	Bs 4,610
(e) Net income	Bs 9,960	Bs 4,646	Bs 3,015

3) Crop budget of other food crops in 5 years later (per ha, green house: 40 sq.m)

	Broad bean	Onion	Quinua	Lettuce(green house)
(a) Cash outlay	Bs 86	Bs 1,388	Bs 11	Bs 102
(b) yield	750 kg	16,000 kg	550 kg	100 kg
(c) price(f.g.p.)	Bs 0.8/ kg	Bs 0.5/ kg	Bs 1 / kg	Bs 4 / kg
(d) Gross income	Bs 600	Bs 8,000	Bs 550	Bs 400
(e) Net income	Bs 514	Bs 6,612	Bs 539	Bs 298

4) Crop budget of forage crops in 5 years later (per ha)

	Barley (Oats)	Alfalfa	Grass
(a) Cash outlay	Bs 385	Bs 719	Bs 132
(b) yield	2,200 kg	3,000 kg	5,000 kg
(c) price(f.g.p.)	Bs 0.6/ kg	Bs 0.8/ kg	Bs 0.1/ kg
(d) Gross income	Bs1,320	B 2,400	Bs 500
(e) Net income	Bs 935	Bs1,681	Bs 368

(2) Farm budget in each farming type in 5 years later

1) Income plan by crop production

Farm budget in crop production in each farming type is planned by the crop extent and the crop budget as follows;

	Sheep Type (Type A,B,C at present)	Dairy Type (Type D,E at present)	Cash Crop Type (Type F at present)
(a) Cash outlay	Bs 286	Bs 704	Bs 524
(b) Gross income	Bs 2,084	Bs 2,543	Bs 2,634
(c) Net income	Bs 1,800	Bs 1,839	Bs 2,108

2) Income plan by livestock production

	Sheep Type (Type A,B,C at present)	Dairy Type (Type D,E at present)	Cash Crop Type (Type F at present)
(a) Cash outlay	Bs 890	Bs 712	Bs 426
(b) Gross income	Bs 4,448	Bs 3,556	Bs 2,128
(c) Net income	Bs 3,558	Bs 2,844	Bs 1,702

3) Average farm budget and income plan in each type

Farm budget and income plan in each type is calculated from 1) and 2), as follows. The income plan for 10 and 15 years later is also shown in the following table. Detail calculations are shown in Annex-E.

	Sheep Type (Type A,B,C at present)	Dairy Type (Type D,E at present)	Cash Crop Type (Type F at present)
(a) Cash outlay	Bs 1,176	Bs 1,416	Bs 952
(b) Gross income	Bs 6,534	Bs 6,099	Bs 4,762
(c) Net income	Bs 5,358	Bs 4,683	Bs 3,810
(d) Net income(10 yrs later)	Bs 7,379	Bs 5,150	Bs 4,150
(e) Net income(15 yrs later)	Bs 7,736	Bs 5,621	Bs 4,471

(3) Production Plan

1) Production plan in 5 years later

(a) Increment in crops production

Increment in crop production in 5 years later will be achieved in all the crops because of the yield increase by 10%, especially in onion, barley(oats), alfalfa, and grass, which are planned for the enlarged crop extent. As for potato, the production by cash crop farmers will increase by 360 t, while that by self-consuming farmers will decrease by 60 t, and the balance shows 300 t of increment.

Crops	Present	Plan in 5 years later	Increment
a) Potato (Self-consuming farms)	1,740 t	1,680 t	- 60 t
(Cash crop type farm)	900 t	1,260 t	360 t
b) Broad bean	156 t	167 t	11 t
c) Onion	720 t	1,075 t	355 t
d) Lettuce	-	51 t	51 t
e) Quinoa	80 t	88 t	8 t
f) Barley(Oats)	(2,158 t)	(3,388 t)	(1,230 t)
g) Alfalfa	(553 t)	(1,491 t)	(938 t)
h) Grass	-	(6,680 t)	(6,680 t)
Total	3,596 t	4,321 t	725 t
	(2,711 t)	(11,511 t)	(8,800 t)

(b) Increment in livestock production

Increment in livestock production is planned for sheep heads increase by grassland improvement and replacing from low quality of cattle to sheep in upper basin, and for the increase of unit milking capacity per head by increased forage crop and grass, quality improvement of cows through artificial insemination, and introduction of the concentrate feed in lower basin. Milk cow is not planned for the improvement in quantity but in quality.

Livestock	Present	Plan in 5 years later	Increment
(a) Heads of sheep	24,330	42,890	18,560
(b) Heads of draft (beef) cattle	7,280	5,613	-1,667
(c) Sheep production (sale and self-consuming)	6,952	24,018	17,066
(d) Milk production (do.)	1,800 t	3,010 t	1,200 t
(e) Sale of calves	776	1,737	961
(f) Sale of old cattle (including self-consuming)	2,292	1,954	-338
(g) Sale of wool	0	34,313 kg	34,313 kg

2) Production plan in 10 years later and 15 years later

Production in 10 and 15 years later is planned as follows. Yield increase in crop production is not planned after 11 years. After 11 years, the continuous increase of production is planned for milk production, calves production, and wool production.

< Crops >	Plan in 10 years later	Plan in 15 years late
a) Potato (Self-consuming farms)	1,848 t	1,848 t
(Cash crop type farm)	1,386 t	1,386 t
b) Broad bean	178 t	178 t
c) Onion	1,142 t	1,142 t
d) Lettuce	51 t	51 t
e) Quinoa	96 t	96 t
f) Barley(Oats)	3,795 t	3,795 t
g) Alfalfa	1,740 t	1,740 t
h) Grass	12,520 t	12,520 t

< Livestock >	Plan in 10 years later	Plan in 15 years later
(a) Heads of sheep	51,670	51,670
(b) Heads of draft(beef) cattle	4,674	4,674
(c) Sheep production (sale and self-consuming)	33,069	33,069
(d) Milk production (do.)	4,011 t	4,011 t
(e) Sale of calves	1,910 heads	2,090 heads
(f) Sale of old cattle (including self-consuming)	1,830 heads	1,830 heads
(g) Sale of wool	77,505 kg	103,340 kg

6.2.6 Agro-processing

Freeze dried potatoes called Chunyo and Tuunta are popular as agro-processing products. However, the production of freeze dried potato is not a profitable production although the absolute income is raised up a little with available family labors in winter season. In the plan, it cannot propose to enlarge this potato processing due to low productivity, which is estimated at around Bs 1 of net income per one man-day of family labor. Because another production such as green house farming will be more profitable than the dry potato.

6.2.7 Fishery Plan at Putuni Community

With help of CIDPA (Centro de Investigacion y Desarrollo Piscicola del Altiplano)-JICA, the trout culture extension program is planned for Putuni Community, because Putuni holds so many small size farms (Average farm size is 1.5 ha there.) which need a subsidiary income, and Putuni has one of the five irrigation systems that is to be constructed at the first five years, the short term stage.

The plan will be executed according to the CIDPA extension program started in January 1997 at Challuyo community in cantón Warisata. A group of around 20 farmers should be organized for the program, and the size of the fish pond, which is planned to be attached to the construction works of the intake, is 1.5m by 5m times 4 units in 1.2m depth. The farmers portion of the budget for construction is 40% of total, according to the plan by CIDPA-JICA. This portion will be paid with the labors by participants of the group. The budget for the fish culture is roughly estimated by the experience at Challuyo community as follows;

(1) Fish cultivation Cost(cash outlay)	Total cost:	Bs10,200
(2) Gross Return	Total gross return:	Bs14,962
(3) Net Return	Total net return:	Bs 4,762
(4) Per farmer income(20 farmers):		Bs 238/ family (in 6 months)

6.3 Agricultural Support Services

Implementation of proposed agricultural development plan is required certain technical and financial support to farmers in order to adopt for social and economical change or according to transformation self-sustenance economy to market economy of farming through means of appropriate motivation and guidance. Official support organization is hardly function in the project area despite a research institute; a university and a development foundation have a technical support function. Some NGOs are only supporting at the spots in the area to communities.

The plan of improvement of farming is formulated based on farming pattern of the upper, middle and lower basins of Keka River according to agricultural conditions in the project. Organize receptors organization across communities will make possible of an effective support to the area, though the present way of organization based on community as a unit of organization is not able to function effectively.

Aymara society in the target area is formed as community based on kinship and is generally closed social structure. However, recently there are cases of organizations organized across communities, which share a target of works or a purpose of activity as water users association and milk producers association in the project area.

It is essential factor on the support plan for effective implementation of agricultural development plan, which is the major element of the project, is to organize a receptors organization across communities in the area when considering the conditions of the target area. The support provided by mainly NGOs will be carried out as farmers' activities through the organization.

Road and irrigation canal improvement is planed as the hardware approach for an achievement of the agricultural development plan. These facilities are also constructed across communities and their maintenance organ is required a similar form of organization as the support receptors organization. Therefore the support receptors organization will be given function of the maintenance as well and will be the beneficiary to receive all the facility after construction.

A base is proposed in order to realize above mentioned organization and for reliable and effective operation, management and maintenance of equipment provided for agricultural support activity and maintenance works in the area. This base facility is recognized its importance for functioning technical and relevant support services in agricultural and rural development as "Integrated Center of Services" in "PRODARCI" the precedence national plan of this project. The project calls the base facility "Community Re-vitalization Center - CRC -" and there are "Area Center - AC -" for supplement function of CRC and "Meeting Hall".

Establishment of "Coordination Organ" in the La Paz department is proposed for an officially support and coordinate organization to CRC activity. The Coordination Organ will be established in the economical development bureau and will be carried out coordination on the project with Bolivian government during the construction work and coordination work of CRC at the project operation.

6.3.1 Agricultural Support and Extension

(1) Community Re-vitalization Center

CRC, as a core of the development support, will be set up at representative location of the upper, middle and lower basins. AC is to be set up as a supplemental of CRC and MH is to set up in community where there is no meeting facility. Completion of the center's facility and equipment is to be fulfilled by considering operation and function

of the center and effects of the activities according to the stages of the short, middle and long term plan of the project as other facility development plan.

In the short term, agricultural support in CRC and AC, and equipment required for operation and maintenance, and its storage facility will be the priority works in the plan. In the middle term, completion of the training and its related facilities, which were used school or an open space of the center in the short term in order to carry out the proposed activities. MH development plan is to be partially started. Among the middle term plan, training and related facilities are considered as the first priority why the training is concerned directly with farmers' income increase. MH will be completed in the long term and the center's facility will be completed. The detail of the facility and equipment development plan is described in the section 6.5.

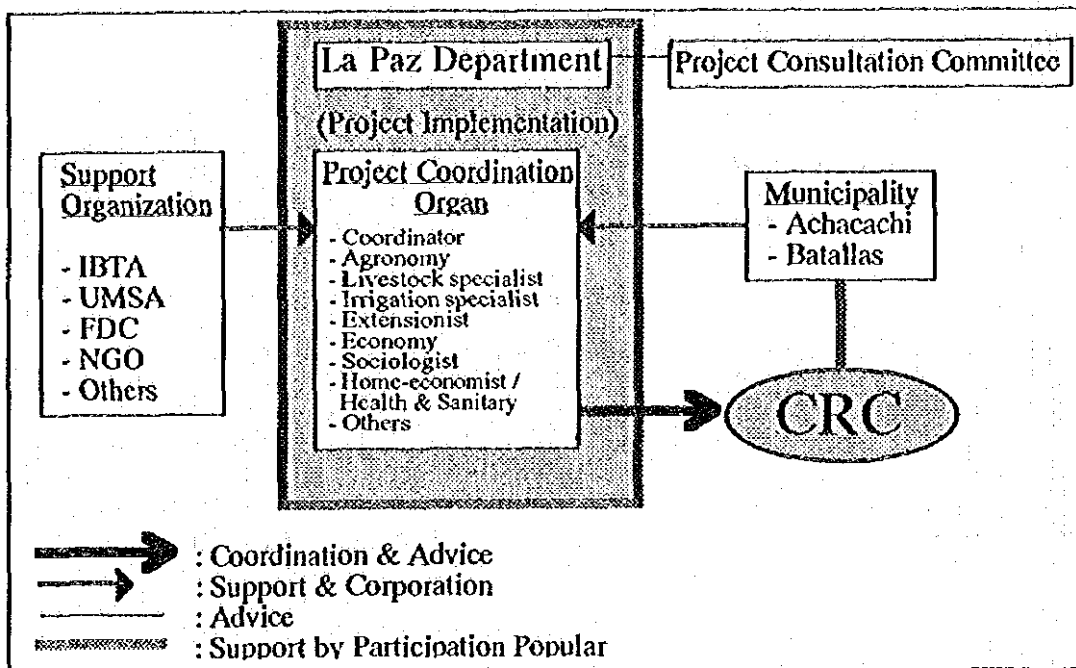
2) Organization and administration

CRC is to be established as the property of the member communities and will be hand over at initial stage. Member communities of each CRC are shown at table.

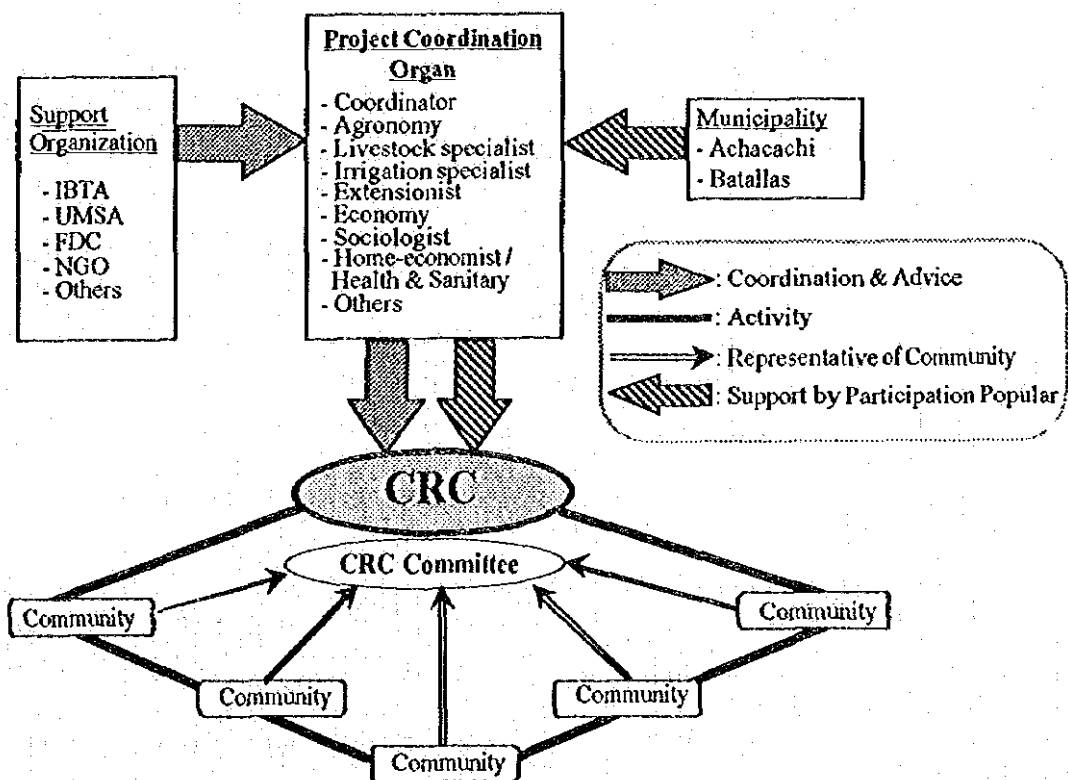
Basin/Center (CRC & AC)		Member Community	Population	Household	Household /Center	Area (ha)	Area/ Center
Upper Basin	Chachacomani (CRC)	Chachacomani	2,314	630	1,184	27	1,167
		Coromata Alta	400	70		296	
		Berenguela	230	40		141	
		Corpapulu	1,500	250		19	
		Palrumani	500	160		572	
		Icrana	150	34		112	
	Kerani (AC)	Kerani	2,500	420	758	320	1,225
		Coromata Media	500	138	575		
		Coromata Baja	900	200	330		
	Middle Basin	Cala Cala (CRC)	Cala Cala	550	240	714	713
Barco Cala Cala			35	14	62		
Pongon Huyo			1,337	380	280		
Pajchani Molino			300	80	782		
Putuni (AC)			Putuni	180	39		474
Marca Masaya		600	145	232			
Pajchani Grande		670	90	412			
Kjasina		900	200	66			
Jaurilaca (AC)		Jaurilaca	700	150	722	229	1,324
Santa Common		149	22	45			
Santa Chico		180	30	179			
Santa Grande		300	65	210			
Avichaca		1,700	300	375			
Lower Basin		Belen (CRC)	Cajón Pata	100	32	96	
			Tipampa	500	123	190	
	Belen		2,000	500	1,135	501	1,710
	Taramaya		1,500	350	392		
	Arasaya Chico		250	80	155		
	Arasaya Kentuyo		160	40	170		
	Arasaya Patanivi		170	40	133		
	Barco Belen	515	125	359			
	Achacachi City	15,000	1,623	172			
	Total	36,790	6,610	8,370			

CRC administrative committee will be formulated with the representatives of the member communities in the CRC area. The committee will prepare action plan and arrange necessary procedure and manage facilities and equipment of the centers (CRC and AC). However, basically all the issues for managing the centers is to be decided by the member.

Project Organization



CRC Organization



2) Activities

Activity of the center is for the agriculture and rural development. Following programs are to be carried out at CRC or at AC.

(a) Support services

a) Extension of production technique for agriculture and livestock

Technical extension for improvement of agricultural and livestock production is to be conducted through training, demonstration and services. Extension subjects will be determined by members' meeting according to the development plan and a problem found in the area. This activity will be started by practical improvement and promotion activities of crops and livestock production using the demonstration plot at the beginning of the project.

b) Improvement of farming and other economical activity

This activity is aimed to increase farmers' income by improving farm management and creating other income generation work. Such as processing agricultural products, handicraft and commercial business are to be subjects of training. This subject will be decided by the members' intention and provided for the interested individuals. Participants are expected to organize group for increase efficiency of activity in future. This will be approached at the middle term stage.

c) Dissemination of skill and knowledge for creating comfortable rural life

Contents of these activities are family life improvement, women and adult education and family sanitary and health. These will be approached from the initial stage through training and group activities conducted by mainly NGOs in order to involve women and motivate members into development process.

d) Management and maintenance of social and economical infrastructure of the area

This activity is to maintain social and economical infrastructure as improved irrigation canals and constructed roads and bridges by using construction machinery such as bulldozer, backhoe, dump-truck etc. provided by the project to each CRC. Normally for maintenance of the public road and bridge is the responsibility and the budget is to be allocated by municipality. The CRC will be able to lease those machinery to municipalities. CRC will select some local personnel for operation and maintenance the machinery. Those personnel are to be trained at official engineering institute or at private firm and they are going to be paid by working hours. Achacachi and Batallas municipalities will support this activity.

e) Providing the place for medical and health care services

On the construction of CRC, one room space for medical treatment will be prepared. This space is to be used for medical and health care by mobile medical service. This service is expected to be realized by the cooperation of Achacachi Hospital in a future plan.

f) The place of communication for community and residents in the area

Meeting facility of CRC, AC and MH is to be used for meeting and gathering of individual, group, community and member communities. These gathering will deepen human bonds within group and community of the area.

g) The place of social and cultural activities for community and residents in the area.

CRC, AC and MH will have meeting facility and these are to be able to utilize

for social and cultural occasions. These gathering will deepen social and cultural bonds within group and community of the area.

(b) Training

Various kinds of training are planned as seasonal training and subject training in agricultural development. Those are to be conducted by Coordination Organ, research and educational institutions and NGOs. Pre-seasonal training is to be organized before cropping season in June to early July and post-seasonal training is in February to early March for identify cropping problem and review the way to solve for the following cropping. All the member of CRC will participate for seasonal training. Subject training and other training subjects such as promotion of environmental conservation are going to be determined based on the development plan and also the problem identified in the area. These training will be arranged by the Coordination Organ at initial stage and expected the taking over to the member gradually. Training subject and number of course during the project period are shown at table below;

Training Subject	Short Term				Middle Term				Long Term				Total		
Agricultural production															
- Seasonal training	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
- Subject training	2	2	2	2	2	2	2	2	2	2	2	2	2	2	30
- Marketing training	-	-	-	-	-	1	1	1	1	1	1	1	1	1	10
- Organization training	-	-	-	-	-	-	-	-	-	1	1	1	1	1	5
Management & economic activity															
- Management training	-	-	-	1	1	1	1	1	1	1	1	1	1	1	12
- Income generation training	-	-	-	-	-	2	2	2	2	2	2	2	2	2	20
- Group activity training	-	-	-	-	-	1	1	1	1	1	1	1	1	1	10
Improvement of living life															
- House management training	1	1	1	1	1	2	2	2	2	2	2	2	2	2	25
- Health management training	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15
- Group activity training	1	1	1	1	1	1	1	1	1	1	-	-	-	-	10

Total training participants in the period of short, middle and long terms are 63,120, 76,870 and 76,870 person respectively. It is included 49,870 participants of seasonal training in each term are included.

(c) Demonstration

Demonstration and on-farm trial are to be conducted at the plot of CRC and farmer's field. The level of the demonstration will be practical on-farm level on technique and management. The member communities should select one highly-motivated personnel, preferably young couple, from the community members to take care of the demonstration plot and he will be paid. Subject of the demonstration and on-farm trial is to be decided based on the development plan and a subject as a problem in seasonal training identified. It will be conducted under the consultation and guidance of technical institutions. Area of the demonstration farm is 1 ha and the basic farming plan is as follows

	Unit : ha and/or heads		
	Upper CRC	Middle CRC	Lower CRC
Barley & Oats	0.5	0.2	0.3
Alfalfa	0.2	0.5	0.5
Forage Crops	0.2	-	-
Cash Crops	-	0.3	0.2
Food Crops	0.1	-	-
Cow	-	1	1
Sheep	10	-	-
Total	1.0	1.0	1.0

Note: All the area including Vinyl house of 200m² for cash crops or food crops

(d) Services

a) Farming service

Planned services of CRC are animal breeding (artificial insemination), animal hygiene (supply vaccination and medicine) and input material supply (supply seed, fertilizer and chemicals), and these services will be provided with cost price basis. In order to foster some personnel to carry out animal breeding and animal hygiene services, volunteer personal will be selected on respective fields of services from the member communities and be sent and trained at relevant training institution or the university.

b) Machinery lease service

Various equipment including construction and farming machinery is to be provided to each CRC. Those machinery are to be used for maintenance of infrastructure and project activity, and the same time those are to be leased to public for raising fund for activities of the centers. Construction machinery are mainly used by the municipalities on the program works for OTBs by the budget of the Participation Popular. Farming and transport machines are mainly used by farmers.

c) Sale and exchange of products

The project area has three weekly markets in Achacachi, Chachacomani and Kerani. However, the space of CRC as an open market is able to provide a place for sales and exchange their products for the daily use in the area and also a point for collecting and loading their merchandise for market. This function in the area could be trading place according to increment of the products in the area.

3) Staff

Staffs required for carrying out their activities, maintaining facilities and equipment for CRCs and AC are as follows;

Position of work	Upper Basin	Middle Basin	Lower Basin
CRC			
- Administration*	1 person	1 person	1 person
- Demonstration Plot*	1 person	1 person	1 person
- Operator**	7 person	6 person	6 person
- Mechanic**	2 person	2 person	2 person
- Artificial inseminator**	2 person	2 person	2 person
AC			
- Administration**	1 person	2 person	-
- Artificial inseminator**	-	2 person	-
Total	14 person	16 person	12 person

Note: * : Permanent employee ** : Occasional workers

The way of employment and payment system will be determined by their own member communities. Basically, Operator, mechanic and artificial inseminator are not permanent worker, they are to be voluntarily trained and their duty will be by occasional when necessary. Administration personnel in CRCs and ACs are to be employed by permanent from members and the demonstration plot personnel are not to be set in AC.

4) Operation and management cost and fund

Operation expense of CRC and AC largely divided into maintenance cost, facility maintenance cost, training cost and demonstration cost. The major sources of income to be utilized for operation of CRC and AC are community development fund of OTB by the

law of "Participacion Popular", agricultural production support and institutional strengthening programs of FDC, machinery lease services and products sale of demonstration plot. On machinery use for maintenance of the proposed facilities, the centers will not charge expense principally except fuel and oil. Annual expense and income regarding CRC and AC are described in detail and its summary is shown below.

Expense Item	Unit: Bs. /Year			Source of fund
	Short Term	Middle Term	Long Term	
(1) Administration:				
- Personnel Expense	146,400	175,200	175,200	Machinery lease service, Products sale
- Machine operation	39,600	46,800	46,800	
(2) Maintenance:				
- CRC, AC building	10,950	15,770	17,240	Machinery lease service
- Canal	23,900	26,900	31,000	Machinery lease service
- Road	32,000	49,000	85,400	Machinery lease service
Sub Total((1)+(2))	252,850	313,670	355,640	
(3) Operation:				
- Training	(207,495)	(422,037)	(422,037)	Development support fund
- Demonstration	2,557	2,672	2,756	Products sale
	(462,902)	(738,379)	(780,433)	
Total	255,407	316,342	358,396	

Income Item	Unit: Bs./year		
	Short Term	Middle Term	Long Term
Machinery lease service			
- Construction machinery	37,440	56,160	74,880
- Farm machinery	191,608	191,608	191,608
- Transport machinery	50,080	83,120	116,160
Products sale	13,447	15,019	15,776
Total	292,575	345,907	398,424

(2) Coordination Organ

Coordination Organ will be organized under prefectural government of La Paz and the organ will take a responsibility smooth implementation of the project.

1) Function and role

The Organ will function as the coordinating among the communities involved in the project and between the project activities and supporting organizations.

The Organ acts together with the centers of respective CRC areas. At the initial stage, it may require to guide management of the centers and planing and activities. The principal of the Organ's role is to give an advice to them in order to foster the mind of self-reliance and independence of the member communities. The organ will take an action for necessary coordination and arrangement with support organization when the CRCs identified a problem and determined an activity to be solved. It is included to contact with an organization and to prepare the plan, the request of support and financial source if necessary till CRCs grow to take care those matter by themselves.

It will also play a role of the project coordination with the prefectural government, the municipal governments and other relevant institutions. Monitoring is also carried out by the Organ to evaluate the project activities to give an advice and guidance to CRCs.

2) Staff

The following staffs are to be allocated to the Organ in order to implement the project. Office is to be set in Achacachi municipality or Belen experimental station.

Transport and communication means will be utilized the equipment provided to CRCs.

Staff	Short Term					Middle Term					Long Term				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Coordinator	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Agronomist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Livestock specialist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Extensionist	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
Economist	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
Sociologist	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1
Irrigation engineer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Home economist, Health & Sanitary specialist	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Others	-	-	-	-	-	- Marketing					- Marketing - Rural development				
Total per Year	5	5	5	5	5	9	9	9	9	9	10	10	10	10	10

3) Operation and management fund

Coordination Organ will be established in the La Paz Prefectural government and the Department will prepare necessary cost of the operation. Required expenses are proposed as personnel expense, transportation cost and office expense. Annual expense is estimated in the table.

Item	(Unit Bs./year)		
	Short Term	Middle Term	Long Term
Office expense	9,396	15,660	17,226
Personnel expense	187,920	313,200	344,520
Transportation cost	10,800	10,800	10,800
Total	208,116	339,660	372,546

6.3.2 Financial Support

Financial support in the project implementation is necessary on CRC activities and subsidy or credit for development works. Support for CRC activity is mainly for training program. FDC is the suitable organization that has the investment program on basic infrastructure, production support and strengthen institution. Especially purpose and system of the last two programs of production support and strengthen institution are suitable for CRC activities.

Support for subsidy or credit for the development works will not consider special system of the project. Necessary support on subsidy or credit will be applied the existing NGOs' supporting system and credit institutions'. Rotation fund of FDC's programs mentioned above is also available for development of production.

Coordination Organ will play an important role on the process of obtaining mentioned systems of support on planing, application and negotiation.

6.3.3 Farmers' Organization

The plan for farmers' organization in the project is to be motivated and promoted through CRC activity and collaborative work with existing organizations.

(1) Development Plan in CRC

The plan of agricultural support services in CRCs' has training and farming service to farmers and will provide some program to develop farmers' organization in the project area.

1) Training

Training will be carried out various aspect such as agricultural production, management and economic activity and improvement of living life. Each program is included the subject for organization or grouping in order to increase efficiency of respective program by the stage of progress as shown at CRC training plan.

In agricultural production program, training of organization will be conducted in long term stage. One hundred fifty (150) every year in a CRC and total two thousand two hundred fifty (2,250) farmers are to be trained. In management and economic activity program, group activity training is starting from middle term. One hundred fifty (150) people annually in each CRC and total four thousand five hundred (4,500) will receive the course during the project period. As for the improvement of living life program, emphasis will be put for skill and know-how of housework and health care. Target is a mainly housewife. The training will be conducted from short to middle term stage. One hundred fifty (150) in each CRC and four thousand five hundred (4,500) in total will receive the course.

2) Farming services

Farming service is planed to provide depot for selling and purchasing input materials for farming as seed, fertilizer, chemical, medicine and semen depend on farming type in the area. Those services have to be organized by the management organ among the CRC member. These services will motivate and promote group activity in the area.

(2) Collaboration with Existing Organization

For the dairy program of the project, collaboration with the milk producers association (APREPO) will be promoted the organization of farmers. Most of farmers in the project area in lower middle to lower basins are already members of APLEPO, however, activity of the association by increase production through the project will activate the association all the more. It will give an effect to the other program activity of the project.

(3) Expected Farmer's Organization through the Project Activity

The project is not intended to organize farmers as the function of CRCs in the project area. However, the project is expected farmers to organize themselves as the result of the development activities for increasing efficiency of production and comfortable rural life. An expected organization and group activities are as follow;

- a) Milk producers' association: It is already organized in lower middle and lower basins and is expected to activate the milk production by the project.
- b) Sheep Growers' organization: It is expected to be organized in upper basin for improving management of sheep raising and quality of sheep.
- c) Vegetable producers' organization: It is expected in lower middle and lower basins. The project activities of training, purchasing input material and marketing will motivate them toward organization.
- d) Marketing organization: It is expected to be organized through a market information released by the project, and activities such as shipping and transport of the products.
- e) Cash crop producers' organization: It is to be organized through the project activities on training, purchasing input materials and marketing in middle and lower basins.