THE REPUBLIC OF CHILE

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ON

THE DEVELOPMENT OF WATER RESOURCES

IN

NORTHERN CHILE

PROGRESS REPORT

SUPPORTING REPORT A

SURFACE WATER

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SUPPORTING REPORT A

Chapter I SURFACE WATER OF SAN JOSE RIVER BASIN

Chapter I SURFACE WATER OF SAN JOSE RIVER BASIN

1.1 General

San Jose river basin located in the Region I in northern Chile has a drainage basin area of about 3,187 km^2 covering the sub-basins of Lauca Canal and Tignamar river. Drainage basin area is shown in Fig. A, 1.1 and Table A, 1.1.

1.1.1 Climate and Precipitation

Information on climate in the basin is obtained from Arica Oficina and Azapa weather stations in the downstream of the basin. Average maximum temperature is in December at 36.4 °C and average minimum temperature is in August at 18.5 °C. Humidity does not vary much throughout a year within a range of 60 - 80 %.

Precipitation is observed regularly by DGA and Meteorological Department. Most of the stations are distributed in the upstream of the basin as shown in Fig. A, 1.2. Periods of the observation are as follows;

Station	Observation Period
Murmuntane	1970-1987
Portezuelo Chapiquina	1976-1979
Central Chapiquina	1963-Present
Belen	1938-Present
Tignamar	1975-Present
Azapa	1966-Present
Oficina Arica	1974-Present
U. del Norte	1980-1984

Average precipitation of these stations are shown in Table A, 1.2 and recorded monthly precipitation is shown in Appendix A, 1.1.

1.1.2 River System

San Jose river, the main river in the basin, flows westwards to Pacific Ocean and is named after the confluence of tributaries including Laco, Seco and Tignamar river. Flow originates in the east from rainfall and snow melt and branches into several tributaries. The main tributary in the basin so called Lauca canal, a man-made canal, bypasses the water from Lauca river outside the basin through an intake to a hydropower station at Chapiquina and then to Laco river which is a natural tributary connecting to San Jose river. Tignamar and Seco river, natural tributaries in the basin, are confluent with Laco river at Pampa Oxaya. In downstream, San Jose river is diverted to an irrigation canal which supplies water to Azapa valley, an important agricultural area, and afterwards flows to the sea at Arica city.

Although there are several tributaries in the basin, two (2) tributaries are merely considered in the model, Lauca Canal and Tignamar river, as the main water sources of San Jose river based on data and information from DGA about the major and dried-up rivers in the basin. Flow model is shown in Fig., A, 1.3.

1.2 Surface Flow Rate

1.2.1 Flow Rate at Major Stations

Daily water levels are observed at DGA's observation stations by automatic recorders. Flow rate at each stations is generally calculated by a so called "Discharge Rating Curve" or "H-Q Curve" which is a calibration curve of water level and flow rate. Major observation stations are as follows;

River	Location	Observation Period
Lauca Canal	Bocatoma Lauca	1979 - Present
	Central Chapiquina	1967 - Present
San Jose	Ausipar	1967 - 1972
	Antes Bocatoma	1974 - 1984
	Acueducto Azapa	1963 - Present

According to DGA's information, observation at Antes Bocatoma was ceased because the station collapsed during a flood in 1984 and at Ausipar has been started again from 1993.

Average surface flow rate of these stations are shown in Table A, 1.3 and Table A, 1.4, fluctuation of these flows throughout a year are shown in Fig. A.1.4, maximum and minimum of average flow rate in the recorded years are shown in Table A, 1.5 and recorded monthly flow rates are shown in Appendix A, 1.2.

Flow rate at Ausipar and Antes Bocatoma are averaged together by the concept that the distance between these stations is not much and the loss is negligible.

Average flow rate at Lauca Canal and Central Chapiquina are 0.965 and 0.796 m^3/s lower than that at Ausipar and Antes Bocatoma, 1.101 m^3/s, possibly due to some additional flow from Tignamar river which is not observed. It can be said that Lauca Canal is a water source of about 70-80 % of San Jose river.

Flow rate at Acueducto Azapa located at the intake canal in Azapa Valley is obviously high in these recent years. Average flow rate from 1963 to 1975 is 0.296 m^3/s, while that from 1976 to 1990 is 0.646 m^3/s, an increase of about 218 %.

At Puente Saucache, flow rate was observed only during flood period, not regularly. The recorded monthly flow rates are also shown in Appendix A, 1.2. It should be noted that all floods were not observed in the recorded years due to the shortage in manpower.

1.2.2 Supplementary Observation

1) Objective

The purpose of the observation is to measure flow rate as supplementary data of DGA's regular observation for more information on water potential and flow balance in the basin.

2) Location

Observation points are located as follows:

(1) at Ausipar AU-1
(2) at downstream of Tignamar river TG-1
(3) at Acueducto Azapa.....AQ-1

3) Observation Method

The measurement was conducted by JICA Study Team & DGA. River conditions during measurement are shown in Appendix A, 1.3. Flow velocity was measured by a propeller current meter across the river section at a length interval of about 1/10 of the river width. Flow rate was calculated as the product of average velocity times cross sectional area

$$Q = \sum_{i=1}^{m} V_i \times A_i$$

where Q = flow rate (m^3/s),
V = flow velocity (m/s),
A = cross sectional area of the river (m^2) and
m = number of sub-cross sections.

4) Date of Observation

Observations were carried out on 12th June, 8th October and 29th November 1993.

5) Results of Observation

Flow rate at each points is shown in Table A, 1.6. At Central Chapiquina, data from DGA on the day of observation is used for comparison.

The first observation : Result of flow rate at Ausipar, 0.554 m^3/s and at Chapiquina+Tignamar river, 0.587 m^3/s, confirms that water sources of San Jose river are mostly from Lauca Canal and Tignamar river. the difference is attributed to the error of measurement and loss by infiltration and evaporation.

Flow rate at Ausipar, 0.554 m^3/s, and Acueducto Azapa, 0.549 m^3/s, clarify that all surface water in San Jose river is taken for agricultural use.

The second observation : The difference of flow rate at Ausipar, 0.717 m^3/s, and Acueducto Azapa, 0.562 m^3/s, is pretty high about 22 %. However, water intake for agricultural use was not observed.

The third observation : Flow balance at Ausipar, 0.780 m^3/s, and Aqueducto Azapa + Sr.Aguero + Bocatoma (0.668+0.061+0.004 = 0.733 m^3/s) has the discrepancy of only 6 %. This confirms the conclusion of the first observation on the entire use of water for agriculture.

No water was found at Puente Saucache on these observation days. This means that all water discharge after agricultural use infiltrated to underground or evaporated.

1.2.3 Calculation of Runoff Coefficient

Runoff, originated from the precipitation or rainfall in the basin, generally flows through water channels as surface flow and infiltrates to underground as groundwater. An effort is done to find out relationship of rainfall and surface flow for the evaluation of groundwater. Average yearly rainfall contour map prepared by DGA in 1987, as shown in Fig. A,1.5, is used to calculate the total amount of water entering the basin in comparison with surface flow rate in the basin which is calculated from the difference of flow at Central Chapiquina and Antes Bocatoma. Runoff coefficient, the ratio of surface flow to rainfall, is found to be 0.068 as shown in Table A, 1.7. This can be interpreted that about 6.8 % of rainfall flows through rivers as surface flow.

1.3 Surface Water Quality

1.3.1 Water Quality at Major Stations

Water quality is observed at DGA's observation stations by sampling method, water samples are taken from the river and analyzed in the laboratory. Observation stations are as follows;

River	Location	Observation Period
Lauca Canal	Sifon N1	1959 - Present
San Jose	Ausipar	1969 - 1981
	Bocatoma	1967 - 1987
	Acueducto Azapa	1970 - Present
	Saucache	1972 - 1977

The items of the analysis are classified as follows;

(1) Health Significance : As, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_3$

(2) Aesthetic Quality : Cl^-, Cu, Fe, Na, P, SO_4, pH

(3) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

Results of the examination are shown in Table A, 1.8 and A, 1.9. Average monthly data are shown in Appendix A, 1.4

1.3.2 Evaluation of Water Quality

According to World Health Organization (WHO), permissible drinking water quality is shown partly as follows;

	pH	Cl^- (mg/l)	SO_4 (mg/l)	Mg (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NH_3$ (mg/l)
Permissible Values	6.0-8.5	250	250	125	0.05	1.0	0.3	9.0	0.5

Water Quality Standard is referred in Appendix A, 5.

The results show that values of As and Fe are higher than permissible drinking values especially at Bocatoma and Acueducto Azapa. Therefore improvement of water quality may be necessary.

1.4 Evaluation of Surface Water Development Potential

Evaluation of surface water potential in San Jose river basin is done by considering the amount of water flows to the sea. Existing data at Puente Saucache are used for this estimation. Hydrograph at this point is shown in Fig. A, 1.6. It can be seen that there were several floods between 1971 and 1977, but only few between 1978 and 1989. However, due to the shortage of manpower as mentioned previously, all floods in the recorded years were not measured and calculation from this hydrograph may provide an erroneous result.

Effort is done to fulfill this hydrograph using daily data at Antes Bocatoma as a reference. At first, flow rate at Antes Bocatoma and Saucache on the same day are plotted as shown in Fig. A, 1.7. Relationship between these two points is assumed and expressed by a linear equation as follows;

$$Q_{Saucache} = aQ_{Antes\ Bocatoma} + b$$

where Q = flow rate (m^3/s),

a, b = constant

Parameter a and b are calculated by Least Square Method using flow rates at both stations as samples. The result is shown below

$$Q_{Saucache} = 0.712Q_{Antes\ Bocatoma} - 0.577$$

or $$Q_{Antes\ Bocatoma} = 1.404Q_{Saucache} + 0.810$$

where Correlation Coefficient (r) = 0.7120

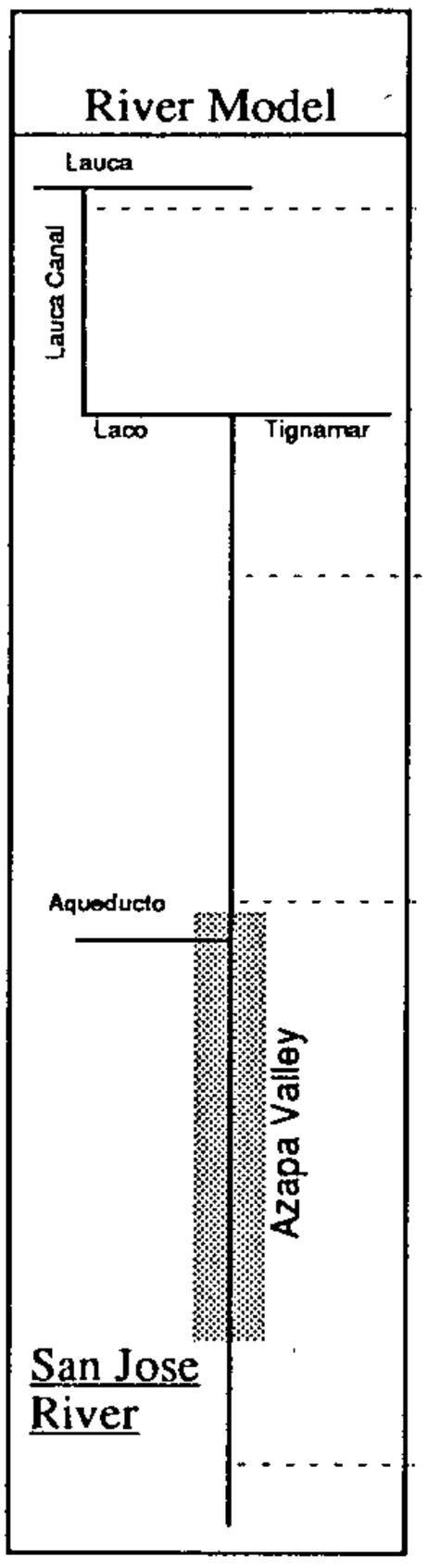
Using this equation, flow rates during flood period at Saucache are calculated based on the recorded daily flow rates at Antes Bocatoma. The results are shown in Appendix A, 1.5.

Total water volume in a year at Saucache is calculated by summation of these calculated and observed flow rates. The results are shown in Table A, 1.10.

In the consecutive years from 1976 to 1984, fluctuation of total volume is pretty high from 0 m^3 in 1983 to 16,936,933 m^3 in 1976. Because of the insufficient recorded years, the tendency is still unclear.

However, average water volume is about 4,708,652 m^3 in a year. This is considered as the water potential in San Jose river basin.

Table A, 1.1 Drainage Basin and Sub-Basin Areas in San Jose River Basin
<Cuenca de Drenaje y Area Sub-cuenca en Cuenca del Rio San Jose>



River	Tributaries	Location	Sub-Basin (km2)	Total Basin (km2)
	Lauca Canal		259.4	259.4
	Tignamar		593.7	853.1
San Jose		Ausipar	340.9	1,194.0
San Jose		Antes Bocatoma	84.1	1,278.1
San Jose		River Mouth	1,908.8	3,186.9

Table A, 1.2 Average Precipitation observed by DGA in San Jose River Basin

<Precipitacion Promedio observada por DGA en la Cuenca del Rio San Jose>

Unit : mm

Station	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Murmuntane	1970-1987	48.51	39.31	13.64	0.46	0.11	1.86	0.79	2.00	0.36	1.59	2.54	9.29	120.45
Port. Chapiquina	1976-1979	42.95	47.83	23.75	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	28.20	143.38
Cent. Chapiquina	1963-Present	47.27	37.70	16.39	0.71	0.39	2.16	0.13	2.19	1.65	1.62	0.92	15.05	126.20
Belen	1938-Present	20.65	17.20	11.44	0.00	0.07	0.67	0.19	0.57	0.10	1.00	0.29	7.52	59.69
Tignamar	1975-Present	36.24	26.74	14.83	0.96	0.05	0.32	0.28	1.08	1.64	0.07	0.71	13.89	96.81
Azapa	1966-Present	0.10	0.02	0.02	0.00	0.06	0.02	0.05	0.05	0.06	0.00	0.22	0.00	0.60
Oficina Arica	1974-Present	0.12	0.23	0.00	0.00	0.00	0.06	0.11	0.03	0.03	0.03	0.05	0.00	0.64
U. del Norte	1980-1984	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10

Table A, 1.3 Average Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel de Flujo de Superficie Promedio Meansual Observado por DGA en las Principales Estaciones de la Cuenca del Rio San Jose>

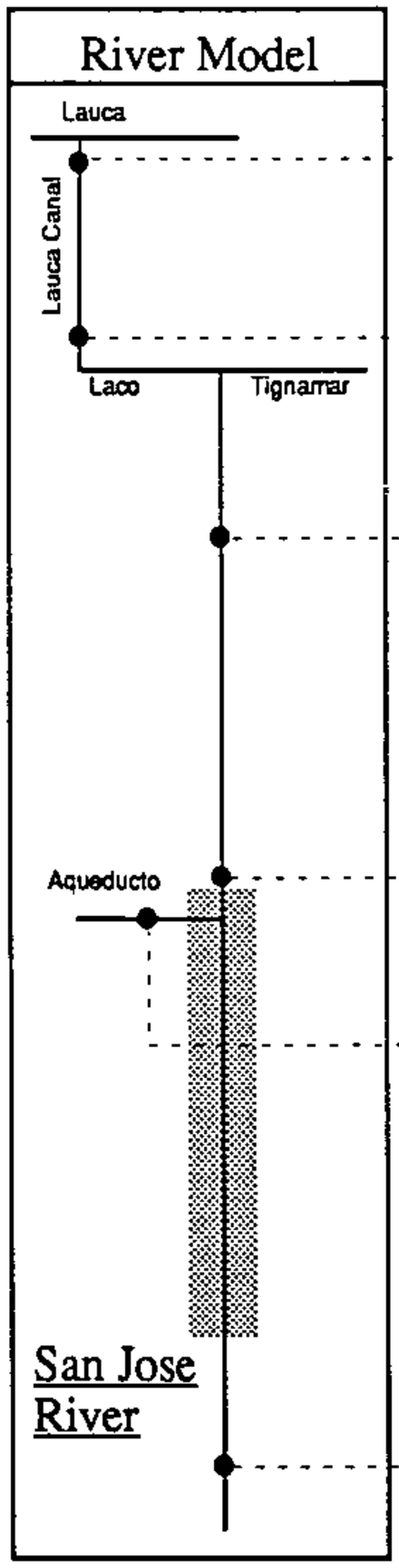
Unit : m^3 /s

River	Location	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Lauca	Bocatoma Lauca	1979-1992	1.050	1.050	1.071	0.905	0.926	0.895	0.893	0.899	0.933	1.003	1.018	0.943	0.965
Canal	Central Chapiquina	1967-1993	0.879	0.877	0.874	0.752	0.757	0.752	0.791	0.784	0.778	0.769	0.770	0.767	0.796
San Jose	Ausipar	1967-1972	2.325	1.604	0.947	0.565	0.890	0.833	0.773	0.705	0.586	0.506	0.506	0.652	0.907
	Antes Bocatoma	1974-1984	1.333	2.558	2.137	0.980	1.010	1.030	0.965	0.879	0.843	0.788	0.802	0.929	1.188
	Ausipar & Antes Bocatoma		1.638	2.272	1.740	0.876	0.970	0.959	0.901	0.825	0.769	0.694	0.717	0.850	1.101
	Acueducto Azapa	1963-1990	0.504	0.362	0.380	0.475	0.546	0.520	0.545	0.517	0.486	0.472	0.501	0.536	0.487

Note : Average flow rate at Ausipar & Antes Bocatoma is calculated by weighted average of the recorded years

Table A, 1.4 Average Surface Flow Rate in San Jose River Basin
<Nivel de Flujo de Superficie Promedio en la Cuenca del Rio San Jose>
(Recorded period of the stations are different but range from 1967 to 1992)

Unit : m^3/s



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Bocatoma Lauca	1.050	1.050	1.071	0.905	0.926	0.895	0.893	0.899	0.933	1.003	1.018	0.943	0.965
Central Chapiquina Hydropower Station	0.879	0.877	0.874	0.752	0.757	0.752	0.791	0.784	0.778	0.769	0.770	0.767	0.796
Ausipar	2.325	1.604	0.947	0.565	0.890	0.833	0.773	0.705	0.586	0.506	0.506	0.652	0.907
Ausipar & Antes Bocatoma Azapa	1.638	2.272	1.740	0.876	0.970	0.959	0.901	0.825	0.769	0.694	0.717	0.850	1.101
Antes Bocatoma Azapa	1.333	2.558	2.137	0.980	1.010	1.030	0.965	0.879	0.843	0.788	0.802	0.929	1.188
Aqueducto Azapa en Bocatoma	0.504	0.362	0.380	0.475	0.546	0.520	0.545	0.517	0.486	0.472	0.501	0.536	0.487

Table A, 1.5 Average, Maximum and Minimum Surface Flow Rate in San Jose River Basin

<Promedio, Tasa de Flujo de Superficie Maximo y Minimo en la Cuenca del Rio San Jose>

(Max. and Min. are the maximum and minimum of average values in a month of the recorded years, not instantaneous values)

Unit : m^3/s

River	Location	Avg.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
San Jose	Bocatoma Lauca	Max.	1.485	1.374	1.584	1.546	1.396	1.203	1.188	1.290	1.350	1.452	1.776	1.528	1.431
		Avg.	1.050	1.050	1.071	0.905	0.926	0.895	0.893	0.899	0.933	1.003	1.018	0.943	0.965
		Min.	0.691	0.678	0.520	0.442	0.466	0.552	0.575	0.639	0.579	0.619	0.615	0.531	0.576
	Central Chapiquina	Max.	1.260	1.215	1.231	1.121	1.079	1.067	1.065	1.190	1.190	1.240	1.124	1.193	1.165
		Avg.	0.879	0.877	0.874	0.752	0.757	0.752	0.791	0.784	0.778	0.769	0.770	0.767	0.796
		Min.	0.450	0.450	0.465	0.384	0.370	0.200	0.480	0.520	0.500	0.430	0.380	0.460	0.424
	Ausipar	Max.	6.700	3.170	2.250	1.070	1.300	1.050	1.030	0.796	0.664	0.644	0.622	0.935	1.686
		Avg.	2.330	1.610	0.948	0.564	0.891	0.833	0.773	0.705	0.586	0.506	0.506	0.652	0.909
		Min.	0.604	0.718	0.120	0.117	0.547	0.663	0.494	0.553	0.463	0.391	0.349	0.508	0.461
	Antes Bocatoma Azapa	Max.	2.720	7.220	5.360	2.110	2.040	1.670	1.500	1.420	1.280	1.070	1.030	1.540	2.413
		Avg.	1.330	2.560	2.140	0.980	1.010	1.030	0.964	0.879	0.842	0.788	0.802	0.929	1.188
		Min.	0.551	0.620	0.540	0.398	0.259	0.357	0.407	0.443	0.475	0.414	0.467	0.489	0.452
	Ausipar & Antes Bocatoma	Max.	6.700	7.220	5.360	2.110	2.040	1.670	1.500	1.420	1.280	1.070	1.030	1.540	2.745
		Avg.	1.638	2.272	1.740	0.876	0.970	0.959	0.901	0.825	0.769	0.694	0.717	0.850	1.101
		Min.	0.551	0.620	0.120	0.117	0.259	0.357	0.407	0.443	0.463	0.391	0.349	0.489	0.381
	Acueducto Azapa en Bocatoma	Max.	0.943	0.976	1.010	1.030	1.090	1.040	1.040	0.863	0.817	0.889	0.942	1.000	0.970
		Avg.	0.504	0.362	0.380	0.475	0.546	0.520	0.545	0.517	0.486	0.472	0.501	0.536	0.487
		Min.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A, 1.6 Surface Flow Rate observed on 12 June, 8 October and 29 November 1993 in San Jose River Basin

<Nivel de Flujo de Superficie Observado entre el 12 de Junio y 10 de Octobre y 29 de Noviembre de 1993 en la Cuenca del Rio San Jose>

River	Location/ Quebrada	Average Velocity (m/s)	Cross-section Area (m2)	Flow Rate (m3/s)	Remarks
Observation on 12th June 1993					Flow Pattern
Canal Lauca	Central Chapiquina	-	-	Data from DGA 0.557	
Tignamar	-	0.51	0.059	0.030	
San Jose	Ausipar	0.54	1.021	0.554	
	Acueducto Azapa	1.40	0.391	0.549	
Observation on 8th October 1993					
San Jose	Ausipar	0.68	1.056	0.717	
	Acueducto Azapa	1.41	0.400	0.562	
Observation on 29th November 1993					
San Jose	Ausipar	0.64	1.213	0.780	
	Bocatoma Sr. Aguero	-	-	0.061	
	Bocatoma	-	-	0.004	
	Acueducto Azapa	1.49	0.450	0.668	

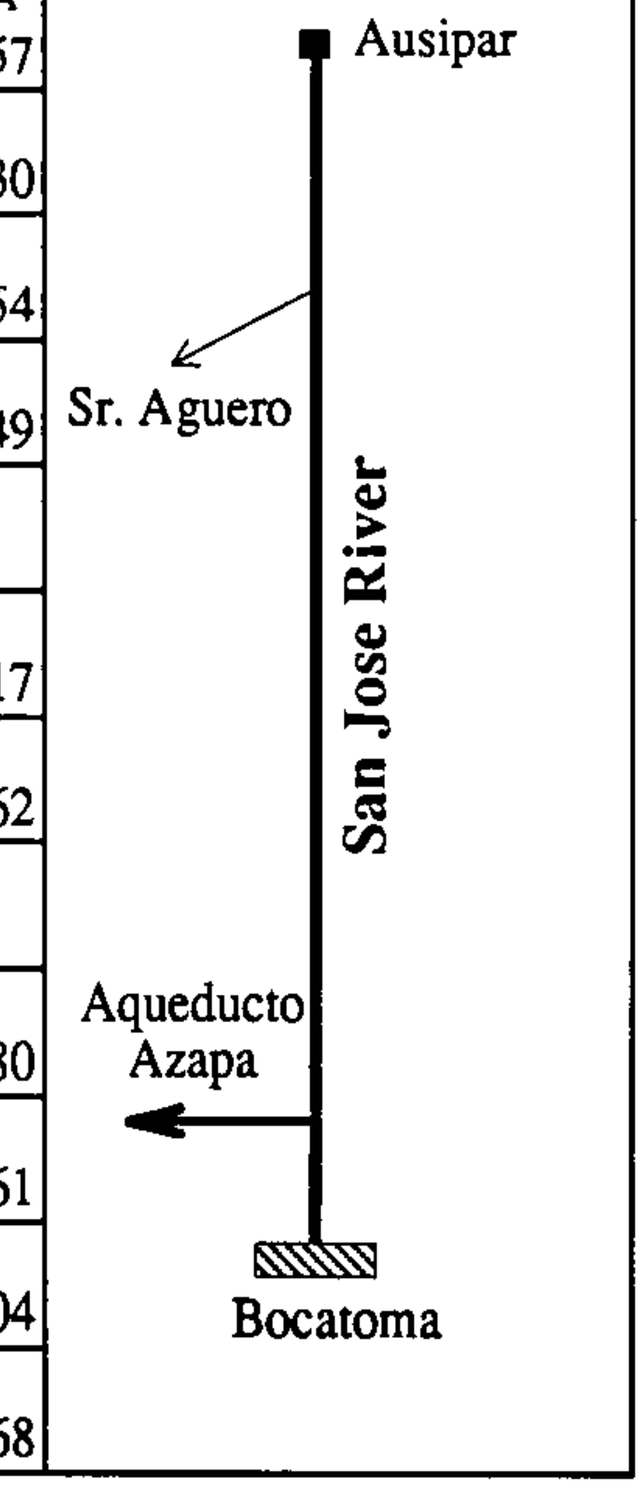


Table A, 1.7 Average Runoff Coefficient in San Jose River Basin
<Coeficientes de Escorrentias Promedios en la Cuenca de Rio San Jose>

Location : **Antes Bocatoma**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	Upstream Basin of A. Bocatoma A (km2)	Average R*A (mm.km2)	Upstream Avg. Rainfall R (mm) (R*A/A)	Flow Rate at A.Bocatoma Q (m3/s)	Runoff Coefficient f (= Q/R*A)	Upstream Average Altitude H (m, msl)
0.0 - 10.0	5.0	1,940.72	31.92	159.59		0.305		
10.0 - 50.0	30.0	296.08	296.08	8,882.40		(C.Chapiquina		
50.0 - 100.0	75.0	218.80	218.80	16,410.00		- A.Bocatoma)		
100.0 - 150.0	125.0	372.50	372.50	46,563.00				
150.0 - 200.0	175.0	234.94	234.94	41,113.80				
200.0 - 250.0	225.0	123.86	123.86	27,868.78				
250.0 - 300.0	275.0	0.00	-	-				
300.0 - 350.0	325.0	0.00	-	-				
> 350.0	-	0.00	-	-		(m3/year)		
		3,186.90	1,278.10	140,997.58	110.32	9,618,480	0.068	3,464

Note : - Average basin rainfall is calculated from Average Annual Precipitation Map (Isohyetal Map) by DGA in 1987
- Flow rate at Antes Bocatoma is the indigeneous flow rate of San Jose River (Antes Bocatoma - Central Chapiquina)
- Upstream average altitude of Antes Bocatoma is obtained by averaging the altitude of the rainfall stations located in the upstream basin of Antes Bocatoma

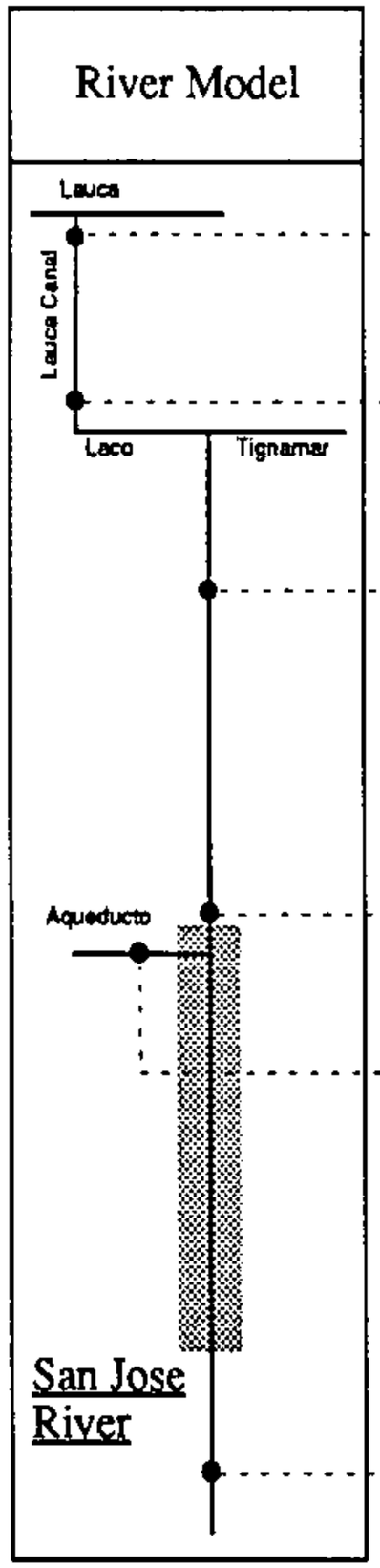
Table A, 1.8 Water Quality observed by DGA in San Jose River Basin

<Calidad de Agua Observada por DGA en la Cuenca del Rio San Jose>

River	Location	pH	E.C (mh/cm)	CO_3 (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	B (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NO_2$ (mg/l)	P (mg/l)	$N\text{-}NH_3$ (mg/l)
San Jose	Canal Lauca	7.97	676	5.725	232.5	41	101	34.3	35.8	7.8	55.3	1.41	0.087	0.059	0.27	0.092	0.003	0.166	0.117
	Ausipar	7.93	801	2.695	243.8	55	134	55.2	35.9	8.2	68.4	1.02	0.078	0.015	0.80	0.227			
	Bocatoma	7.94	756	1.601	191.8	50	135	55.4	31.4	7.0	60.5	1.60	0.080	0.015	1.40	0.126	0.007	0.075	0.062
	Acueducto	7.93	811	6.045	207.4	53	155	54.3	34.1	8.2	67.5	1.68	0.118	0.061	0.83	0.135	0.004	0.133	0.073
	Saucache	7.47	634	0.100	172.8	56	130	77.3	15.8	6.3	47.3	1.13	0.085	0.112	0.82	0.402	0.005		0.000
Permissible Value		6.0 - 8.5				250	250		125.0				0.050	1.000	0.30	9.000			0.500

Table A, 1.9 Average Water Quality and Surface Flow Rate in San Jose River Basin
<Calidad Promedio del Agua y Nivel de Flujo en la Cuenca del Rio San Jose>

(Recorded period of the stations are different but range from 1967 to 1992)



	pH	E.C (mh/cm)	CO_3 (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	B (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NO_2$ (mg/l)	P (mg/l)	$N\text{-}NH_3$ (mg/l)	Q (m^3/s)
Bocatoma Lauca	7.97	676	5.725	232.5	41	101	34.3	35.8	7.8	55.3	1.41	0.087	0.059	0.268	0.092	0.003	0.166	0.117	0.965
Central Chapiquina Hydropower Station																			
Ausipar	7.93	801	2.695	243.8	55	134	55.2	35.9	8.2	68.4	1.02	0.078	0.015	0.797	0.227				0.907
Antes Bocatoma Azapa	7.94	756	1.601	191.8	50	135	55.4	31.4	7.0	60.5	1.60	0.080	0.015	1.399	0.126	0.007	0.075	0.062	1.188
Aqueducto Azapa en Bocatoma	7.93	811	6.045	207.4	53	155	54.3	34.1	8.2	67.5	1.68	0.118	0.061	0.829	0.135	0.004	0.133	0.073	0.487
Puente Saucache	7.47	634	0.100	172.8	56	130	77.3	15.8	6.3	47.3	1.13	0.085	0.112	0.824	0.402	0.005		0.000	-

Table A, 1.10 Water Volume at Saucache and Antes Bocatoma

<Volumen de Agua en Saucache y Antes Bocatoma>

Year	Number of Flooding days	Total Water Volume at Saucache (m3)	Total Water Volume at Antes Bocatoma (m3)	Ratio (%)
1976	75	16,936,933	55,585,958	30.47 %
1977	33	16,799,754	45,549,302	36.88 %
1978	2	276,096	25,753,162	1.07 %
1979	17	1,826,638	31,185,216	5.86 %
1980	6	642,474	22,796,899	2.82 %
1981	5	984,932	17,212,694	5.72 %
1982	1	60,877	16,775,683	0.36 %
1983	No Flood	0	12,398,659	0.00 %
1984	26	4,850,161	15,255,821	31.79 %
Average for 9 consecutive years		4,708,652	26,945,933	17.47 %

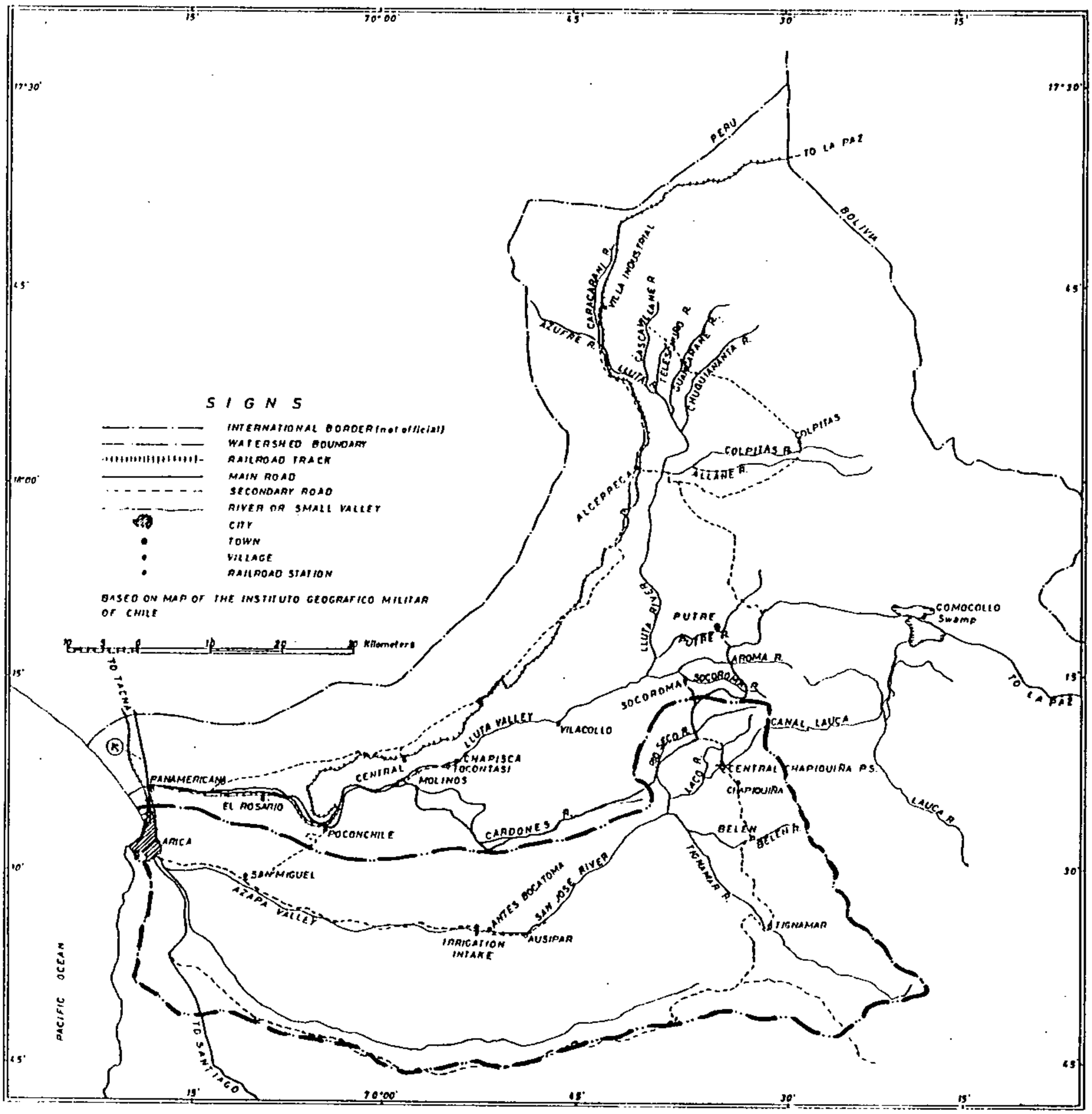


Fig. A, 1.1 River System of San Jose River Basin
<Systema Fluvial de la Cuenca del Rio San Jose>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Visviri	17 35 -	69 30	4070
2	Villa Industrial	17 47 -	69 43	4060
3	Humapalca	17 50 -	69 42	3970
4	Caquena	18 03 -	69 12	4400
5	Alcerreca	18 00 -	69 40	3990
6	Puquios	18 11 -	69 45	3750
7	Putre	18 12 -	69 35	3530
8	Pecollo	18 10 -	69 29	4050
9	Cotacotani	18 11 -	69 14	4500
10	Isla Blanca	18 11 -	69 13	4500
11	Parinacota (ex Endesa)	18 12 -	69 16	4390
12	Chucuyo (ex Endesa)	18 13 -	69 20	4200
13	Chucuyo (Carabineros)	18 13 -	69 20	4200
14	Las Cuevas (Conaf)	18 12 -	69 30	3940
15	Murmuntane	18 21 -	69 32	3200
16	Portezuelo Chapiquiña	18 23 -	69 29	4400
17	Central Chapiquiña	18 23 -	69 33	3280
18	Lluta	18 24 -	70 10	290
19	Oficina Arica	18 29 -	70 19	20
20	U. del Norte	18 29 -	70 19	27
21	Aerodromo El Buitre	18 30 -	70 19	30
22	Azapa	18 31 -	70 01	250
23	Belén	18 29 -	69 31	3240
24	Tignamar	18 35 -	69 30	3200

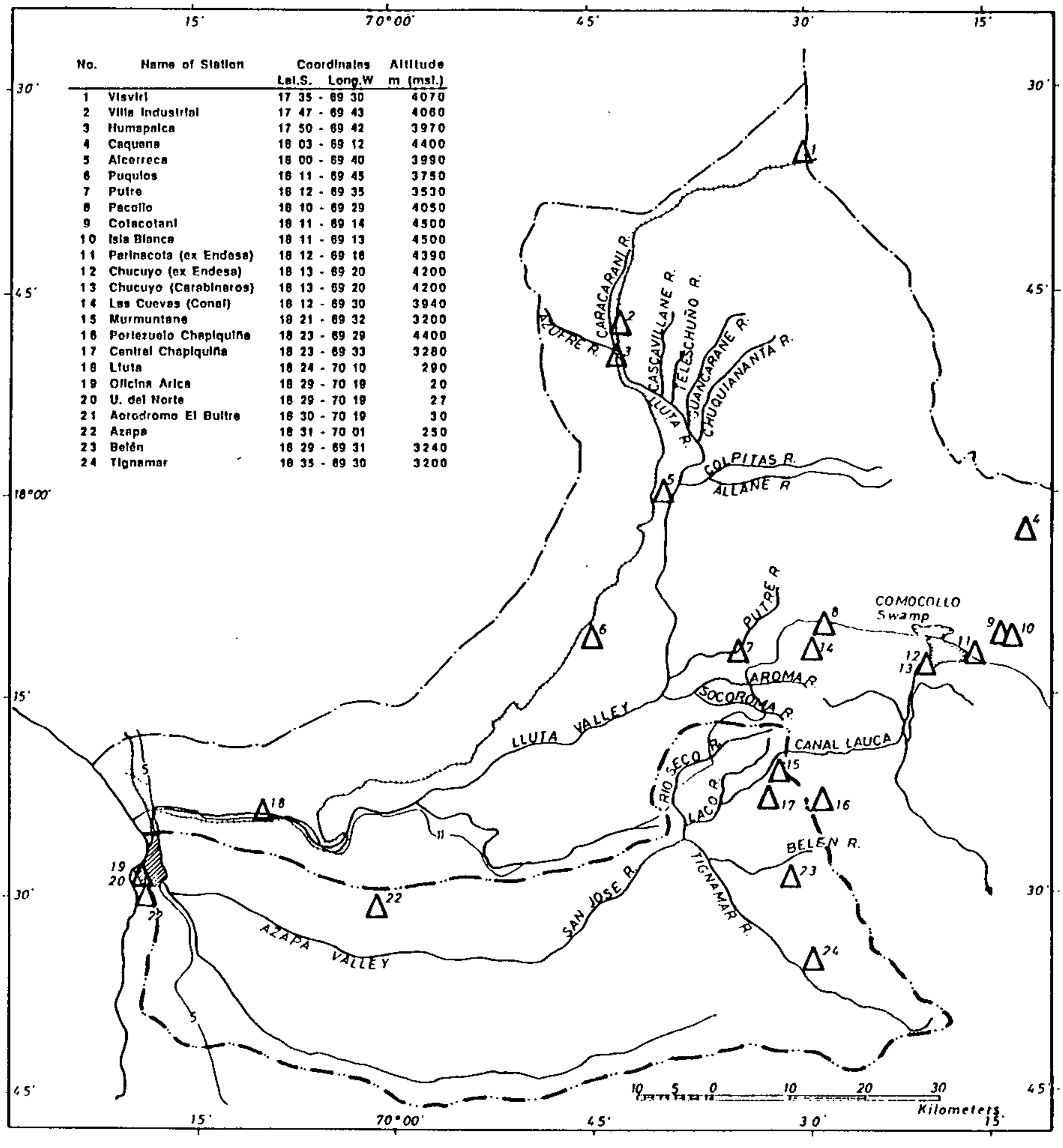
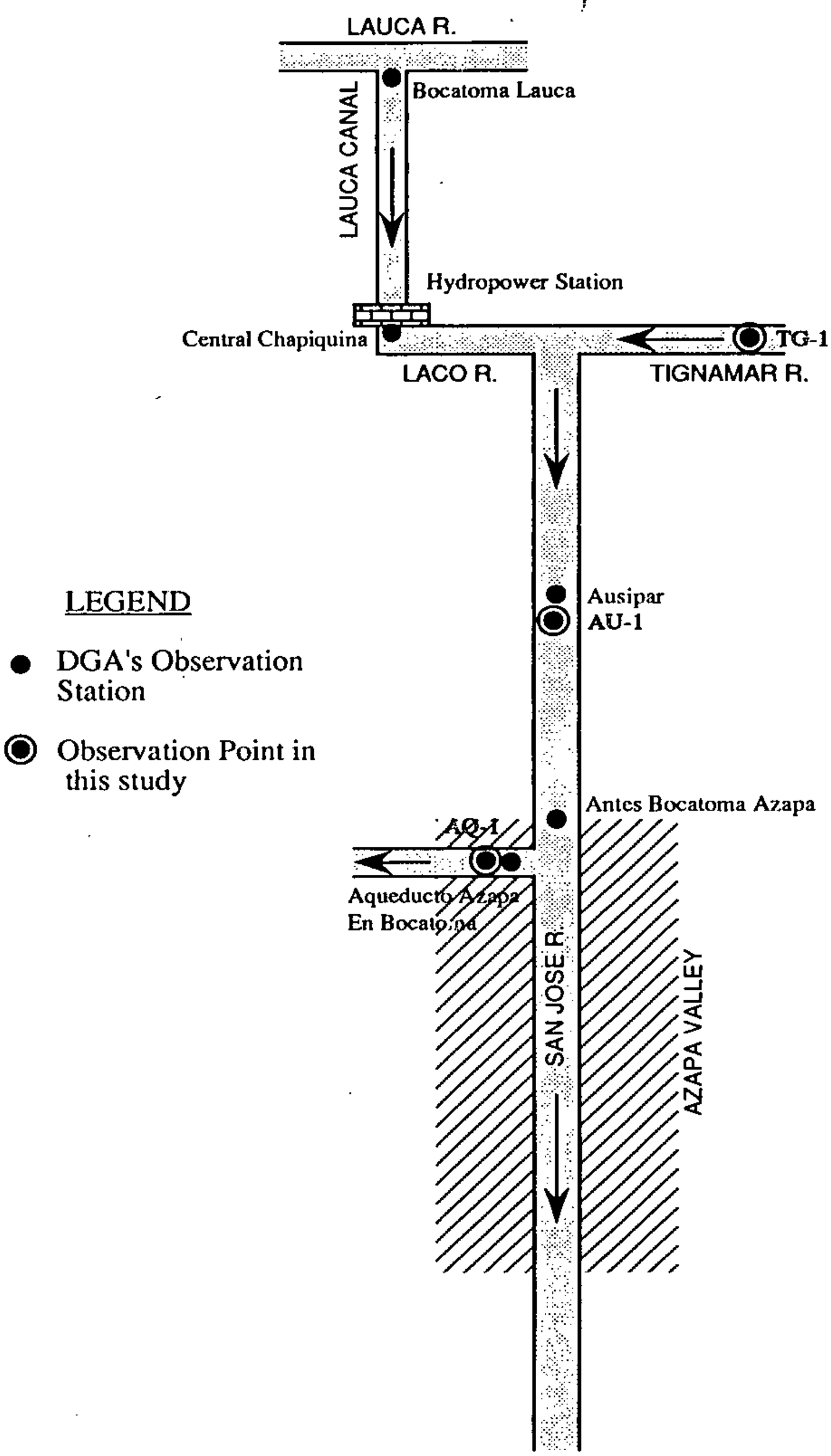


Fig. A, 1.2 Precipitation Stations of DGA in San Jose River Basin

<Estacion de Precipitacion de DGA en la Cuenca del Rio San Jose>



Flow Model in San Jose River Basin

Fig. A, 1.3 Flow Model in San Jose River Basin

<Modelo de Flujo en la Cuenca del Rio San Jose>

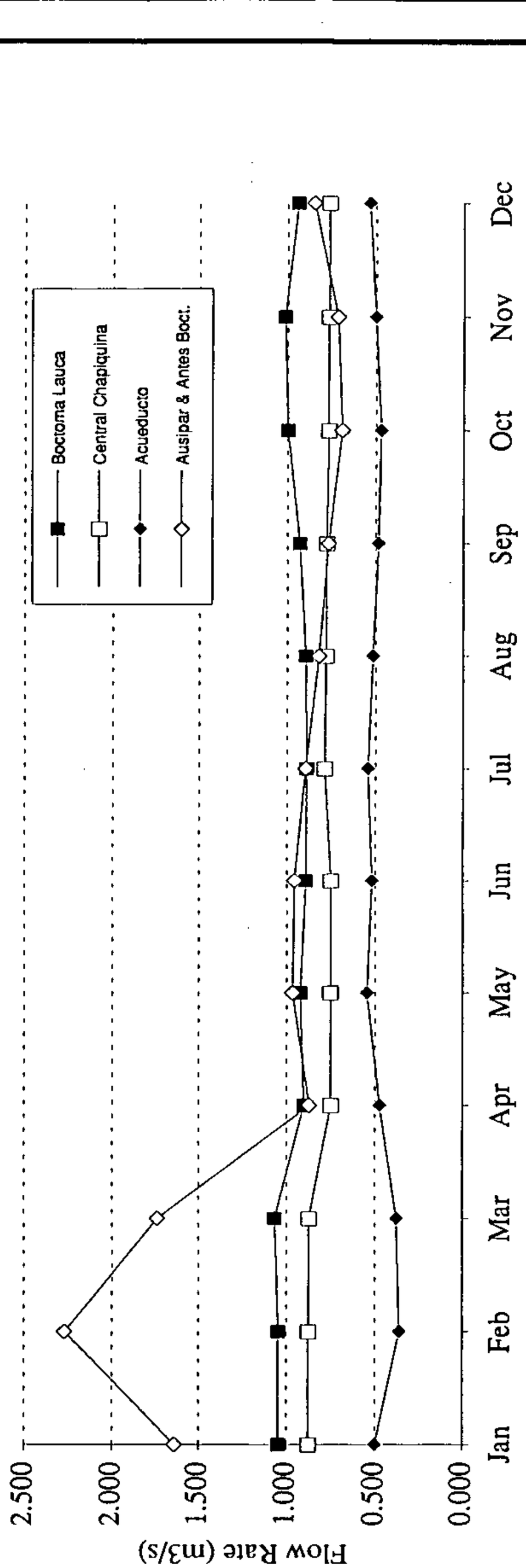


Fig. A, 1.4 Average Surface Flow Rate in San Jose River Basin

<Nivel de Flujo de Superficie Premedio Meansual de la Cuenca del Rio San Jose>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Visviri	17 35 -	69 30	4070
2	Villa Industrial	17 47 -	69 43	4060
3	Humapalca	17 50 -	69 42	3970
4	Caquena	18 03 -	69 12	4400
5	Alcerreca	18 00 -	69 40	3990
6	Puquios	18 11 -	69 45	3750
7	Putre	18 12 -	69 35	3530
8	Pacollo	18 10 -	69 29	4050
9	Colacolani	18 11 -	69 14	4500
10	Isla Blanca	18 11 -	69 13	4500
11	Parinacota (ex Endosa)	18 12 -	69 18	4390
12	Chucuyo (ex Endesa)	18 13 -	69 20	4200
13	Chucuyo (Carabineros)	18 13 -	69 20	4200
14	Las Cuevas (Conaf)	18 12 -	69 30	3940
15	Murmuntane	18 21 -	69 32	3200
16	Portezuelo Chapiquiña	18 23 -	69 29	4400
17	Central Chapiquiña	18 23 -	69 33	3280
18	Lluta	18 24 -	70 10	290
19	Oficina Arica	18 29 -	70 19	20
20	U. del Norte	18 29 -	70 19	27
21	Aerodromo El Buitre	18 30 -	70 19	30
22	Azapa	18 31 -	70 01	250
23	Belén	18 29 -	69 31	3240
24	Tignamar	18 35 -	69 30	3200

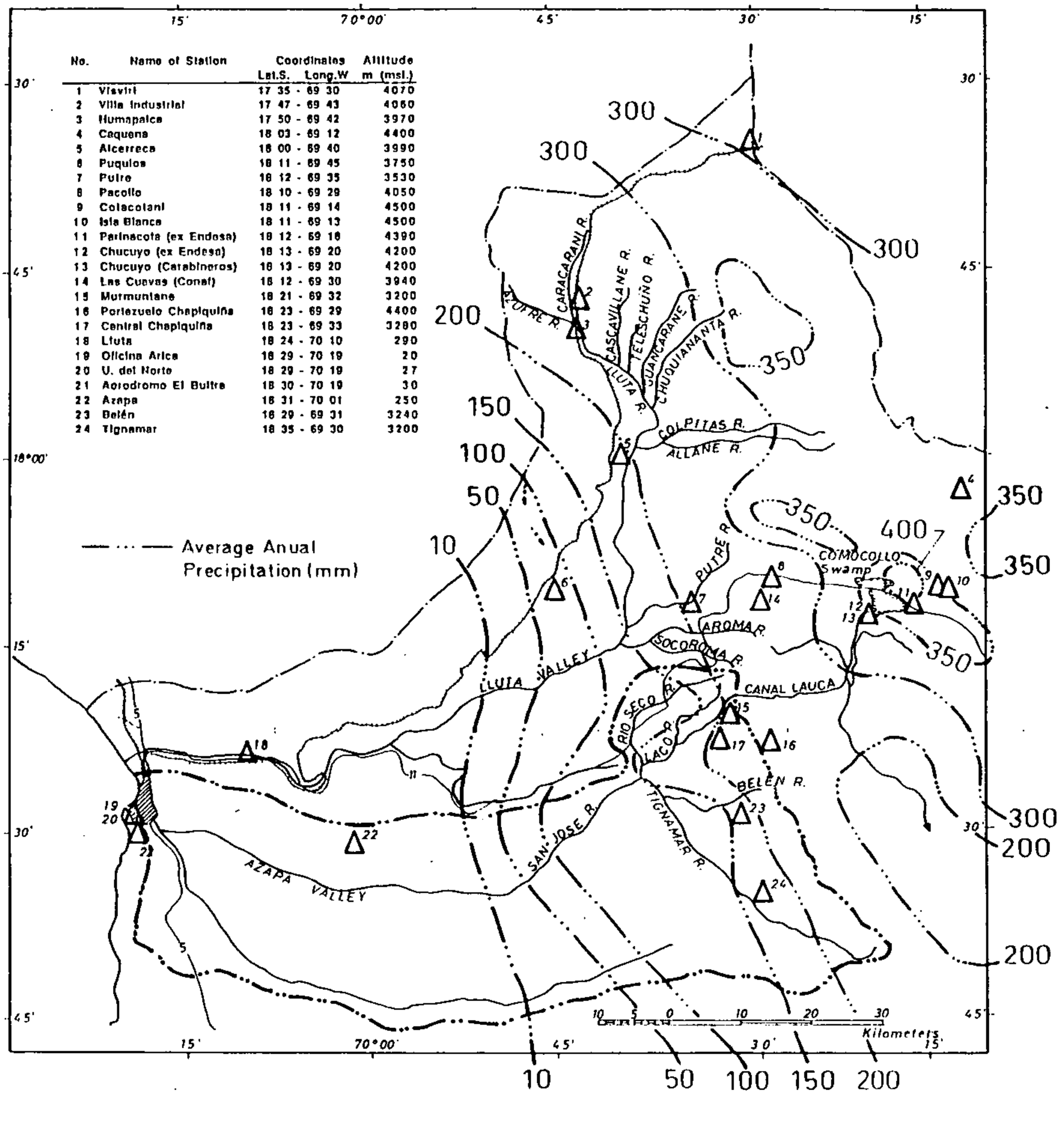


Fig. A, 1.5 Average Precipitation (Isohyetal Map) in San Jose River Basin

<Precipitacion Promedio en Mapa de Isoyeta en la Cuenca del Rio San Jose>

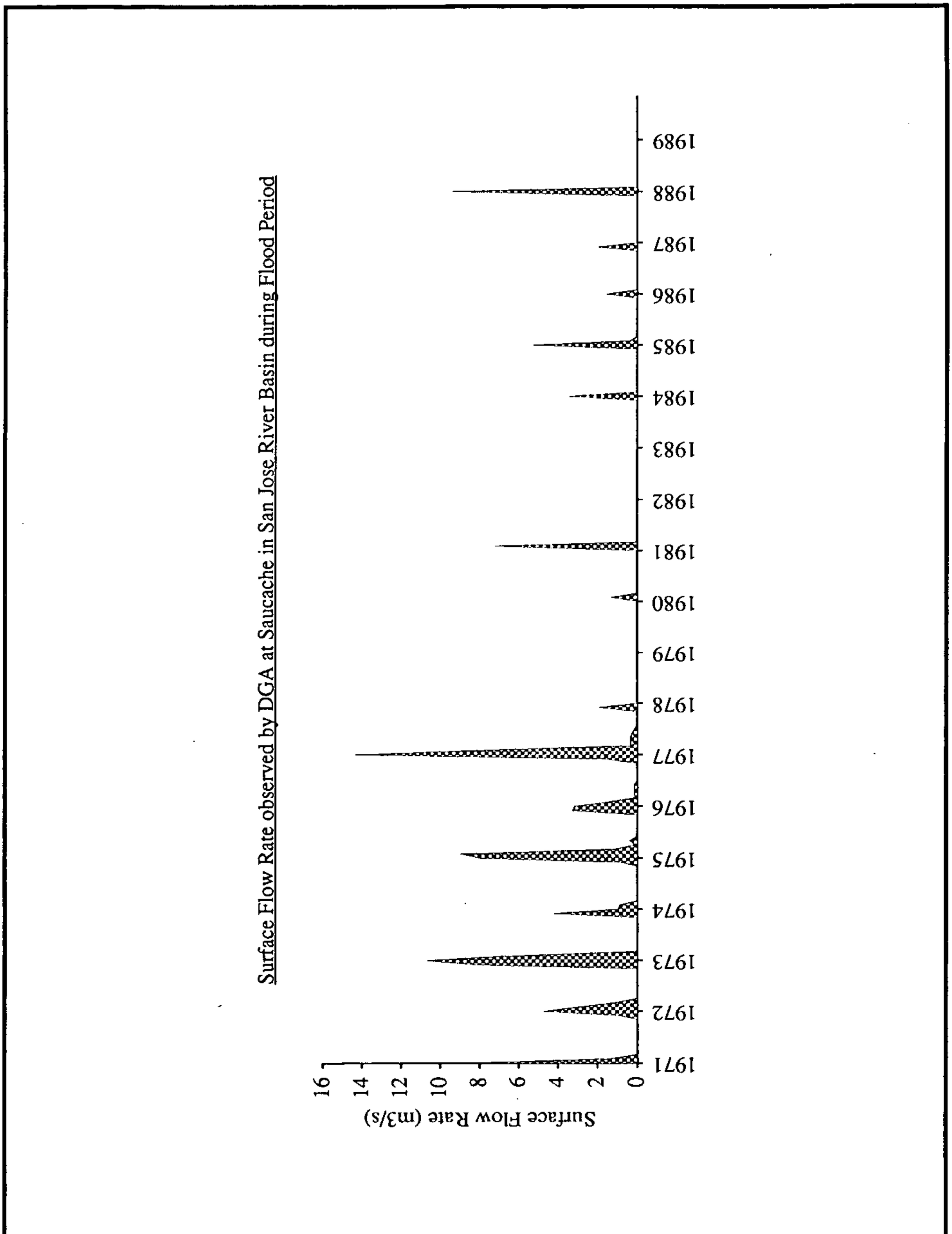


Fig. A, 1.6 Surface Flow Rate at Saucache during Flood Period

<Nivel de Flujo de Superficie en Saucache durante el Periodo de Avenidas>

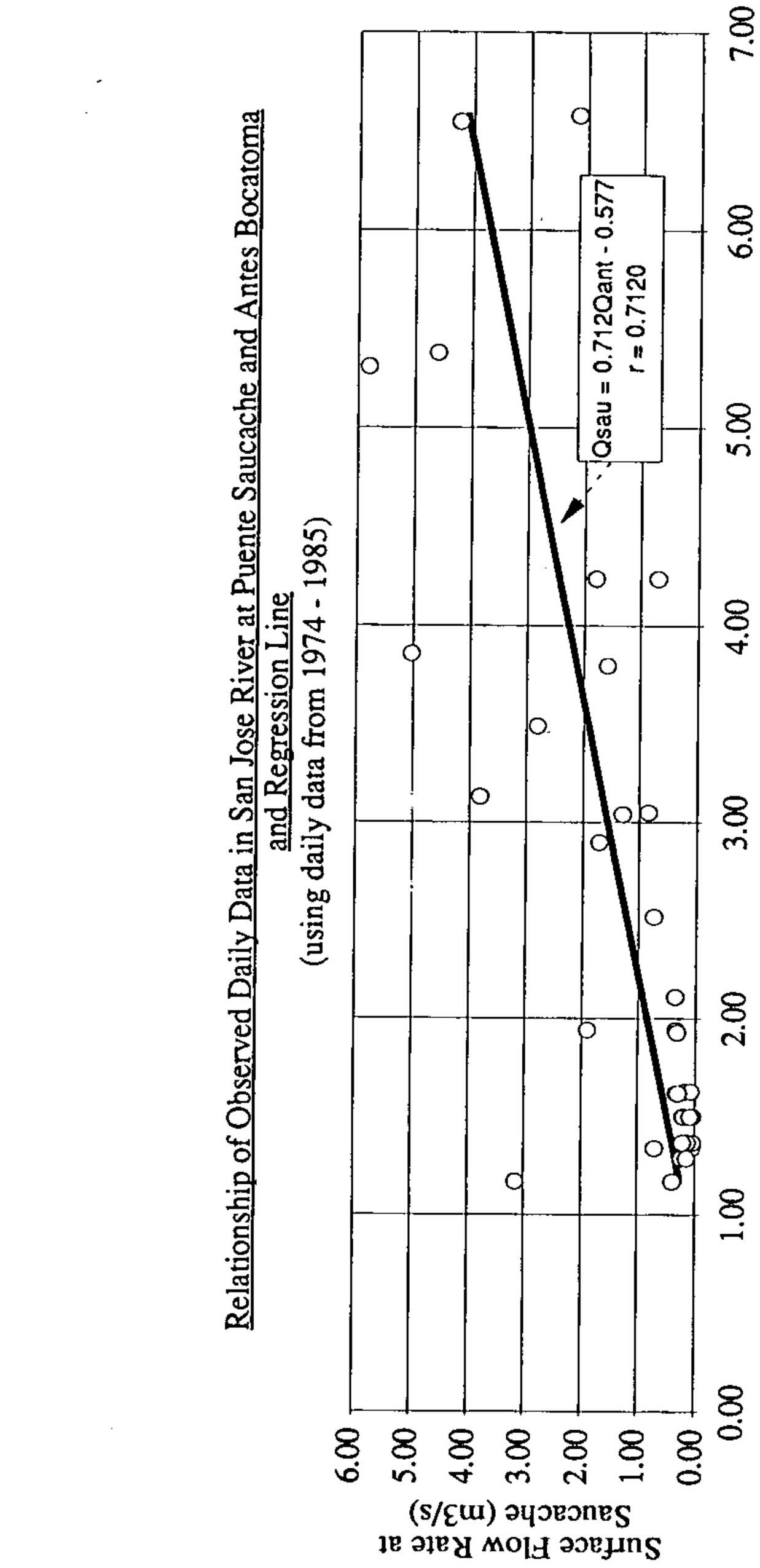


Fig. A, 1.7 Relationship of Observed Data at Saucache and Antes Bocatoma and Regression line

<Relacion de Datos Observado en Saucache y Antes Bocatoma y Linea de Regresion>

SUPPORTING REPORT A

Chapter II SURFACE WATER OF LLUTA RIVER BASIN

several tributaries. Main tributaries are Azufre, Caracarani, Cascavillane, Teleschuno, Guancarane, Chuquiananta, Colpitas, Allane, Putre, Aroma and Socoroma. Flow originates from the mountain areas in the north and north-east. In the north, Caracarani river, a main tributary, flows southwards, joins Azufre, Cascavillane, Teleschuno, Guancarane and Chuquiananta river in between Humapalca and Alcerreca. In the north-east, Colpitas and Allane river flow eastwards and meet Caracarani at Alcerreca. Lluta river, named after this confluence, combines with Putre, Aroma and Socoroma river at Putre, flows through Lluta Valley and down to Pacific Ocean at Arica city.

Several tributaries and Quebradas in the basin are not taken into consideration in the flow model because flow rates are negligibly small based on data and information from DGA. Flow model is shown in Fig. A, 2.3.

2.2 Surface Flow Rate

2.2.1 Flow Rate at Major Stations

Daily water levels are observed at DGA's observation stations by automatic recorders. Flow rate at each stations is generally calculated by a so called "Discharge Rating Curve" or "H-Q Curve" which is a calibration curve of water level and flow rate. Major observation stations are as follows;

River	Location	Observation Period
Caracarani	Humapalca	1973 - Present
	Alcerreca	1961 - 1984
Colpitas	Alcerreca	1961 - Present
Lluta	Alcerreca	1961 - Present
	Tocontasi	1946 - 1985
	Chapisca	1987 - Present
	Panamericana	1969 - Present

Data from Tocontasi and Chapisca are combined together in the analysis because the station at Chapisca is a new re-located station of that at Tocontasi.

Average surface flow rate of these stations are shown in Table A, 2.3, fluctuation of these flows throughout a year are shown in Fig. A.2.4 and recorded monthly flow rates are shown in Appendix A, 2.2.

At Azufre river, there is no permanent observation station. Observation has been done since 1985 up to the present occasionally at about once in a month by measuring velocity and cross sectional area, not interpolation from H-Q curve.

Therefore, for flow balance in the basin, average monthly flow rate of Azufre river is calculated from the correlation with flow rate of Caracarani river at Humapalca as shown in Fig. A, 2.5. Relationship between these two points is assumed to be linear as follows;

$$Q_{Caracarani} = aQ_{Azufre} + b$$

where Q = flow rate (m^3/s),
a, b = constant

Parameter a and b are calculated by Least Square Method using flow rates at both stations as samples. The result is shown below

$$Q_{Caracarani} = 1.40Q_{Azufre} + 0.261$$

where Correlation Coefficient (r) = 0.7053

From this result, flow balance is calculated as shown in Table A, 2.4.

The portion of flow rate in Lluta river and its tributaries is as follows;

River	Flow Rate (m^3/s)	Portion
Caracarani	0.378	17 %
Azufre	0.084	4 %
Cascavillane + Teleschuno + Guancarane + Chuquiananta	0.396	18 %
Colpitas	0.521	24 %
Putre + Aroma + Socoroma	0.331	15 %
Unknown	0.509	23 %
Lluta	2.216	100 %

Unknown flow is calculated from the balance of flow in Caracarani (0.855 m^3/s), Colpitas (0.521 m^3/s) and Lluta river (1.885 m^3/s) at Alcerreca. The explanation of this is in Section 2.2.2 in combination with the results from supplementary observation.

Probability is used to analyze these data because of the sufficiently long recorded years to find out the probability of exceedance (P(x)) at 80% and 90% or non-exceedance (F(x)) at 20% and 10%. This means the probability that flow does not exceed or is less than this value, is 20% and 10% or equivalent to 5 and 10 year return period.

Using Hazen Probability, P(x) and F(x) are defined as follows;

$$P(x_j) = \frac{2j - 1}{(2N)} \quad \text{and} \quad F(x_j) = 1 - P(x_j)$$

where j = order of x_j counted from the largest value of sample

N = size of sample

Flow rate in Caracarani at Humapalca and Alcerreca, Colpitas at Alcerreca and Lluta at Chapisca & Tocontasi and Panamericana are analyzed as shown in Table A, 2.5 and monthly fluctuations are shown in Appendix A, 2.3.

2.2.2 Calculation of Runoff Coefficient

Runoff, originated from the precipitation or rainfall in the basin, generally flows through water channels as surface flow and infiltrates to underground as groundwater. An effort is done to find out relationship of rainfall and surface flow for the evaluation of groundwater. Average yearly rainfall contour map prepared by DGA in 1987, as shown in Fig. A, 2.6, is used to calculate the total amount of water entering the basin in comparison with surface flow rate in the basin. Flow rate at Alcerreca and Tocontasi are selected as checking points of surface flow. Runoff coefficient, the ratio of surface flow to rainfall, is found to be 0.186 at Alcerreca and 0.143 at Tocontasi as shown in Table A, 2.6 and A, 2.7. This can be interpreted that about 18.6 % of rainfall flows through rivers in the upstream and 14.3 % in the midstream as surface flow.

2.3 Surface Water Quality

2.3.1 Water Quality at Major Stations

Water quality is observed regularly at DGA's observation stations by sampling method, water samples are taken from the river and analyzed in the laboratory. Observation stations are as follows;

River	Location	Observation Period
Caracarani	Humapalca	1967 - 1985
	Alcerreca	1967 - 1989
Azufre	Humapalca	1967 - 1984
Colpitas	Alcerreca	1967 - 1989
Lluta	Alcerreca	1967 - 1985
	Tocontasi	1967 - 1987
	Poconchile	1968 - 1985
	Panamericana	1967 - 1989

The items of the analysis are classified as follows;

(1) Health Significance : As, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_3$

(2) Aesthetic Quality : Cl^-, Cu, Fe, Na, P, SO_4, pH

(3) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

Results of the examination are shown in Table A, 2.8 and A, 2.9. Average monthly data are shown in Appendix A, 2.4

2.3.2 Evaluation of Water Quality

According to WHO's Guideline, water quality in Lluta river and tributaries are worse than standard limit.

The consecutive worst two (2) rivers by considering the health significance are

Number 1 Azufre river at Humapalca
Number 2 Colpitas river at Alcerreca

It is remarkable that these rivers are in the upstream of Lluta river. Therefore, bad water quality in Lluta river is possibly from these sources.

Information on water quality of the other main tributaries including Cascavillane, Teleschuno, Guancarane, Chuquiananta, Putre, Aroma and Socoroma. can be obtained from the supplementary observation in this study as explained in the latter section.

2.4 Supplementary Observation

2.4.1 Simultaneous Observation in the Upstream Tributaries

1) Objective

The purposes of the observation are to measure flow rate and examine water quality as supplementary data of DGA's regular observation for more information on the available water sources.

2) Location

Observation points are located as follows:

Location	Code	Latitude	Longitude
1. Azufre	AZ-1	17° 50′	69° 43′
2. Caracarani, before confluence with Azufre	CR-1	17° 50′	69° 42′
3. Cascavillane	CV-1	17° 51′	69° 39′
4. Teleschuno, Queb. Teleschuno	TL-1	17° 51′	69° 38′
5. Teleschuno, Queb. Gualluma	TL-2	17° 51′	69° 38′
6. Guancarane	GC-1	17° 51′	69° 36′
7. Chuquiananta	CQ-1	17° 52′	69° 35′
8. Colpitas	CP-1	17° 57′	69° 28′
9. Allane	AL-1	17° 59′	69° 28′
10. Putre, Queb. Llancomane	PT-1	18° 10′	69° 31′
11. Putre, Queb. Pacollo	PT-2	18° 10′	69° 30′
12. Putre, Queb. Taipicahua	PT-3	18° 11′	69° 30′
13. Putre, Queb. Jurase	PT-4	18° 12′	69° 30′
14. Putre, Queb. Lluscuma	PT-5	18° 12′	69° 30′
15. Aroma	AR-1	18° 14′	69° 33′
16. Socoroma	SR-1	18° 16′	69° 31′
17. Chapisca	TC-1	18° 23′	69° 55′

Location of these points are shown in Fig. A, 2.3 and A, 2.7.

3) Observation Method

The measurement was conducted by JICA Study Team & DGA. River conditions during the measurement are shown in Appendix A, 2.5. The items of measurement are as follows;

(1) Flow Rate

Flow velocity was measured by a propeller current meter across the river section at a length interval of about 1/10 of the river width. Flow rate was calculated as the product of average velocity times cross sectional area

$$Q = \sum_{i=1}^{m} V_i \times A_i$$

where Q = flow rate (m^3/s),
V = flow velocity (m/s),
A = cross sectional area of the river (m^2) and
m = number of sub-cross sections.

(2) Water Quality

Water Quality was measured by sampling method. Samples were taken from the checking points and analyzed in the laboratory following the standard method of water quality analysis. Items of the analysis are classified as follows;

(i) Health Significance : As, Cd, Cr, CN, F, Pb, NO_3

(ii) Aesthetic Quality : Al, Cl^-, Cu, $CaCO_3$, Fe, Mn, Na, SO_4, TDS, Zn, pH

(iii) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

4) Date of Observation

Observation was carried out on 1st - 3rd June 1993

5) Results of Observation

(1) Surface Flow Rate

Flow rate at each points is shown in Table A, 2.10.

Result of flow rate measured in Azufre (0.076 m^3/s) and Caracarani river (0.394 m^3/s) at Humapalca shows a good agreement with the calculation in Caracarani from the correlation as mentioned previously (0.367 m^3/s). The difference is about 7 %.

Balance of flow are as follows;

River	Flow Rate (m^3/s)	Portion
Caracarani	0.394	33 %
Azufre	0.076	6%
Cascavillane + Teleschuno + Guancarane + Chuquiananta	0.334	29 %
Colpitas + Allane	0.231	19 %
Putre	0.315	27 %
Aroma	0.033	3 %
Socoroma	0.012	1 %
Unknown	-0.211	-15 %
Lluta	1.184	100 %

Unknown flow from this balance is -15 % of flow in Lluta river at Alcerreca. This contradicts the unknown flow from average monthly balance (23 %). Therefore, it is attributed mainly to the error of measurement.

Major water sources of Lluta river are Caracarani (33 %), Cascavillane+Teleschuno+Guancarane+Chuquiananta (29 %) and Putre river (27 %). These sources contribute about 89 % to Lluta river.

(2) Water Quality

Results of the examination is shown in Table A, 2.11. Classification as acceptable and unacceptable rivers in water quality of the tributaries of Lluta river according to Water Quality Standard, shown in Appendix A, 5, is as follows;

River	Flow Rate (m^3/s)	Portion
Unacceptable		
Azufre	0.076	6 %
Colpitas	0.211	17%
Cascavillane	0.082	7 %
Allane	0.020	2 %
Putre : Pacollo	0.017	2 %
Putre : Jurase	0.009	1 %
Sub-total	0.415	35%
Acceptable		
Teleschuno	0.007	1 %
Guancarane	0.168	15%
Chuquiananta	0.077	7 %
Caracarani	0.394	33%
Putre : Llancomane	0.043	4 %
Putre : Taipicahua	0.184	16%
Aroma	0.033	3 %
Socoroma	0.012	1 %
Sub-total	0.918	80%
Putre : Lluscuma	0.062	6 %
Unknown	-0.211	-15%
Total at Chapisca	1.184	100%

It should be noted that water quality at Lluscuma was not observed.

2.4.2 Intensive Observation in the Contaminated Tributaries

1) Objective

From the result of water quality examinations mentioned above, Azufre and Colpitas rivers are the most contaminated tributaries of Lluta river. However, contaminated tributaries of these rivers need to be observed intensively for water potential development. Clarification of the definite contaminated tributaries of these rivers is the purpose of this observation.

2) Location

Observation points are shown in Fig. A, 2.8 for Azufre river and Fig. A, 2.9 for Colpitas river.

3) Observation Method

The measurement was conducted by DGA in cooperation with JICA Study Team. Observation items and method are the same as that of simultaneous observation.

4) Date of Observation

Observation was carried out in the middle of November 1993 and took about 2 weeks.

5) Results of Observation

Flow rate and water quality in these tributaries are shown in Table A, 2.12 and A, 2.13(1) to 2.13(6).

Conclusions drawn from the observation result are as follows;

<u>Azufre River</u> (refer to Table A, 2.13(7) and Fig. A, 2.8)

(1) Flow Rate

- The location so called Agua Calientes is considered as the original water source of Azufre river with the springs AV-1, AV-2, AV-3, AV-4, AV-5, AV-6 and AV-7.

- There is no flow at A-6 and A-7 because water infiltrates into underground from A-8 and emerges to surface again at A-5A.

- Flow rate at A-5A is higher than A-3 because water partly infiltrates into underground again along the river course between these 2 points.

- Flow rate at A-1 (Lluta) approximately equals A-3 (Azufre)+ A-4 (Caracarani)

A-1 (100%) = A-3 (30%) + A-4 (70%)

(2) Water Quality

- Azufre river is contaminated from its original source at Agua Calientes at AV-1, AV-2 and AV-7. Although flow rate of these points are apparently low, in wet season the pollutants will be washed out to the stream.

- Water quality at A-8 is worse than at A-10 although the tributary at A-11 is comparatively clean. This may be because pollutant source is from the river bed along the stream, not from the tributary.

- Water quality becomes better after flow infiltrates and emerges from A-8 to A-15A.

- Another contaminated source is at A-5B.

Colpitas River (refer to Table A, 2.13(8) and Fig. A, 2.9)

(1) Flow Rate

- Flow originates from the mountains in the east outside the study drainage basin with several tributaries flowing into 2 main tributaries.

- Main tributaries are Colpitas and Allane rivers with the portion of Allane (C-4) 58 % and Colpitas (C-5) 42 %.

(2) Water Quality

- Contaminated source is the whole upstream part of Colpitas river at C-11A, C-11B, C-10, C-6 and C-5.

- Although Allane river is comparatively clean, water quality is still higher than the standard limit.

- Small tributaries between C-3 and confluence of C-4 (Allane) and C-5 (Colpitas) at CV-1 to CV-5 also discharge a large amount of pollutants to the river.

2.5 Evaluation of Surface Water Development Potential

Evaluation of surface water potential in Lluta river basin is done by considering the water potential to be stored by a dam or reservoir before flowing to the sea. Tocontasi & Chapisca is selected for the analysis instead of Panamericana due to the insufficient recorded years at Panamericana.

Accumulated water volume from 1946 at Tocontasi & Chapisca is plotted with the assumed amount of water release at this station as shown in Fig. A, 2.10. From this mass curve, approximate slope of the observed data is in between flow rate 2.0 and 3.0 m^3/s. This means that water release from Tocontasi should be less than 3.0 m^3/s in order to maintain the storage. Monthly volume storage is calculated as shown in Fig. A, 2.11 and Appendix A, 2.6. Inflow is the actual flow rate from the measurement and outflow is the assumed water release from this station.

Storage volume of the dam is determined by the accumulation of inflow and outflow. Outflow of 1.5 and 2.0 m^3/s are selected for the calculation as shown in Appendix A, 2.7. From this calculation, maximum and minimum accumulated volume storage are listed in Table A, 2.14 and A, 2.15. Rising period means the period that volume storage is in the minimum stage, the following actual flow is higher than the water release (1.5 or 2.0 m^3/s) and the volume storage is gradually increasing. Decreasing period is the reverse stage.

Probability of nonexceedance (F(x)) is used to find out the return period year of the volume storage. The results are shown in Table A, 2.16 and A, 2.17.

The required volume storage is determined from the maximum storage volume during decreasing period to insure the condition of no empty storage. It can be briefly summarized that

For return period of 10 years;

Storage volume = 15,375,456 m^3, if water release = 2.0 m^3/s

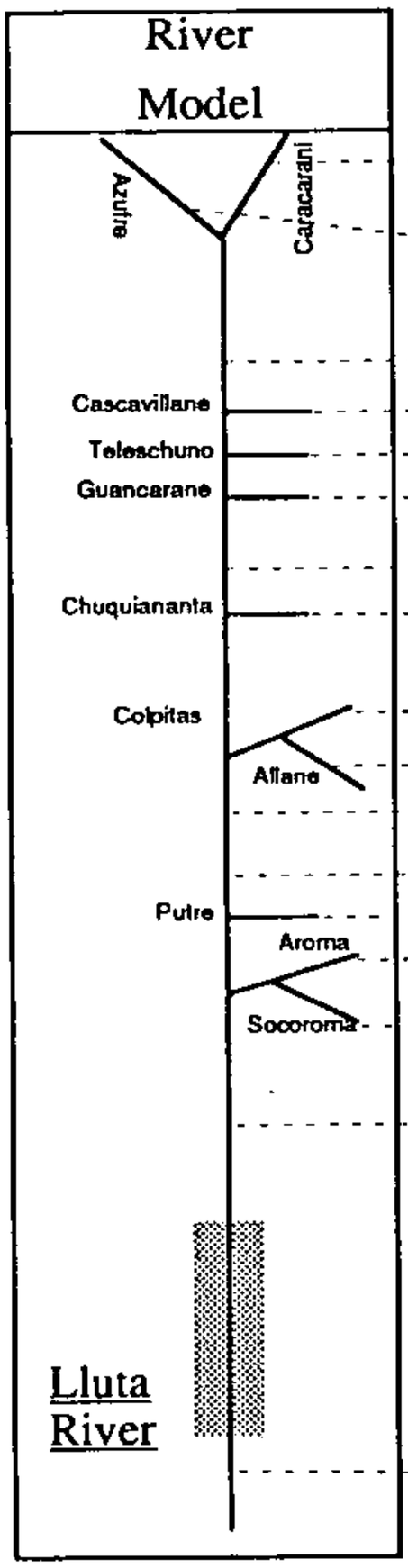
Storage volume = 5,086,848 m^3, if water release = 1.5 m^3/s

For return period of 5 years;

Storage volume = 12,913,171 m^3, if water release = 2.0 m^3/s

Storage volume = 3,361997 m^3, if water release = 1.5 m^3/s

Table A, 2.1 Drainage Basin and Sub-Basin Areas in Lluta River Basin
<Cuenca de Drenaje y Area Sub-cuenca en Cuenca del Rio Lluta>



River	Tributaries	Location	Sub-Basin (km2)	Total Basin (km2)
	Caracarani	Humapalca	141.3	141.3
	Azufre	Humapalca	37.3	178.6
Lluta		Humapalca	90.7	269.3
	Cascavillane		28.2	297.5
	Teleschuno		40.8	338.2
	Guancarane		101.1	439.4
Lluta			123.1	562.5
	Chuquiananta		142.1	704.6
	Colpitas		218.6	923.2
	Allane		245.6	1,168.8
Lluta		Alcerreca	-	1,168.8
Lluta			485.2	1,654.1
	Putre		304.3	1,958.3
	Aroma		70.5	2,028.9
	Socoroma		50.5	2,079.3
Lluta		Tocontasi	470.7	2,550.0
Lluta		River Mouth	828.0	3,378.0

Table A, 2.2 Average Precipitation observed by DGA in Lluta River Basin

<Precipitacion Promedio observada por DGA en la Cuenca del Rio Lluta>

Unit : mm

Station	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Villa Industrial	1975-Present	112.76	75.46	65.35	6.04	1.53	2.26	5.81	0.79	1.00	4.77	13.46	51.69	340.93
Humapalca	1971-Present	108.31	72.89	55.60	5.05	0.65	1.74	1.00	5.43	0.45	4.54	5.67	25.87	287.21
Alcerreca	1971-Present	75.94	57.92	39.46	4.33	1.87	2.40	3.04	1.31	1.28	2.70	4.02	26.78	221.07
Puquios	1975-1981	21.67	5.57	9.71	0.71	0.00	0.00	1.07	0.57	0.29	0.57	2.57	12.01	54.76
Putre	1976-Present	61.32	41.48	22.06	0.92	0.18	1.77	0.23	1.72	2.11	2.49	3.10	23.60	160.99
Pacollo	1978-Present	68.06	45.08	27.14	1.49	0.25	3.25	1.66	3.00	0.50	3.69	6.64	19.95	180.71
Las Cuevas	1986-1988	77.63	38.00	17.00	9.33	1.00	3.17	11.00	0.00	0.00	0.00	2.20	21.50	180.83
Lluta	1966-1992	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29

Table A, 2.3 Average Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel de Flujo de Superficie Promedio Meansual Observado por DGA en las Principales Estaciones de la Cuenca del Rio Lluta>

Unit : m^3 /s

River	Location	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Caracarani	Humapalca	1973-1990	0.698	0.625	0.475	0.317	0.303	0.303	0.426	0.321	0.268	0.268	0.242	0.295	0.378
	Alcerreca	1961-1984	0.965	1.343	1.022	0.864	0.760	0.796	0.861	0.828	0.761	0.677	0.637	0.752	0.855
Colpitas	Alcerreca	1961-1990	0.705	0.812	0.668	0.580	0.469	0.452	0.442	0.423	0.407	0.411	0.419	0.465	0.521
Lluta	Alcerreca	1961-1990	2.939	3.832	3.088	1.795	1.512	1.531	1.498	1.386	1.406	1.146	1.137	1.351	1.885
	Tocontasi	1946-1985	2.940	4.590	4.410	1.770	1.790	1.840	1.980	1.760	1.560	1.340	1.290	1.490	2.230
	Chapisca	1987-1990	2.250	6.060	1.950	1.670	1.490	1.530	1.500	1.390	1.440	1.230	1.130	1.260	1.908
	Avg.(Tocontasi+Chapisca)		2.887	4.741	4.222	1.759	1.809	1.802	1.937	1.746	1.542	1.332	1.307	1.508	2.216
	Panamericana	1969-1990	2.807	6.104	2.321	0.839	0.751	1.128	1.023	0.566	0.339	0.208	0.164	0.371	1.385

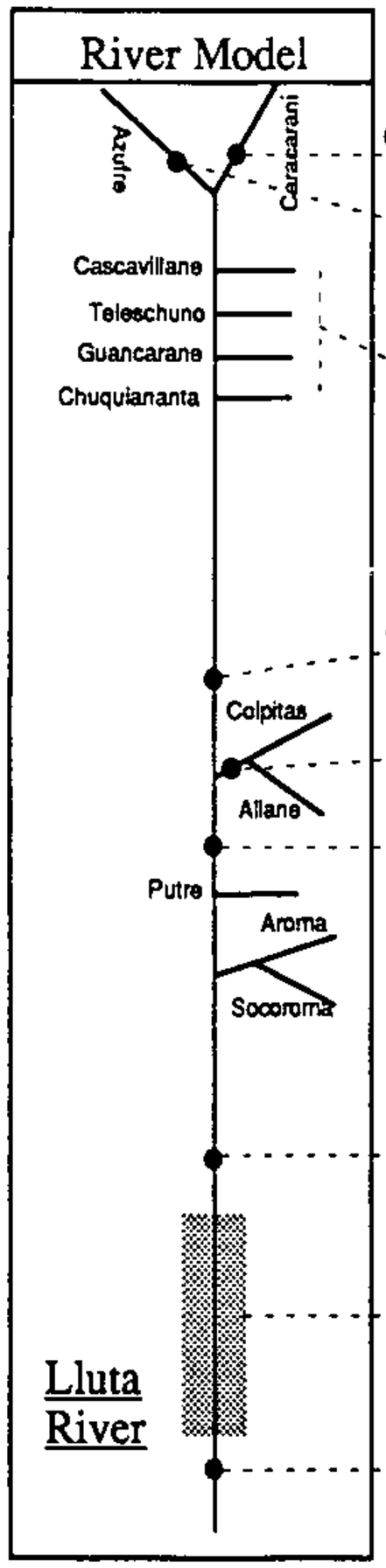
Note : Average flow rate in Tocontasi and Chapisca is calculated by weighted average of the recorded years

Table A, 2.4 Average Surface Flow Rate in Lluta River Basin

<Nivel de Flujo de Superficie Promedio en la Cuenca del Rio Lluta>

(Recorded period of the stations are different but range from 1946 to 1990)

Unit : m^3/s



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Q1 Humapalca	0.698	0.625	0.475	0.317	0.303	0.303	0.426	0.321	0.268	0.268	0.242	0.295	0.378
Q2 Humapalca (Data in Azufre River are interpolated from the Correlation with Caracarani River in Alcerreca)	*0.312*	*0.260*	*0.153*	*0.040*	*0.030*	*0.030*	*0.118*	*0.043*	*0.005*	*0.005*	*0.000*	*0.024*	*0.084*
Q3 Calculated from Flow Balance ($Q_3 = Q_4 - Q_2 - Q_1$)	*0.000*	*0.458*	*0.395*	*0.507*	*0.426*	*0.463*	*0.318*	*0.464*	*0.487*	*0.404*	*0.395*	*0.432*	*0.396*
Q4 Caracarani in Alcerreca	0.965	1.343	1.022	0.864	0.760	0.796	0.861	0.828	0.761	0.677	0.637	0.752	0.855
Q5 Colpitas	0.705	0.812	0.668	0.580	0.469	0.452	0.442	0.423	0.407	0.411	0.419	0.465	0.521
Q6 Lluta in Alcerreca	2.939	3.832	3.088	1.795	1.512	1.531	1.498	1.386	1.406	1.146	1.137	1.351	1.885
Q7 Tocontasi & Chapisca	2.887	4.741	4.222	1.759	1.809	1.802	1.937	1.746	1.542	1.332	1.307	1.508	2.216
Q8 Agricultural Consumption, calculated from Flow Balance ($Q_8 = Q_7 - Q_9$)	*0.080*	*0.000*	*1.900*	*0.921*	*1.058*	*0.674*	*0.915*	*1.180*	*1.203*	*1.124*	*1.143*	*1.137*	*0.831*
Q9 Panamericana	2.807	6.104	2.321	0.839	0.751	1.128	1.023	0.566	0.339	0.208	0.164	0.371	1.385

Table A, 2.5 Average and Probable Surface Flow Rate at Major Stations in Lluta River Basin

<Nivel Promedio y Flujo Probable de Superficie en las Estaciones Principales en la Cuenca del Rio Lluta>

Unit : m^3 /s

River	Location	Probability Exceedance	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Caracarani	Humapalca	Average	0.698	0.625	0.475	0.317	0.303	0.303	0.426	0.321	0.268	0.268	0.242	0.295	0.378
		90%	0.258	0.066	0.256	0.255	0.257	0.243	0.240	0.211	0.218	0.182	0.140	0.142	0.206
		80%	0.315	0.167	0.289	0.257	0.268	0.244	0.254	0.244	0.233	0.201	0.185	0.192	0.237
	Alcerreca	Average	0.965	1.343	1.022	0.864	0.760	0.796	0.861	0.828	0.761	0.677	0.637	0.752	0.855
		90%	0.579	0.436	0.368	0.567	0.659	0.559	0.739	0.688	0.619	0.521	0.424	0.514	0.556
		80%	0.710	0.565	0.535	0.617	0.692	0.734	0.784	0.736	0.633	0.528	0.522	0.579	0.636
Colpitas	Alcerreca	Average	0.705	0.812	0.668	0.580	0.469	0.452	0.442	0.423	0.407	0.411	0.419	0.465	0.521
		90%	0.402	0.412	0.394	0.371	0.288	0.296	0.271	0.264	0.289	0.270	0.282	0.333	0.323
		80%	0.453	0.437	0.446	0.433	0.372	0.365	0.304	0.356	0.344	0.353	0.332	0.355	0.379
Lluta	Tocontasi & Chapisca	Average	2.887	4.741	4.222	1.759	1.809	1.802	1.937	1.746	1.542	1.332	1.307	1.508	2.216
		90%	1.250	1.502	1.320	1.260	1.215	1.309	1.554	1.328	1.228	1.094	1.037	1.018	1.260
		80%	1.614	1.813	1.830	1.400	1.444	1.521	1.589	1.470	1.302	1.168	1.089	1.091	1.444
	Pan-americana	Average	2.807	6.104	2.321	0.839	0.751	1.128	1.023	0.566	0.339	0.208	0.164	0.371	1.385
		90%	0.393	0.246	0.382	0.098	0.159	0.565	0.696	0.253	0.096	0.049	0.069	0.072	0.256
		80%	0.611	0.433	0.517	0.164	0.297	0.710	0.786	0.317	0.125	0.067	0.078	0.082	0.349

Table A, 2.6 Average Runoff Coefficient in Lluta River Basin
<Coeficientes de Escorrentia Promedios en la Cuenca de Rio Lluta>

Location : **Lluta River at Alcerreca**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	Upstream Basin of Alcerreca A (km2)	Average R*A (mm.km2)	Upstream Avg. Rainfall R (mm) (R*A/A)	Flow Rate at Alcerreca Q (m3/s)	Runoff Coefficient f (= Q/R*A)	Upstream Average Altitude H (m, msl)
0.0 - 10.0	5.0	967.13	-	-		1.885		
10.0 - 50.0	30.0	165.60	-	-				
50.0 - 100.0	75.0	256.90	-	-				
100.0 - 150.0	125.0	270.38	-	-				
150.0 - 200.0	175.0	345.60	-	-				
200.0 - 300.0	250.0	1,089.04	885.44	221,360.00				
300.0 - 350.0	325.0	158.80	158.80	51,610.00				
350.0 - 400.0	375.0	124.56	124.56	46,710.00		(m3/year)		
		3,378.00	1,168.80	319,680.00	273.51	59,445,360	0.186	4,007

Note : - Average basin rainfall is calculated from Average Annual Precipitation Map (Isohyetal Map) by DGA in 1987
- Flow rate is obtained from monthly data observed by DGA
- Upstream average altitude of the station is obtained by averaging the altitude of the rainfall stations located in the upstream basin of that station

Table A, 2.7 Average Runoff Coefficient in Lluta River Basin
<Coeficientes de Escorrentia Promedios en la Cuenca de Rio Lluta>

Location : **Lluta River at Tocontasi**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	Upstream Basin of Tocontasi A (km2)	Average R*A (mm.km2)	Upstream Avg. Rainfall R (mm) (R*A/A)	Flow Rate at Tocontasi Q (m3/s)	Runoff Coefficient f (= Q/R*A)	Upstream Average Altitude H (m, msl)
0.0 - 10.0	5.0	967.13	139.13	695.63		2.216		
10.0 - 50.0	30.0	165.60	165.60	4,968.00				
50.0 - 100.0	75.0	256.90	256.90	19,267.50				
100.0 - 150.0	125.0	270.38	270.38	33,796.88				
150.0 - 200.0	175.0	345.60	345.60	60,480.00				
200.0 - 300.0	250.0	1,089.04	1,089.04	272,260.00				
300.0 - 350.0	325.0	158.80	158.80	51,610.00				
350.0 - 400.0	375.0	124.56	124.56	46,710.00		(m3/year)		
		3,378.00	2,550.00	489,788.00	192.07	69,883,776	0.143	3,899

Note : - Average basin rainfall is calculated from Average Annual Precipitation Map (Isohyetal Map) by DGA in 1987
- Flow rate is obtained from monthly data observed by DGA
- Upstream average altitude of the station is obtained by averaging the altitude of the rainfall stations located in the upstream basin of that station

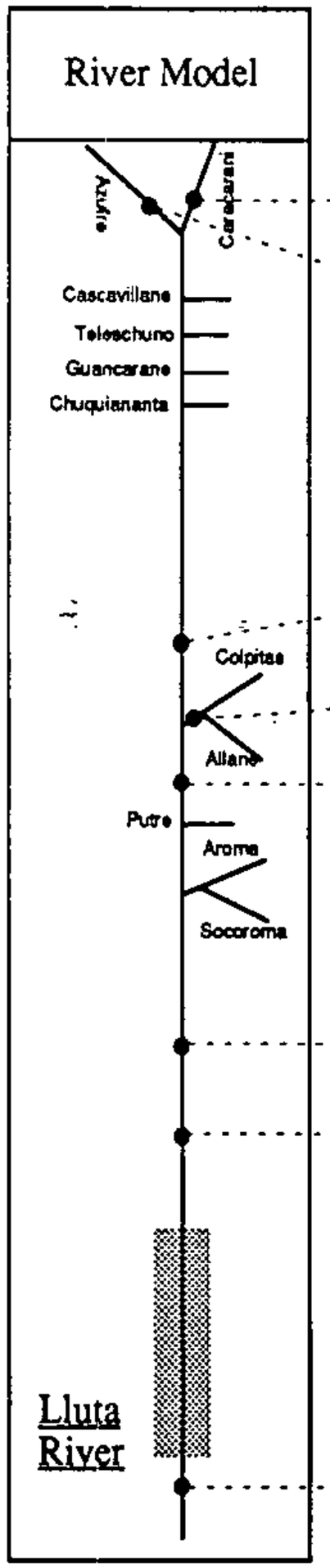
Table A, 2.8 Water Quality observed by DGA in Lluta River Basin

<Calidad de Agua Observada por DGA en la Cuenca del Rio Lluta>

River	Location	pH	E.C (mh/cm)	CO_3 (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	B (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NO_2$ (mg/l)	P (mg/l)	$N\text{-}NH_3$ (mg/l)
Caracarani	Humapalca	7.80	1,475	3.644	213.4	165	285	71.6	47.1	20.4	155.6	3.23	0.120	0.029	1.17	0.150	0.003	0.130	0.033
Azufre	Humapalca	2.11	9,243	0.000	0.0	1,377	2,111	174.1	190.5	139.8	314.2	19.05	1.246	0.215	61.94	3.628	0.069	-	0.230
Caracarani	Alcerreca	5.72	1,357	0.000	42.4	219	305	61.2	35.8	23.7	129.5	5.81	0.140	0.055	4.79	0.090	0.000	0.081	0.118
Colpitas	Alcerreca	7.53	2,375	0.725	132.6	545	223	70.8	29.3	60.4	350.2	21.55	0.465	0.014	1.41	0.124	0.001	0.164	0.037
Lluta	Alcerreca	6.28	1,734	0.378	58.9	309	284	65.5	36.7	35.6	193.7	9.85	0.209	0.031	4.83	0.188	0.000	0.000	-
	Tocontasi	6.89	1,728	0.686	56.6	323	310	92.5	36.7	28.5	198.9	10.69	0.305	0.106	3.82	0.209	0.003	0.055	0.092
	Poconchile	7.05	2,049	0.000	55.8	411	373	125.6	41.2	33.9	231.8	11.17	0.173	0.000	-	-	-	-	-
	Panamericana	7.43	3,895	0.000	89.1	704	751	269.4	81.9	53.0	428.6	16.84	0.124	0.075	2.37	0.431	0.015	0.046	0.211
Permissible Value		6.0 - 8.5				250	250		125.0				0.050	1.000	0.30	9.000			0.500

Table A, 2.9 Average Water Quality and Surface Flow Rate in Lluta River Basin
<Calidad Promedio del Agua y Nivel de Flujo en la Cuenca del Rio Lluta>

(Recorded period of the stations are different but range from 1946 to 1990)



	pH	E.C (mh/cm)	CO_3 (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	B (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NO_2$ (mg/l)	P (mg/l)	$N\text{-}NH_3$ (mg/l)	Q (m^3/s)
Humapalca	7.80	1,475	3.644	213.4	165	285	71.6	47.1	20.4	155.6	3.23	0.120	0.029	1.168	0.150	0.003	0.130	0.033	0.378
Humapalca	2.11	9,243	0.000	0.0	1,377	2,111	174.1	190.5	139.8	314.2	19.05	1.246	0.215	61.94	3.628	0.069	-	0.230	0.084
Caracarani in Alcerreca	5.72	1,357	0.000	42.4	219	305	61.2	35.8	23.7	129.5	5.81	0.140	0.055	4.788	0.090	0.000	0.081	0.118	0.855
Colpitas	7.53	2,375	0.725	132.6	545	223	70.8	29.3	60.4	350.2	21.55	0.465	0.014	1.414	0.124	0.001	0.164	0.037	0.521
Lluta in Alcerreca	6.28	1,734	0.378	58.9	309	284	65.5	36.7	35.6	193.7	9.85	0.209	0.031	4.825	0.188	0.000	0.000	-	1.885
Tocontasi & Chapisca	6.89	1,728	0.686	56.6	323	310	92.5	36.7	28.5	198.9	10.69	0.305	0.106	3.817	0.209	0.003	0.055	0.092	2.216
Poconchile	7.05	2,049	0.000	55.8	411	373	125.6	41.2	33.9	231.8	11.17	0.173	0.000	-	-	-	-	-	-
Panamericana	7.43	3,895	0.000	89.1	704	751	269.4	81.9	53.0	428.6	16.84	0.124	0.075	2.371	0.431	0.015	0.046	0.211	1.385

Table A, 2.10 Surface Flow Rate observed on 1st - 3rd June 1993 in Lluta River Basin
<Nivel de Flujo de Superficie Observado entre el 1 - 3 de Junio de 1993 en la Cuenca del Rio Lluta>

River	Location/ Quebrada	Code No.	Average Velocity (m/s)	Cross-section Area (m2)	Flow Rate (m3/s)	Remarks
Azufre	Humapalca	AZ-1	0.54	0.141	0.076	
Caracarani	Humapalca	CR-1	0.47	0.838	0.394	
Cascavillane	-	CV-1	0.59	0.139	0.082	Total Q = 0.334
Teleschuno	Qda. Teleschuno	TL-1	0.27	0.026	0.007	
	Qda. Gualluma	TL-2	no flow	-	-	
Guancarane	-	GC-1	0.33	0.509	0.168	
Chuquiananta	-	CQ-1	0.37	0.208	0.077	
Colpitas	-	CP-1	0.38	0.555	0.211	
Allane	-	AL-1	0.28	0.071	0.020	
Putre	Qda. Llancomane	PT-1	0.68	0.063	0.043	DGA calls "Llancoma"
	Qda. Pacollo	PT-2	0.37	0.046	0.017	
	Qda. Taipicahua	PT-3	0.52	0.354	0.184	Total Q = 0.315
	Qda. Jurase	PT-4	0.40	0.023	0.009	
	Canal Lluscuma	PT-5	0.53	0.117	0.062	
Aroma	-	AR-1	0.58	0.057	0.033	DGA calls "Socoroma"
Socoroma	-	SR-1	0.29	0.041	0.012	DGA calls "Colallaque"
Lluta	Chapisca	LT-1	0.69	1.716	1.184	

Table A, 2.11 (1) Water Quality observed on 1st - 3rd June 1993 in Lluta River Basin
<Calidad de Agua Observado entre el 1-3 de Junio 1993 en la Cuenca del Rio Lluta>

River	Code	Health Significance						
		As (mg/l)	Cd (mg/l)	Cr (mg/l)	CN (mg/l)	F (mg/l)	Pb (mg/l)	NO3 (mg/l)
Azufre	AZ-1	4.308	0.160	0.10		2.002	2.40	0.190
Caracarani	CR-1	0.085	0.002	0.03	0.00	0.350	0.02	0.509
Cascavillane	CV-1	0.421	0.002	0.03	0.00	0.140	0.02	0.000
Teleschuno	TL-1	0.000	0.000	0.02	0.00	0.180	0.02	0.000
Guancarane	GC-1	0.018	0.003	0.03	0.00	0.150	0.03	0.000
Chuquiananta	CQ-1	0.000	0.002	0.04	0.00	0.240	0.02	0.137
Colpitas	CP-1	1.058	0.002	0.04	0.00	0.350	0.02	0.563
Allane	AL-1	0.175	0.009	0.03	0.00	0.290	0.04	0.000
Putre : Llancomane	PT-1	0.093	0.001	0.02	0.00	0.260	0.00	0.000
Putre : Pacollo	PT-2	0.149	0.001	0.01	0.00	0.310	0.01	0.000
Putre : Taipicahua	PT-3	0.033	0.002	0.01	0.00	0.220	0.01	0.000
Putre : Jurase	PT-4	0.128	0.001	0.03	0.00	0.210	0.00	0.244
Aroma	AR-1	0.000	0.002	0.02	0.00	0.950	0.00	0.297
Socoroma	SR-1	0.000	0.003	0.02	0.00	0.950	0.02	0.190
Lluta at Chapisca	TC-1	0.270	0.009	0.03	0.00	0.760	0.07	3.291

Table A, 2.11 (2) Water Quality observed on 1st - 3rd June 1993 in Lluta River Basin

<Calidad de Agua Observado entre el 1-3 de Junio 1993 en la Cuenca del Rio Lluta>

River	Code	Aesthetic Quality										
		pH	CaCO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	Na (mg/l)	Zn (mg/l)	Al (mg/l)	Cu (mg/l)	Fe (mg/l)	Mn (mg/l)	TDS (mg/l)
Azufre	AZ-1	3.04	451.5	327.0	716.0	156.4	15.300	240.0	0.105	82.24	11.45	1,935
Caracarani	CR-1	6.30	446.5	151.7	370.0	156.0	0.010	0.3	0.021	0.26	0.08	1,328
Cascavillane	CV-1	6.70	70.5	8.9	80.7	29.7	0.019	0.9	0.200	10.30	0.30	212
Teleschuno	TL-1	6.32	61.0	5.3	60.0	17.5	0.008	0.1	0.015	0.17	0.03	151
Guancarane	GC-1	7.30	28.0	16.3	17.3	17.5	0.005	0.2	0.015	0.31	0.03	94
Chuquiananta	CQ-1	7.80	202.0	6.4	165.2	19.6	0.010	0.9	0.015	0.31	0.05	362
Colpitas	CP-1	6.70	332.4	873.5	254.5	589.0	0.034	0.9	0.030	2.54	0.45	2,452
Allane	AL-1	7.18	146.0	145.0	77.3	132.9	0.010	0.1	0.018	0.74	0.18	768
Putre : Llancomane	PT-1	7.79	103.0	20.2	89.5	25.0	0.007	0.3	0.013	0.90	0.03	276
Putre : Pacollo	PT-2	8.15	127.5	95.7	78.8	80.0	0.005	0.0	0.011	0.07	0.02	495
Putre : Taipicahua	PT-3	4.57	33.0	15.0	26.0	16.6	0.004	0.1	0.010	0.14	0.03	113
Putre : Jurase	PT-4	4.24	757.0	222.3	1129.0	303.6	0.061	5.3	0.037	2.72	0.87	2,018
Aroma	AR-1	3.31	184.0	5.3	374.6	15.2	0.148	22.3	0.024	10.10	0.93	625
Socoroma	SR-1	4.03	0.0	6.7	393.8	20.2	0.121	11.2	0.016	0.37	1.56	650
Lluta at Chapisca	TC-1	5.37	443.5	400.0	402.0	234.6	0.567	9.1	0.027	2.55	0.86	1,700

Table A, 2.11 (3) Water Quality observed on 1st - 3rd June 1993 in Lluta River Basin
<Calidad de Agua Observado entre el 1-3 de Junio 1993 en la Cuenca del Rio Lluta>

River	Code	Others									
		Temp (C)	EC (mh/cm)	CO3 (mg/l)	HCO3 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Turbidity (mg/l)	DO (mg/l)	B (mg/l)
Azufre	AZ-1	9.0	2,522	0.00	0.00	99.50	49.50	36.50	25	1.90	25.72
Caracarani	CR-1	1.9	1,700	0.00	220.00	96.20	50.20	21.80	12	2.40	2.30
Cascavillane	CV-1	4.4	300	0.00	46.40	18.60	5.90	4.10	116	2.30	0.48
Teleschuno	TL-1	8.7	200	0.00	33.00	18.00	3.90	3.10	15	7.40	0.17
Guancarane	GC-1	-	100	0.00	40.20	6.70	2.80	3.30	16	8.00	0.23
Chuquiananta	CQ-1	6.5	500	0.00	78.10	44.50	22.10	5.20	14	8.80	0.00
Colpitas	CP-1	7.8	3,900	0.00	179.40	96.50	3.00	59.50	38	7.80	14.10
Allane	AL-1	6.1	1,000	0.00	175.10	36.90	13.10	10.40	14	7.90	4.74
Putre : Llancomane	PT-1	1.9	400	0.00	44.50	28.90	7.60	5.30	34	2.20	0.85
Putre : Pacollo	PT-2	11.5	700	0.00	133.00	31.00	12.20	19.00	9	6.40	4.17
Putre : Taipicahua	PT-3	0.0	167	0.00	36.00	9.10	2.60	3.90	13	2.00	0.91
Putre : Jurase	PT-4	6.8	2,500	0.00	9.70	303.50	9.50	14.50	17	8.10	8.26
Aroma	AR-1	3.0	800	0.00	0.00	45.00	17.40	5.90	15	2.10	0.34
Socoroma	SR-1	1.8	800	0.00	0.00	83.10	22.00	4.70	16	2.60	0.28
Lluta at Chapisca	TC-1	-	2,100	0.00	7.90	116.00	35.00	37.80	46	9.40	12.22

Table A, 2.12 Surface Flow Rate observed in Azufre and Colpitas Rivers

<Nivel de Flujo de Superficie Observado en Rio Azufre y Colpitas>

Observation Period : November 1993

Code No.	Latitude	Logitude	Average Velocity (m/s)	Cross-section Area (m2)	Flow Rate (m3/s)	Remarks
Azufre River						
A-1	17°50′37″	69°42′16″	0.560	0.432	0.242	
A-2	17°50′37″	69°42′16″	-	-	0.000	measured by volume
A-3	17°50′17″	69°42′27″	0.448	0.164	0.074	
A-4	17°50′18″	69°42′23″	0.240	0.721	0.173	
A-5A	17°49′01″	69°44′22″	0.707	0.169	0.119	
A-5B	17°49′01″	69°44′22″	-	-	0.000	measured by volume
A-8	17°45′46″	69°48′09″	0.532	0.090	0.048	
A-10	17°45′20″	69°49′09″	0.377	0.128	0.048	
A-11	17°45′24″	69°49′07″	0.187	0.034	0.006	
A-12	17°43′25″	69°49′16″	0.248	0.055	0.014	
A-13	17°43′36″	69°49′03″	0.493	0.080	0.039	
AV-1	17°43′06″	69°49′19″	0.063	0.037	0.002	
AV-2	17°43′08″	69°49′16″	-	-	0.003	measured by volume
AV-3	17°43′21″	69°49′20″	-	-	0.000	measured by volume
AV-4	17°43′22″	69°49′20″	-	-	0.001	measured by volume
AV-5	17°43′22″	69°49′20″	-	-	0.001	measured by volume
Colpitas River						
C-1	17°59′59″	69°37′50″	0.490	1.901	0.932	
C-2	17°59′39″	69°37′48″	0.418	1.350	0.564	
C-3	17°59′45″	69°37′40″	0.540	0.640	0.346	
C-4	17°59′22″	69°35′35″	0.569	0.270	0.154	
C-5	17°59′21″	69°35′35″	0.241	0.457	0.110	
C-6	17°58′15″	69°34′03″	0.245	0.289	0.071	
C-9	17°58′51″	69°27′31″	0.191	0.029	0.006	
C-10	17°58′10″	69°27′14″	0.377	0.195	0.074	
C-11A	17°57′25″	69°25′36″	0.226	0.076	0.017	
C-11B	17°57′25″	69°25′36″	0.124	0.030	0.004	
C-12	17°59′01″	69°26′14″	0.086	0.029	0.002	
C-14	17°58′59″	69°27′31″	-	-	0.001	measured by volume
CV-1	17°59′24″	69°35′38″	-	-	0.002	measured by volume
CV-2	17°59′42″	69°36′22″	-	-	0.001	measured by volume
CV-3	17°59′42″	69°36′22″	-	-	0.002	measured by volume
CV-4	17°59′48″	69°36′58″	-	-	0.000	measured by volume
CV-5	17°59′24″	69°36′01″	-	-	0.004	measured by volume

Note : The observation points located in the map but not shown here dried up during the observation period

Table A, 2.13 (1) Water Quality observed in Azufre River
<Calidad de Agua Observado en Rio Azufre>

Observation Period : November 1993

River/Quebrada	Code	Health Significance						
		As (mg/l)	Cd (mg/l)	Cr (mg/l)	CN (mg/l)	F (mg/l)	Pb (mg/l)	NO3 (mg/l)
Lluta	A-1	1.739	-	-	-	-	-	-
Qda. Chadonasa	A-2	0.010	-	-	-	-	-	-
Azufre	A-3	5.212	-	-	-	-	-	-
Caracarani	A-4	0.166	-	-	-	-	-	-
Azufre	A-5A	0.006	-	-	-	-	-	-
Qda. Quenuavichiucha	A-5B	5.434	-	-	-	-	-	-
Azufre	A-8	6.753	-	-	-	-	-	-
Azufre	A-10	3.189	-	-	-	-	-	-
Azufre	A-11	2.327	-	-	-	-	-	-
Azufre-Agua Caliente	A-12	-	-	-	-	-	-	-
Azufre-Agua Caliente	A-13	1.513	-	-	-	-	-	-
Azufre-Agua Caliente	AV-1	4.759	-	-	-	-	-	-
Azufre-Agua Caliente	AV-2	4.663	-	-	-	-	-	-
Azufre-Agua Caliente	AV-3	0.000	-	-	-	-	-	-
Azufre-Agua Caliente	AV-4	0.000	-	-	-	-	-	-
Azufre-Agua Caliente	AV-5	0.013	-	-	-	-	-	-
Azufre-Agua Caliente	AV-6	0.193	-	-	-	-	-	-
Azufre-Agua Caliente	AV-7	0.785	-	-	-	-	-	-
Azufre-Agua Caliente	AV-8	0.032	-	-	-	-	-	-

Table A, 2.13 (2) Water Quality observed in Azufre River
<Calidad de Agua Observado en Rio Azufre>

Observation Period : November 1993

River/Quebrada	Code	Aesthetic Quality										
		pH	CaCO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	Na (mg/l)	Zn (mg/l)	Al (mg/l)	Cu (mg/l)	Fe (mg/l)	Mn (mg/l)	TDS (mg/l)
Lluta	A-1	2.96	-	661.9	1,200.8	257.6	-	-	-	-	-	-
Qda. Chadonasa	A-2	2.60	-	211.3	396.2	119.6	-	-	-	-	-	-
Azufre	A-3	2.84	-	1,683.5	3,194.0	466.0	-	-	-	-	-	-
Caracarani	A-4	5.11	-	173.4	300.2	172.5	-	-	-	-	-	-
Azufre	A-5A	3.23	-	1,196.8	1,248.8	322.0	-	-	-	-	-	-
Qda. Quenuavichiucha	A-5B	2.81	-	1,745.9	3,784.8	420.9	-	-	-	-	-	-
Azufre	A-8	3.01	-	2044.4	3938.5	506.0	-	-	-	-	-	-
Azufre	A-10	3.76	-	967.8	2,233.4	306.4	-	-	-	-	-	-
Azufre	A-11	3.60	-	786.3	1,248.8	151.8	-	-	-	-	-	-
Azufre-Agua Caliente	A-12	-	-	-	-	-	-	-	-	-	-	-
Azufre-Agua Caliente	A-13	2.18	-	352.0	1,858.8	262.2	-	-	-	-	-	-
Azufre-Agua Caliente	AV-1	4.10	-	506.2	2,497.6	414.0	-	-	-	-	-	-
Azufre-Agua Caliente	AV-2	2.94	-	459.4	2,497.6	368.0	-	-	-	-	-	-
Azufre-Agua Caliente	AV-3	7.17	-	11.3	33.1	11.3	-	-	-	-	-	-
Azufre-Agua Caliente	AV-4	7.22	-	13.5	30.3	11.7	-	-	-	-	-	-
Azufre-Agua Caliente	AV-5	7.19	-	42.5	100.9	19.3	-	-	-	-	-	-
Azufre-Agua Caliente	AV-6	1.65	-	156.0	1,508.1	248.4	-	-	-	-	-	-
Azufre-Agua Caliente	AV-7	1.89	-	377.9	1,469.7	240.4	-	-	-	-	-	-
Azufre-Agua Caliente	AV-8	6.00	-	72.3	165.2	72.5	-	-	-	-	-	-

Table A, 2.13 (3) Water Quality observed in Azufre River
<Calidad de Agua Observado en Rio Azufre>

Observation Period : November 1993

River/Quebrada	Code	Others									
		Temp (C)	EC (mh/cm)	CO3 (mg/l)	HCO3 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Turbidity (mg/l)	DO (mg/l)	B (mg/l)
Lluta	A-1	-	6,200	0.00	0.00	153.90	84.00	68.00	-	2.90	8.93
Qda. Chadonasa	A-2	-	1,700	0.00	0.00	90.00	56.50	29.00	-	3.60	3.13
Azufre	A-3	-	18,800	0.00	0.00	285.00	160.00	190.00	-	2.80	27.87
Caracarani	A-4	-	1,800	0.00	298.40	77.60	47.10	27.00	-	5.40	2.46
Azufre	A-5A	-	19,500	0.00	0.00	410.00	180.00	90.00	-	3.40	6.82
Qda. Quenuavichiucha	A-5B	-	5,300	0.00	0.00	322.00	170.00	156.00	-	1.80	27.87
Azufre	A-8	-	24,700	0.00	0.00	330.10	175.00	210.00	-	4.30	28.93
Azufre	A-10	-	10,600	0.00	0.00	259.90	125.00	160.00	-	3.60	7.03
Azufre	A-11	-	10,800	0.00	0.00	145.10	65.10	50.10	-	3.50	9.56
Azufre-Agua Caliente	A-12	-	-	-	-	-	-	-	-	-	-
Azufre-Agua Caliente	A-13	-	5,700	0.00	0.00	220.00	103.00	104.90	-	3.90	9.77
Azufre-Agua Caliente	AV-1	-	9,400	0.00	0.00	185.00	90.00	100.10	-	2.60	12.08
Azufre-Agua Caliente	AV-2	-	9,100	0.00	0.00	195.00	90.00	109.90	-	1.80	11.03
Azufre-Agua Caliente	AV-3	-	200	0.00	24.40	9.40	5.50	5.10	-	3.10	0.00
Azufre-Agua Caliente	AV-4	-	100	0.00	28.10	10.20	5.70	5.10	-	2.80	0.00
Azufre-Agua Caliente	AV-5	-	400	0.00	70.20	42.30	17.60	6.70	-	2.00	0.03
Azufre-Agua Caliente	AV-6	-	4,500	0.00	0.00	218.00	104.00	126.30	-	4.50	2.33
Azufre-Agua Caliente	AV-7	-	5,600	0.00	0.00	181.00	88.00	116.90	-	4.80	11.87
Azufre-Agua Caliente	AV-8	-	1,000	0.00	167.20	59.90	29.60	12.90	-	2.50	0.84

Table A, 2.13 (4) Water Quality observed in Colpitas River
<Calidad de Agua Observado en Rio Colpitas>

Observation Period : November 1993

River/Quebrada	Code	Health Significance						
		As (mg/l)	Cd (mg/l)	Cr (mg/l)	CN (mg/l)	F (mg/l)	Pb (mg/l)	NO3 (mg/l)
Lluta : after confluence	C-1	0.520	-	-	-	-	-	-
Lluta : before confluenc	C-2	0.299	-	-	-	-	-	-
Colpitas	C-3	0.674	-	-	-	-	-	-
Colpitas	C-3-4	0.679	-	-	-	-	-	-
Allane	C-4	0.459	-	-	-	-	-	-
Colpitas	C-5	0.998	-	-	-	-	-	-
Colpitas	C-6	1.692	-	-	-	-	-	-
Allane	C-9	0.341	-	-	-	-	-	-
Colpitas	C-10	2.081	-	-	-	-	-	-
Colpitas	C-11A	0.810	-	-	-	-	-	-
Colpitas	C-11B	4.489	-	-	-	-	-	-
Allane	C-12	0.444	-	-	-	-	-	-
Qda. Curaguara	C-14	0.098	-	-	-	-	-	-
Colpitas	CV-1	-	-	-	-	-	-	-
Colpitas	CV-2	0.853	-	-	-	-	-	-
Colpitas	CV-2'	0.565	-	-	-	-	-	-
Colpitas	CV-3	0.913	-	-	-	-	-	-
Colpitas	CV-4	1.719	-	-	-	-	-	-
Colpitas	CV-4'	0.587	-	-	-	-	-	-
Colpitas	CV-5	0.578	-	-	-	-	-	-

Table A, 2.13 (5) Water Quality observed in Colpitas River
<Calidad de Agua Observado en Rio Colpitas>

Observation Period : November 1993

River/Quebrada	Code	Aesthetic Quality										
		pH	CaCO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	Na (mg/l)	Zn (mg/l)	Al (mg/l)	Cu (mg/l)	Fe (mg/l)	Mn (mg/l)	TDS (mg/l)
Lluta : after confluence	C-1	5.21	-	408.4	665.2	165.6	-	-	-	-	-	-
Lluta : before confluenc	C-2	3.20	-	366.2	665.2	161.0	-	-	-	-	-	-
Colpitas	C-3	6.76	-	607.6	240.2	370.3	-	-	-	-	-	-
Colpitas	C-3-4	6.69	-	651.9	252.6	425.5	-	-	-	-	-	-
Allane	C-4	6.93	-	426.8	206.6	271.4	-	-	-	-	-	-
Colpitas	C-5	6.77	-	1,099.7	342.0	731.4	-	-	-	-	-	-
Colpitas	C-6	6.68	-	1,760.1	396.7	1,196.0	-	-	-	-	-	-
Allane	C-9	7.13	-	149.6	235.4	138.0	-	-	-	-	-	-
Colpitas	C-10	7.95	-	1,648.1	377.0	1,127.0	-	-	-	-	-	-
Colpitas	C-11A	7.88	-	478.6	147.0	312.8	-	-	-	-	-	-
Colpitas	C-11B	7.67	-	4,485.8	259.4	2,829.0	-	-	-	-	-	-
Allane	C-12	7.23	-	375.4	90.3	317.4	-	-	-	-	-	-
Qda. Curaguara	C-14	8.10	-	142.2	48.5	100.7	-	-	-	-	-	-
Colpitas	CV-1	6.62	-	-	-	-	-	-	-	-	-	-
Colpitas	CV-2	6.08	-	1,773.6	307.4	966.0	-	-	-	-	-	-
Colpitas	CV-2'	6.76	-	570.0	206.6	377.2	-	-	-	-	-	-
Colpitas	CV-3	6.70	-	2,070.3	270.4	1,081.0	-	-	-	-	-	-
Colpitas	CV-4	7.28	-	1,081.2	195.0	538.2	-	-	-	-	-	-
Colpitas	CV-4'	6.80	-	582.8	241.1	381.8	-	-	-	-	-	-
Colpitas	CV-5	5.68	-	573.2	206.6	331.2	-	-	-	-	-	-

Table A, 2.13 (6) Water Quality observed in Colpitas River
<Calidad de Agua Observado en Rio Colpitas>

Observation Period : November 1993

River/Quebrada	Code	Others									
		Temp (C)	EC (mh/cm)	CO3 (mg/l)	HCO3 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Turbidity (mg/l)	DO (mg/l)	B (mg/l)
Lluta : after confluence	C-1	-	2,200	0.00	0.00	110.40	48.00	38.00	-	2.60	5.56
Lluta : before confluenc	C-2	-	2,500	0.00	0.00	93.60	47.60	41.10	-	3.10	3.87
Colpitas	C-3	-	2,500	0.00	378.30	79.60	23.40	71.60	-	3.90	22.61
Colpitas	C-3-4	-	2,500	0.00	148.30	84.00	21.00	70.00	-	3.30	24.67
Allane	C-4	-	2,300	0.00	134.20	68.00	21.00	70.00	-	3.70	12.67
Colpitas	C-5	-	3,700	0.00	191.60	117.00	21.00	75.90	-	3.10	72.00
Colpitas	C-6	-	5,900	0.00	251.40	216.00	24.00	120.00	-	3.10	133.05
Allane	C-9	-	900	0.00	124.50	59.10	19.00	16.40	-	3.40	6.05
Colpitas	C-10	-	5,800	0.00	251.40	140.10	22.00	120.00	-	4.30	61.79
Colpitas	C-11A	-	1,500	0.00	140.30	53.10	12.70	45.40	-	4.90	20.88
Colpitas	C-11B	-	2,000	0.00	609.00	148.10	25.30	204.90	-	8.10	181.47
Allane	C-12	-	1,800	0.00	299.00	20.40	23.00	13.70	-	4.70	16.18
Qda. Curaguara	C-14	-	500	0.00	146.40	30.70	11.30	11.30	-	4.60	4.60
Colpitas	CV-1	-	2,200	-	-	-	-	-	-	3.50	-
Colpitas	CV-2	-	8,700	0.00	184.30	114.00	58.00	380.10	-	4.10	83.58
Colpitas	CV-2'	-	2,800	0.00	158.60	78.00	22.00	77.00	-	3.30	19.94
Colpitas	CV-3	-	9,600	0.00	130.60	110.00	60.00	450.00	-	4.40	93.05
Colpitas	CV-4	-	4,200	0.00	83.00	76.00	36.00	206.50	-	5.80	26.67
Colpitas	CV-4'	-	2,700	0.00	140.30	80.00	22.00	70.00	-	3.80	19.73
Colpitas	CV-5	-	3,600	0.00	218.40	88.20	34.10	70.00	-	4.80	15.73

Table A, 2.13(7) Water Quality Observed in Azufre River
<Calidad de Agua Observado en Rio Azufre>

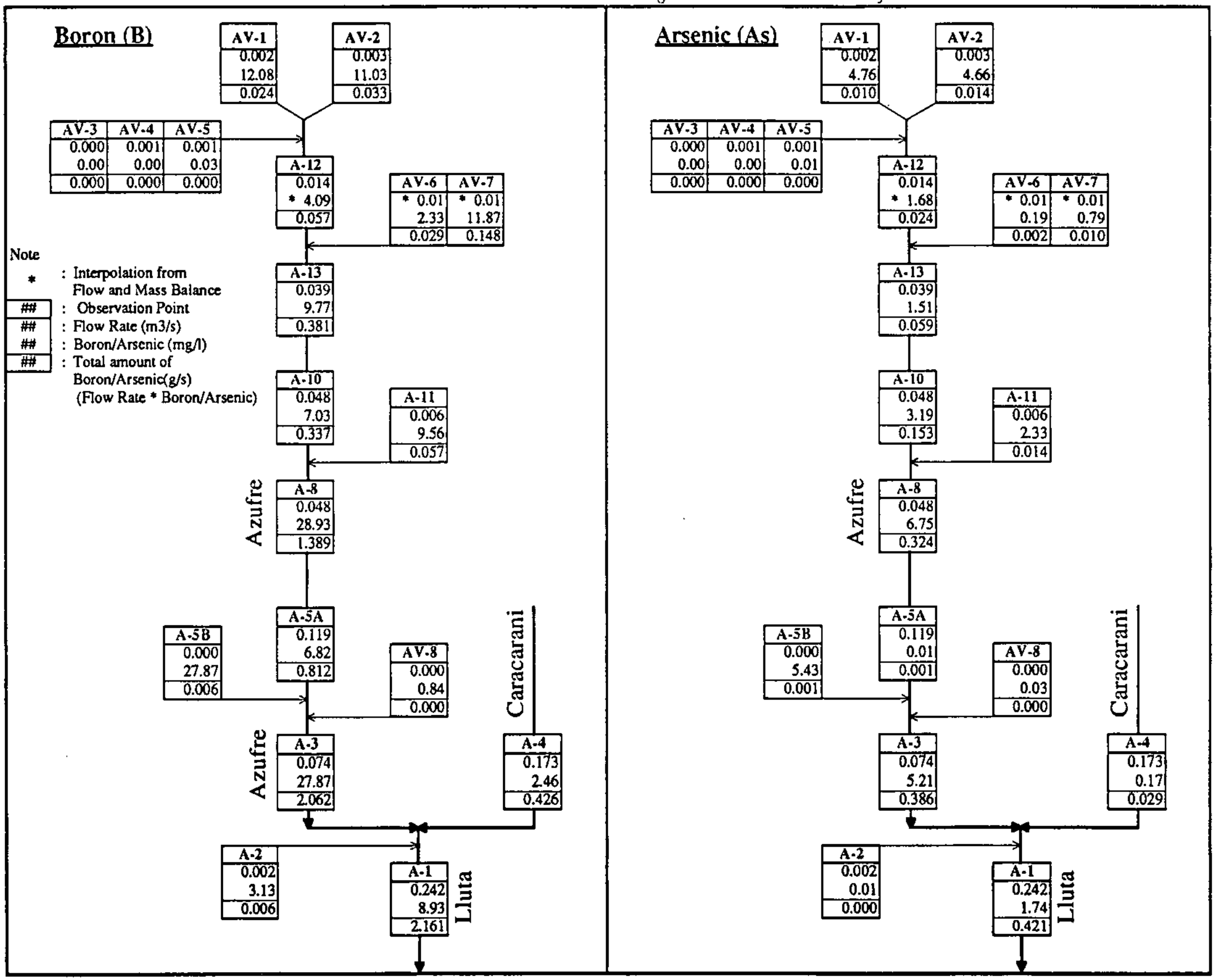


Table A, 2.13(8) Water Quality Observed in Colpitas River
<Calidad de Agua Observado en Rio Colpitas>

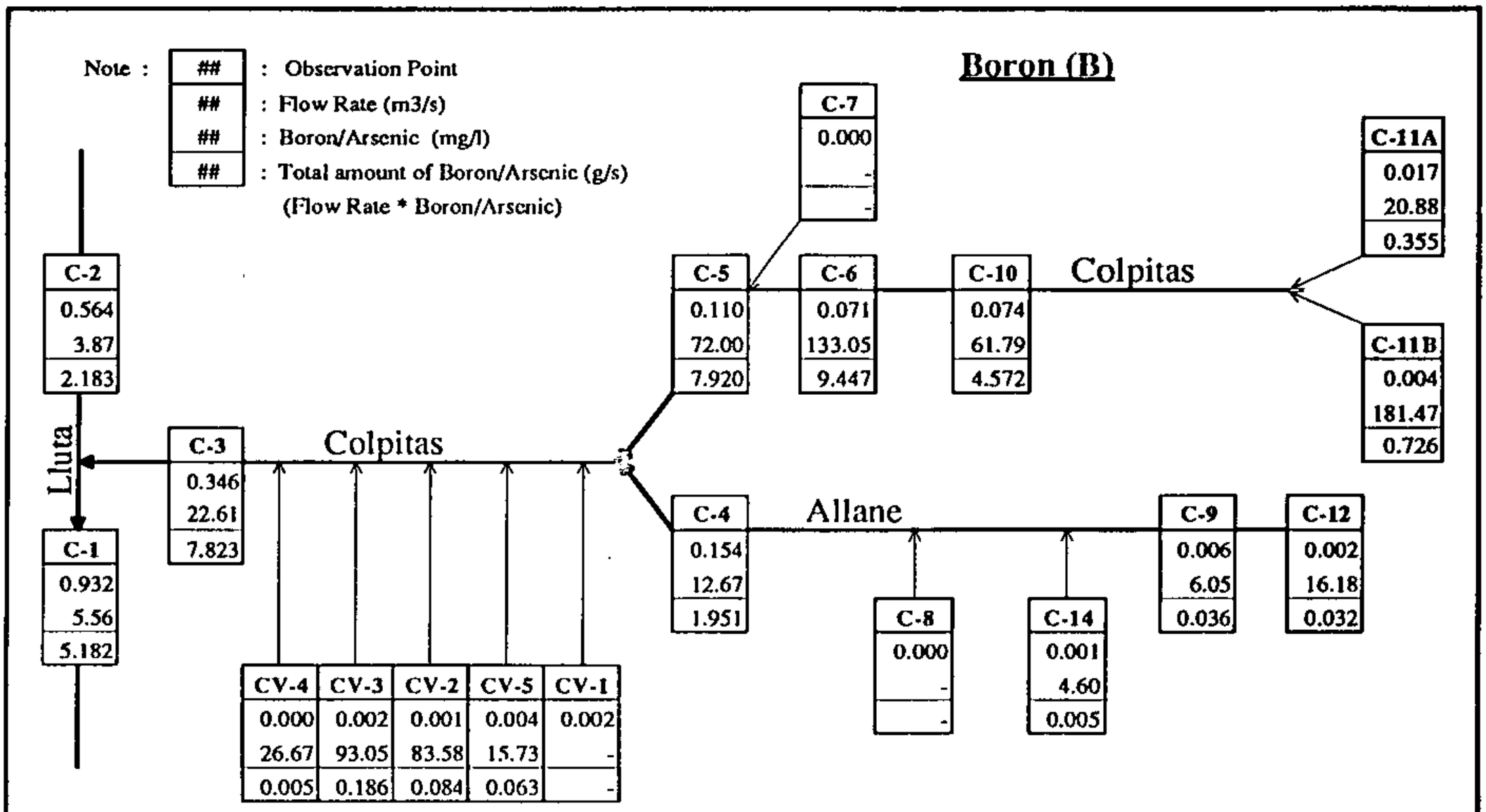


Table A, 2.14 (1) Storage Volume at Tocontasi & Chapisca

<Volumen de Almacenamiento en Tocontasi y Chapisca>

(Inflow = Qobs, Outflow = 2.0 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Year	Month	Max or Min Vol.Storage (m3)	Necessary Storage Volume (m3)	
			Rising Period	Decreasing Period
1946	Mar	14,785,027		
1946	Dec	2,643,408		-12,141,619
1947	Jan	2,938,032	294,624	
1947	Nov	-14,799,024		-17,737,056
1947	Dec	-14,209,776	589,248	
1948	Jan	-14,531,184		-321,408
1948	Mar	-163,728	14,367,456	
1948	Dec	-6,769,872		-6,606,144
1949	Jul	54,428,976	61,198,848	
1950	Feb	45,225,302		-9,203,674
1950	Mar	46,135,958	910,656	
1950	Dec	37,162,886		-8,973,072
1951	Mar	41,656,550	4,493,664	
1951	Dec	30,039,206		-11,617,344
1952	Sep	65,290,406	35,251,200	
1952	Dec	63,048,326		-2,242,080
1953	Mar	121,415,846	58,367,520	
1953	Nov	115,947,850		-5,467,997
1954	Mar	149,035,680	33,087,830	
1954	Dec	140,115,917		-8,919,763
1955	Mar	154,900,944	14,785,027	
1955	Nov	147,653,971		-7,246,973
1956	Feb	152,459,539	4,805,568	
1957	Jan	139,546,368		-12,913,171
1957	Mar	147,299,126	7,752,758	
1957	Nov	138,138,307		-9,160,819
1958	Mar	155,880,288	17,741,981	
1958	Apr	155,260,800		-619,488
1958	Sep	159,470,208	4,209,408	
1959	Jan	153,392,832		-6,077,376
1959	Mar	165,831,581	12,438,749	
1959	Dec	156,911,818		-8,919,763
1960	Mar	171,696,845	14,785,027	
1960	Dec	162,777,082		-8,919,763
1961	Mar	177,562,109	14,785,027	
1961	Dec	167,705,251		-9,856,858
1962	Mar	181,874,074	14,168,822	
1962	May	180,772,474		-1,101,600
1962	Jun	180,927,994	155,520	
1962	Dec	175,086,490		-5,841,504
1963	Sep	200,148,538	25,062,048	
1963	Dec	196,962,883		-3,185,654
1964	Jan	199,309,162	2,346,278	
1964	Jul	194,988,730		-4,320,432
1964	Sep	195,597,850	609,120	
1964	Dec	193,132,858		-2,464,992
1965	Apr	208,391,962	15,259,104	
1965	Jun	203,493,946		-4,898,016
1966	Feb	214,959,226	11,465,280	
1966	May	212,992,762		-1,966,464
1966	Jun	213,718,522	725,760	
1967	Jan	200,009,434		-13,709,088
1967	Mar	209,154,874	9,145,440	

Table A, 2.14 (2) Storage Volume at Tocontasi & Chapisca
<Volumen de Almacenamiento en Tocontasi y Chapisca>
(Inflow = Qobs, Outflow = 2.0 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Year	Month	Max or Min Vol.Storage (m3)	Necessary Storage Volume (m3)	
			Rising Period	Decreasing Period
1968	Jan	198,850,205		-10,304,669
1968	Mar	214,821,763	15,971,558	
1968	Dec	200,488,867		-14,332,896
1969	Mar	215,273,894	14,785,027	
1969	Dec	205,346,794		-9,927,101
1970	Jan	206,471,722	1,124,928	
1970	Feb	206,036,266		-435,456
1970	Mar	206,464,810	428,544	
1970	Dec	188,014,954		-18,449,856
1971	Mar	197,097,322	9,082,368	
1971	Dec	181,334,506		-15,762,816
1972	Mar	229,287,370	47,952,864	
1972	Apr	228,667,882		-619,488
1972	Aug	233,586,634	4,918,752	
1972	Dec	227,860,819		-5,725,814
1973	Mar	242,645,846	14,785,027	
1973	Dec	232,069,018		-10,576,829
1974	Mar	249,701,530	17,632,512	
1974	Jul	247,759,258		-1,942,272
1974	Aug	250,250,170	2,490,912	
1974	Dec	241,617,773		-8,632,397
1975	Mar	254,860,042	13,242,269	
1975	Jun	253,386,058		-1,473,984
1975	Jul	253,787,818	401,760	
1975	Nov	248,017,162		-5,770,656
1976	Mar	289,566,058	41,548,896	
1976	Apr	288,946,570		-619,488
1976	May	288,973,354	26,784	
1976	Dec	281,317,450		-7,655,904
1977	Jun	301,375,382	20,057,933	
1977	Dec	294,631,430		-6,743,952
1978	Feb	300,529,094	5,897,664	
1978	Dec	285,463,526		-15,065,568
1979	Jan	286,963,430	1,499,904	
1979	Feb	284,810,342		-2,153,088
1979	Mar	288,560,102	3,749,760	
1979	Dec	279,049,709		-9,510,394
1980	Mar	293,834,736	14,785,027	
1981	Jan	279,601,286		-14,233,450
1981	Mar	315,178,214	35,576,928	
1982	Jan	303,011,021		-12,167,194
1982	Feb	303,228,749	217,728	
1983	Dec	255,530,938		-47,697,811
1984	Mar	268,585,718	13,054,781	
1985	Jan	255,816,662		-12,769,056
1985	Mar	269,181,965	13,365,302	
1985	Nov	261,650,650		-7,531,315
1986	Mar	276,837,437	15,186,787	
1986	Dec	267,917,674		-8,919,763
1987	Mar	282,702,701	14,785,027	
1987	Dec	272,600,208		-10,102,493
1988	Mar	304,944,912	32,344,704	
1988	Dec	294,030,000		-10,914,912
1989	Mar	304,503,494	10,473,494	

Table A, 2.15 (1) Storage Volume at Tocontasi & Chapisca

<Volumen de Almacenamiento en Tocontasi y Chapisca>

(Inflow = Qobs, Outflow = 1.5 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Year	Month	Max or Min Vol.Storage (m3)	Necessary Storage Volume (m3)	
			Rising Period	Decreasing Period
1946	Jun	20,857,392		
1946	Dec	18,411,408		-2,445,984
1947	Jan	20,045,232	1,633,824	
1947	Jun	18,444,240		-1,600,992
1947	Jul	18,631,728	187,488	
1947	Nov	15,397,776		-3,233,952
1948	Aug	40,491,792	25,094,016	
1948	Nov	39,677,040		-814,752
1949	Sep	111,623,702	71,946,662	
1949	Dec	110,070,230		-1,553,472
1950	Sep	117,367,142	7,296,912	
1950	Dec	116,002,886		-1,364,256
1951	Sep	126,607,622	10,604,736	
1951	Dec	124,647,206		-1,960,416
1954	Sep	283,149,475	158,502,269	
1954	Dec	282,027,917		-1,121,558
1955	Sep	304,782,739	22,754,822	
1955	Nov	303,994,771		-787,968
1956	Sep	316,969,632	12,974,861	
1957	Jan	314,333,568		-2,636,064
1957	Aug	327,830,371	13,496,803	
1957	Nov	326,015,107		-1,815,264
1958	Oct	361,336,896	35,321,789	
1959	Jan	359,716,032		-1,620,864
1959	Sep	378,785,376	19,069,344	
1959	Dec	377,663,818		-1,121,558
1960	Sep	400,418,640	22,754,822	
1960	Dec	399,297,082		-1,121,558
1961	Aug	422,015,962	22,718,880	
1961	Dec	419,993,251		-2,022,710
1962	Sep	443,995,258	24,002,006	
1962	Nov	443,062,138		-933,120
1963	Nov	480,869,914	37,807,776	
1963	Dec	480,786,883		-83,030
1964	Mar	486,014,602	5,227,718	
1964	Apr	485,470,282		-544,320
1964	Oct	491,751,130	6,280,848	
1964	Nov	491,466,010		-285,120
1965	Apr	513,167,962	21,701,952	
1965	Jun	510,905,146		-2,262,816
1966	Jul	537,567,322	26,662,176	
1967	Jan	532,476,634		-5,090,688
1967	Sep	548,252,669	15,776,035	
1967	Dec	545,746,205		-2,506,464
1968	Apr	566,772,163	21,025,958	
1968	Jun	562,376,995		-4,395,168
1968	Sep	564,274,426	1,897,430	
1968	Dec	563,152,867		-1,121,558
1969	Sep	585,858,442	22,705,574	
1969	Dec	583,778,794		-2,079,648
1970	Mar	588,784,810	5,006,016	
1970	Jun	587,164,810		-1,620,000

Table A, 2.15 (2) Storage Volume at Tocontasi & Chapisca

<Volumen de Almacenamiento en Tocontasi y Chapisca>

(Inflow = Qobs, Outflow = 1.5 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Year	Month	Max or Min Vol.Storage (m3)	Necessary Storage Volume (m3)	
			Rising Period	Decreasing Period
1970	Jul	587,298,730	133,920	
1970	Dec	582,214,954		-5,083,776
1971	Mar	595,185,322	12,970,368	
1971	May	594,790,474		-394,848
1971	Jul	595,186,186	395,712	
1971	Dec	591,302,506		-3,883,680
1972	Sep	654,959,434	63,656,928	
1972	Dec	653,596,819		-1,362,614
1973	Sep	676,351,642	22,754,822	
1973	Dec	673,573,018		-2,778,624
1974	Aug	702,251,770	28,678,752	
1974	Dec	698,889,773		-3,361,997
1975	Aug	720,861,034	21,971,261	
1975	Nov	719,717,962		-1,143,072
1976	Sep	772,977,514	53,259,552	
1976	Dec	770,125,450		-2,852,064
1977	Sep	800,947,526	30,822,077	
1977	Dec	799,207,430		-1,740,096
1978	Feb	807,653,894	8,446,464	
1978	Mar	807,225,350		-428,544
1978	Aug	808,509,254	1,283,904	
1978	Dec	805,807,526		-2,701,728
1979	Jan	808,646,630	2,839,104	
1979	Feb	807,703,142		-943,488
1979	Mar	812,792,102	5,088,960	
1979	Apr	812,688,422		-103,680
1979	Oct	816,381,677	3,693,254	
1979	Dec	815,161,709		-1,219,968
1980	Aug	836,281,757	21,120,048	
1980	Dec	832,391,942		-3,889,814
1981	Sep	874,268,813	41,876,870	
1981	Dec	871,676,813		-2,592,000
1982	Feb	873,425,549	1,748,736	
1982	Apr	872,787,917		-637,632
1982	Jul	873,475,661	687,744	
1982	Nov	864,403,834		-9,071,827
1982	Dec	864,805,594	401,760	
1983	Dec	854,714,938		-10,090,656
1984	Aug	873,605,174	18,890,237	
1984	Oct	872,573,558		-1,031,616
1984	Nov	872,884,598	311,040	
1985	Jan	872,107,862		-776,736
1985	Sep	891,538,618	19,430,755	
1985	Nov	891,031,450		-507,168
1986	Sep	915,527,232	24,495,782	
1986	Dec	914,405,674		-1,121,558
1987	Sep	937,214,928	22,809,254	
1987	Dec	934,856,208		-2,358,720
1988	Aug	972,892,944	38,036,736	
1988	Nov	972,027,216		-865,728
1989	May	987,793,747	15,766,531	
1990	May	977,468,688		-10,325,059
1990	Sep	979,512,912	2,044,224	

Table A, 2.16 Probability of Storage Volume at Tocontasi & Chapisca

<Probabilidad de Volumen de Almacenamiento en Tocontasi y Chapisca>

(Inflow = Qobs, Outflow = 2.0 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Order	Necessary Storage Volume (m3)		Weibull Probability		
	Rising Period	Decreasing Period	T (Year)	P(x) (%)	F(x) (%)
1	61,198,848	-47,697,811	45.000	2.22	97.78
2	58,367,520	-18,449,856	22.500	4.44	95.56
3	47,952,864	-17,737,056	15.000	6.67	93.33
4	41,548,896	-15,762,816	11.250	8.89	91.11
5	35,576,928	-15,065,568	9.000	11.11	88.89
6	35,251,200	-14,332,896	7.500	13.33	86.67
7	33,087,830	-14,233,450	6.429	15.56	84.44
8	32,344,704	-13,709,088	5.625	17.78	82.22
9	25,062,048	-12,913,171	5.000	20.00	80.00
10	20,057,933	-12,769,056	4.500	22.22	77.78
11	17,741,981	-12,167,194	4.091	24.44	75.56
12	17,632,512	-12,141,619	3.750	26.67	73.33
13	15,971,558	-11,617,344	3.462	28.89	71.11
14	15,259,104	-10,914,912	3.214	31.11	68.89
15	15,186,787	-10,576,829	3.000	33.33	66.67
16	14,785,027	-10,304,669	2.813	35.56	64.44
17	14,785,027	-10,102,493	2.647	37.78	62.22
18	14,785,027	-9,927,101	2.500	40.00	60.00
19	14,785,027	-9,856,858	2.368	42.22	57.78
20	14,785,027	-9,510,394	2.250	44.44	55.56
21	14,785,027	-9,203,674	2.143	46.67	53.33
22	14,785,027	-9,160,819	2.045	48.89	51.11
23	14,367,456	-8,973,072	1.957	51.11	48.89
24	14,168,822	-8,919,763	1.875	53.33	46.67
25	13,365,302	-8,919,763	1.800	55.56	44.44
26	13,242,269	-8,919,763	1.731	57.78	42.22
27	13,054,781	-8,919,763	1.667	60.00	40.00
28	12,438,749	-8,632,397	1.607	62.22	37.78
29	11,465,280	-7,655,904	1.552	64.44	35.56
30	10,473,494	-7,531,315	1.500	66.67	33.33
31	9,145,440	-7,246,973	1.452	68.89	31.11
32	9,082,368	-6,743,952	1.406	71.11	28.89
33	7,752,758	-6,606,144	1.364	73.33	26.67
34	5,897,664	-6,077,376	1.324	75.56	24.44
35	4,918,752	-5,841,504	1.286	77.78	22.22
36	4,805,568	-5,770,656	1.250	80.00	20.00
37	4,493,664	-5,725,814	1.216	82.22	17.78
38	4,209,408	-5,467,997	1.184	84.44	15.56
39	3,749,760	-4,898,016	1.154	86.67	13.33
40	2,490,912	-4,320,432	1.125	88.89	11.11
41	2,346,278	-3,185,654	1.098	91.11	8.89
42	1,499,904	-2,464,992	1.071	93.33	6.67
43	1,124,928	-2,242,080	1.047	95.56	4.44
44	910,656	-2,153,088	1.023	97.78	2.22

Table A, 2.17 Probability of Storage Volume at Tocontasi & Chapisca

<Probabilidad de Volumen de Almacenamiento en Tocontasi y Chapisca>

(Inflow = Qobs, Outflow = 1.5 m3/s)

("Rising" or "Decreasing" refers to the period that storage volume changes from Max. to Min. or Min. to Max. in a cycle)

Order	Necessary Storage Volume (m3)		Weibull Probability		
	Rising Period	Decreasing Period	T (Year)	P(x) (%)	F(x) (%)
1	158,502,269	-10,325,059	45.000	2.22	97.78
2	71,946,662	-10,090,656	22.500	4.44	95.56
3	63,656,928	-9,071,827	15.000	6.67	93.33
4	53,259,552	-5,090,688	11.250	8.89	91.11
5	41,876,870	-5,083,776	9.000	11.11	88.89
6	38,036,736	-4,395,168	7.500	13.33	86.67
7	37,807,776	-3,889,814	6.429	15.56	84.44
8	35,321,789	-3,883,680	5.625	17.78	82.22
9	30,822,077	-3,361,997	5.000	20.00	80.00
10	28,678,752	-3,233,952	4.500	22.22	77.78
11	26,662,176	-2,852,064	4.091	24.44	75.56
12	25,094,016	-2,778,624	3.750	26.67	73.33
13	24,495,782	-2,701,728	3.462	28.89	71.11
14	24,002,006	-2,636,064	3.214	31.11	68.89
15	22,809,254	-2,592,000	3.000	33.33	66.67
16	22,754,822	-2,506,464	2.813	35.56	64.44
17	22,754,822	-2,445,984	2.647	37.78	62.22
18	22,754,822	-2,358,720	2.500	40.00	60.00
19	22,718,880	-2,262,816	2.368	42.22	57.78
20	22,705,574	-2,079,648	2.250	44.44	55.56
21	21,971,261	-2,022,710	2.143	46.67	53.33
22	21,701,952	-1,960,416	2.045	48.89	51.11
23	21,120,048	-1,815,264	1.957	51.11	48.89
24	21,025,958	-1,740,096	1.875	53.33	46.67
25	19,430,755	-1,620,864	1.800	55.56	44.44
26	19,069,344	-1,620,000	1.731	57.78	42.22
27	18,890,237	-1,600,992	1.667	60.00	40.00
28	15,776,035	-1,553,472	1.607	62.22	37.78
29	15,766,531	-1,364,256	1.552	64.44	35.56
30	13,496,803	-1,362,614	1.500	66.67	33.33
31	12,974,861	-1,219,968	1.452	68.89	31.11
32	12,970,368	-1,143,072	1.406	71.11	28.89
33	10,604,736	-1,121,558	1.364	73.33	26.67
34	8,446,464	-1,121,558	1.324	75.56	24.44
35	7,296,912	-1,121,558	1.286	77.78	22.22
36	6,280,848	-1,121,558	1.250	80.00	20.00
37	5,227,718	-1,121,558	1.216	82.22	17.78
38	5,088,960	-1,031,616	1.184	84.44	15.56
39	5,006,016	-943,488	1.154	86.67	13.33
40	3,693,254	-933,120	1.125	88.89	11.11
41	2,839,104	-865,728	1.098	91.11	8.89
42	2,044,224	-814,752	1.071	93.33	6.67
43	1,897,430	-787,968	1.047	95.56	4.44
44	1,748,736	-776,736	1.023	97.78	2.22

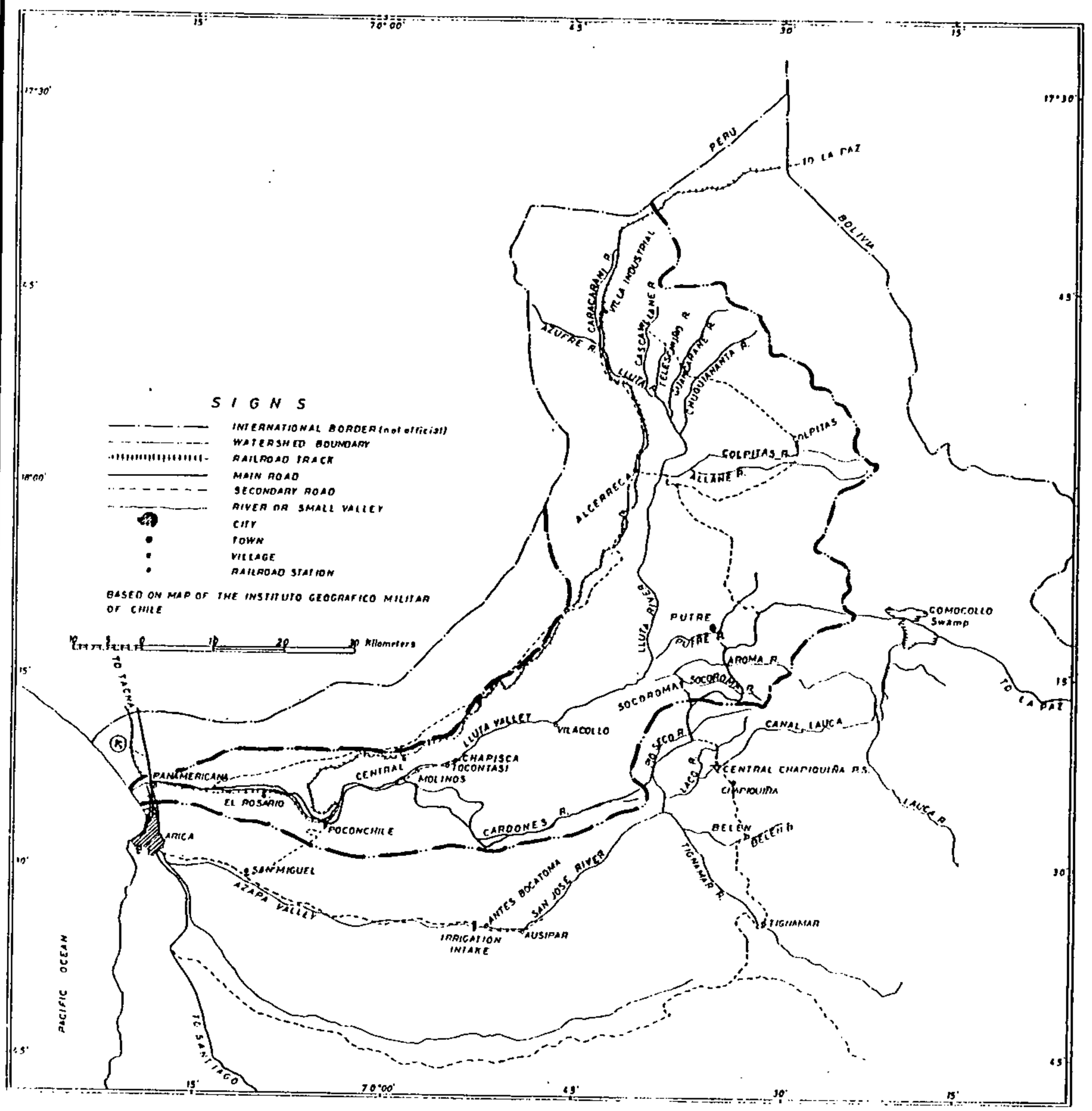


Fig. A, 2.1 River System of Lluta River Basin

<Systema Fluvial de la Cuenca del Rio Lluta>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Visviri	17 35 -	69 30	4070
2	Villa Industrial	17 47 -	69 43	4060
3	Humapalca	17 50 -	69 42	3970
4	Caquena	18 03 -	69 12	4400
5	Alcerreca	18 00 -	69 40	3990
6	Puquios	18 11 -	69 45	3750
7	Putre	18 12 -	69 35	3530
8	Pacollo	18 10 -	69 29	4050
9	Cotacotani	18 11 -	69 14	4500
10	Isla Blanca	18 11 -	69 13	4500
11	Parinacota (ex Endesa)	18 12 -	69 16	4390
12	Chucuyo (ex Endesa)	18 13 -	69 20	4200
13	Chucuyo (Carabineros)	18 13 -	69 20	4200
14	Las Cuevas (Conaf)	18 12 -	69 30	3940
15	Murmuntane	18 21 -	69 32	3200
16	Portezuelo Chapiquiña	18 23 -	69 29	4400
17	Central Chapiquiña	18 23 -	69 33	3280
18	Lluta	18 24 -	70 10	290
19	Oficina Arica	18 29 -	70 19	20
20	U. del Norte	18 29 -	70 19	27
21	Aerodromo El Buitre	18 30 -	70 19	30
22	Azapa	18 31 -	70 01	250
23	Belén	18 29 -	69 31	3240
24	Tignamar	18 35 -	69 30	3200

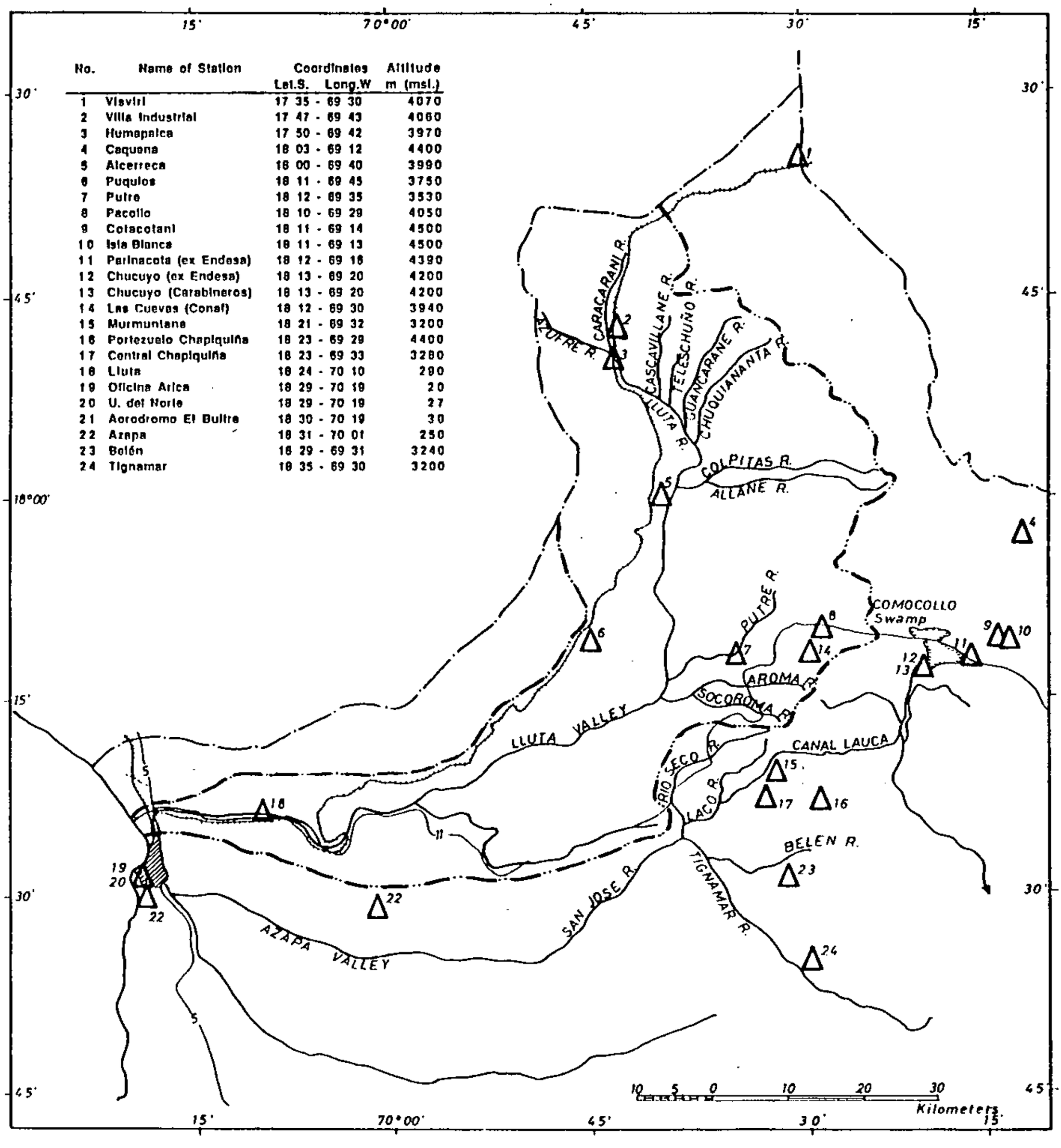
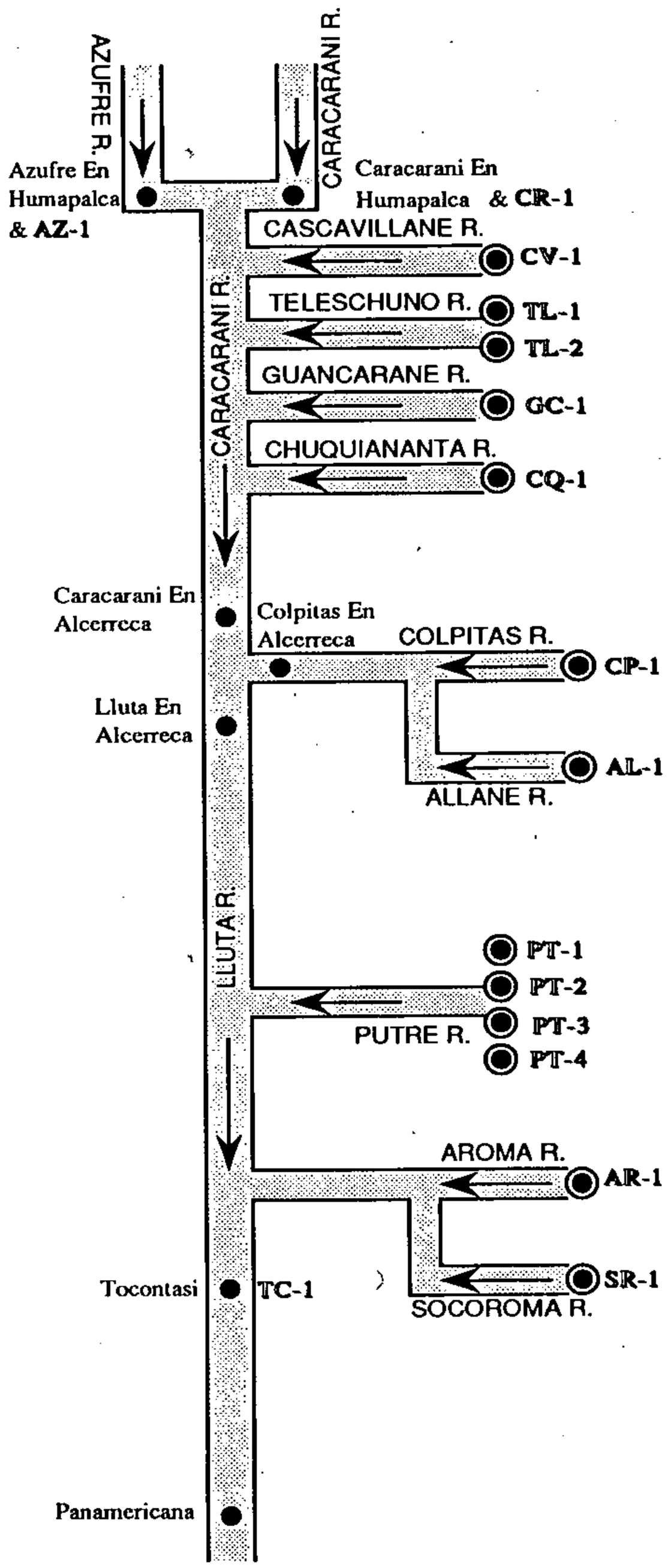


Fig. A, 2.2 Precipitation Stations of DGA in Lluta River Basin

<Estacion de Precipitacion de DGA en la Cuenca del Rio Lluta>



LEGEND

- DGA's Observation Station
- Observation Point in this study

Flow Model in Lluta River Basin

Fig. A, 2.3 Flow Model in Lluta River Basin ,
<Modelo de Flujo en la Cuenca del Rio Lluta>

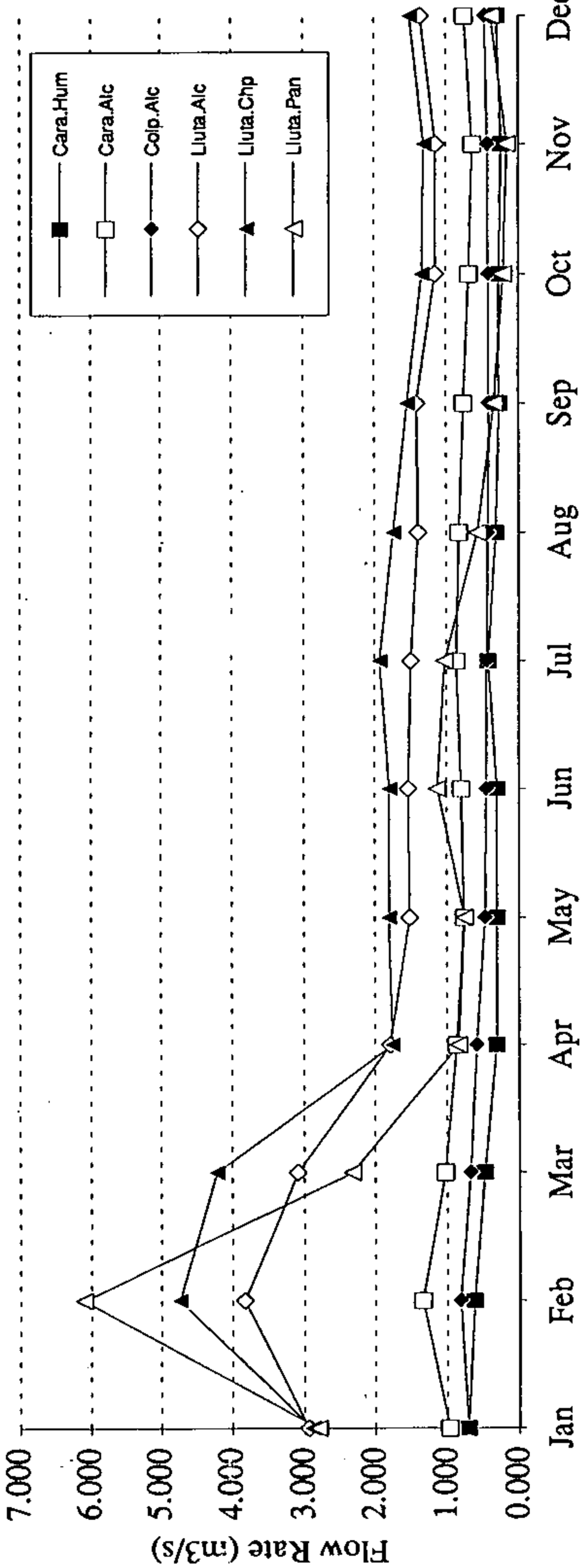


Fig. A, 2.4 Average Surface Flow Rate in Lluta River Basin

<Nivel de Flujo de Superficie Premedio Meansual de la Cuenca del Rio Lluta>

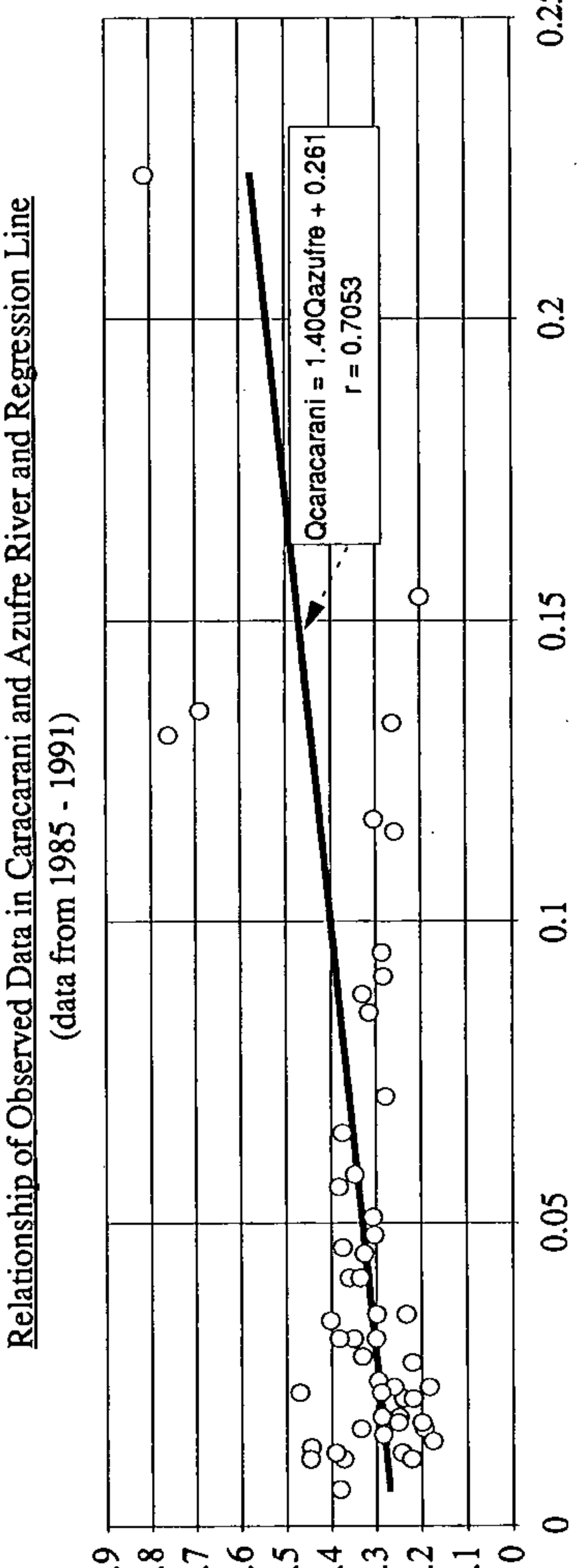


Fig. A, 2.5 Relationship of Observed Data in Caracarani and Azufre river and Regression line

<Relacion de Datos Observado en Rio Caracarani y Azufre y Linea de Regresion>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Visviri	17 35 -	69 30	4070
2	Villa Industrial	17 47 -	69 43	4060
3	Humapalca	17 50 -	69 42	3970
4	Caquena	18 03 -	69 12	4400
5	Alcerreca	18 00 -	69 40	3990
6	Puquios	18 11 -	69 45	3750
7	Putre	18 12 -	69 35	3530
8	Pacollo	18 10 -	69 29	4050
9	Colacolani	18 11 -	69 14	4500
10	Isla Blanca	18 11 -	69 13	4500
11	Parinacota (ex Endesa)	18 12 -	69 18	4380
12	Chucuyo (ex Endesa)	18 13 -	69 20	4200
13	Chucuyo (Carabineros)	18 13 -	69 20	4200
14	Las Cuevas (Conaf)	18 12 -	69 30	3940
15	Murmuntane	18 21 -	69 32	3200
16	Portezuelo Chapiquiña	18 23 -	69 29	4400
17	Central Chapiquiña	18 23 -	69 33	3280
18	Lluta	18 24 -	70 10	290
19	Oficina Arica	18 29 -	70 18	20
20	U. del Norte	18 29 -	70 19	27
21	Aerodromo El Buitre	18 30 -	70 19	30
22	Azapa	18 31 -	70 01	250
23	Belén	18 29 -	69 31	3240
24	Tignamar	18 35 -	69 30	3200

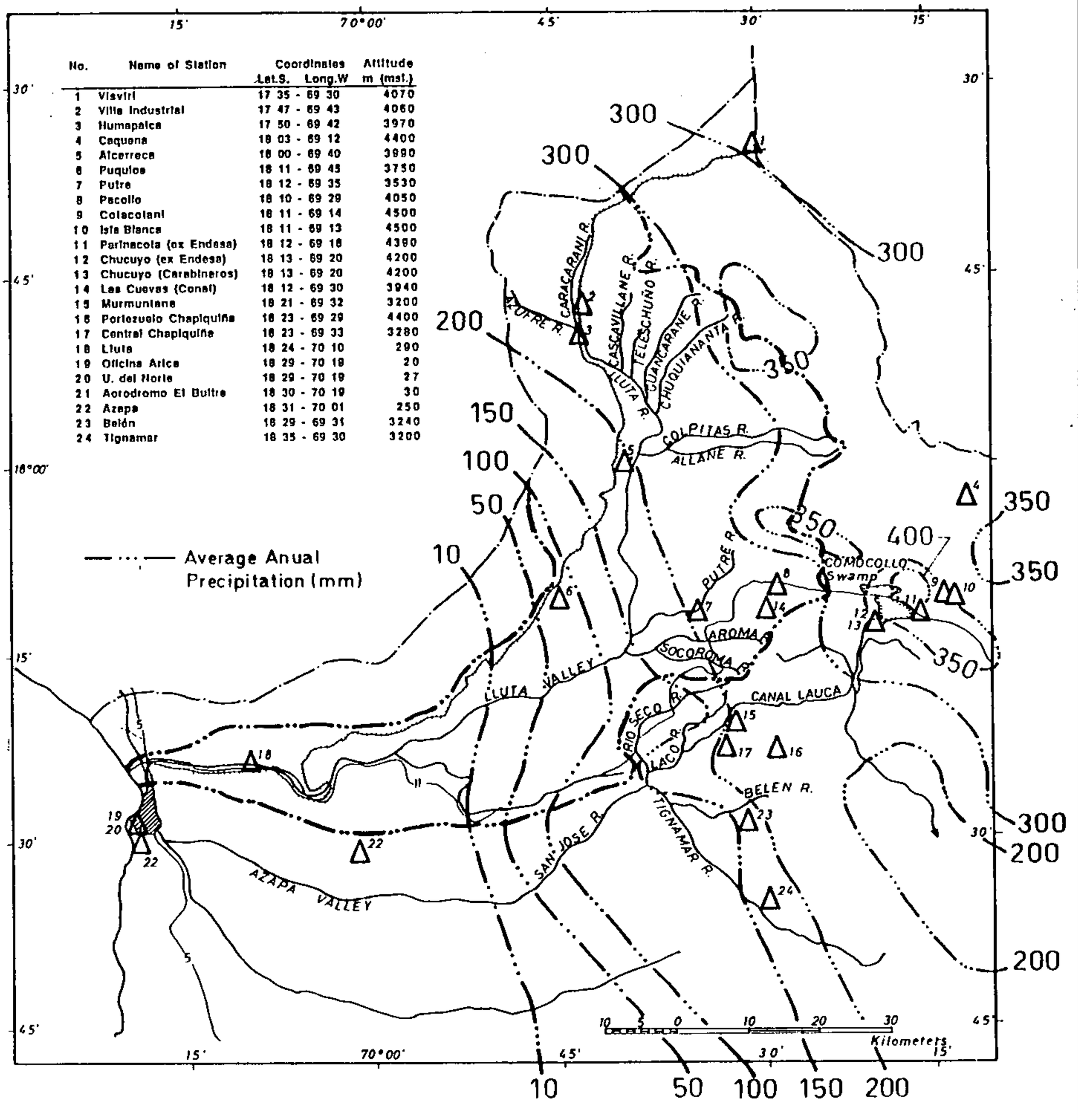


Fig. A, 2.6 Average Precipitation (Isohyetal Map) in Lluta River Basin

<Precipitacion Promedio en Mapa de Isoyeta en la Cuenca del Rio Lluta>

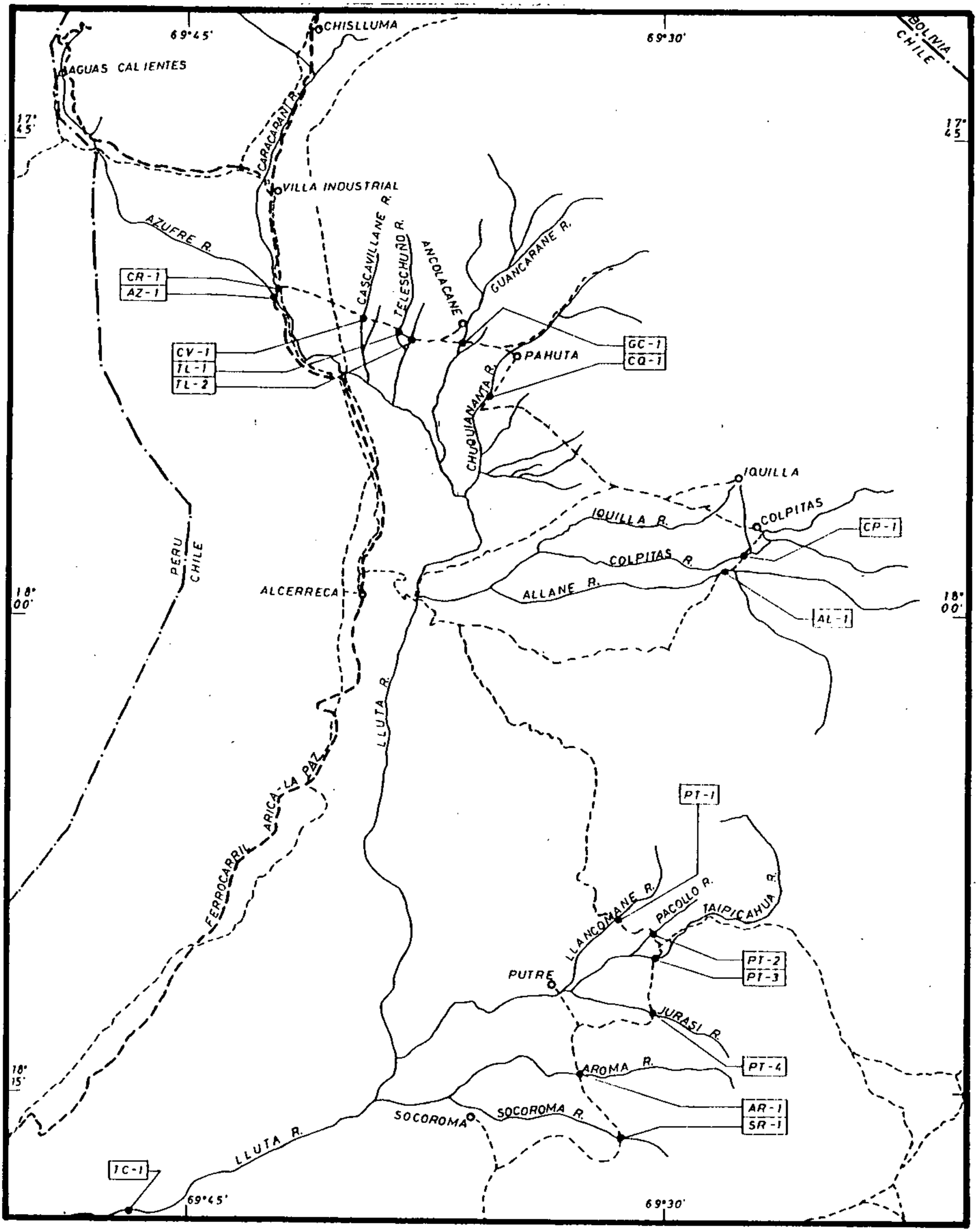


Fig. A, 2.7 Location of Observation Points on 1st - 3rd June 1993 in Lluta River Basin

<Ubicacion de Los Puntos de Observacion el 1 - 3 Junio 1993 en la Cuenca del Rio

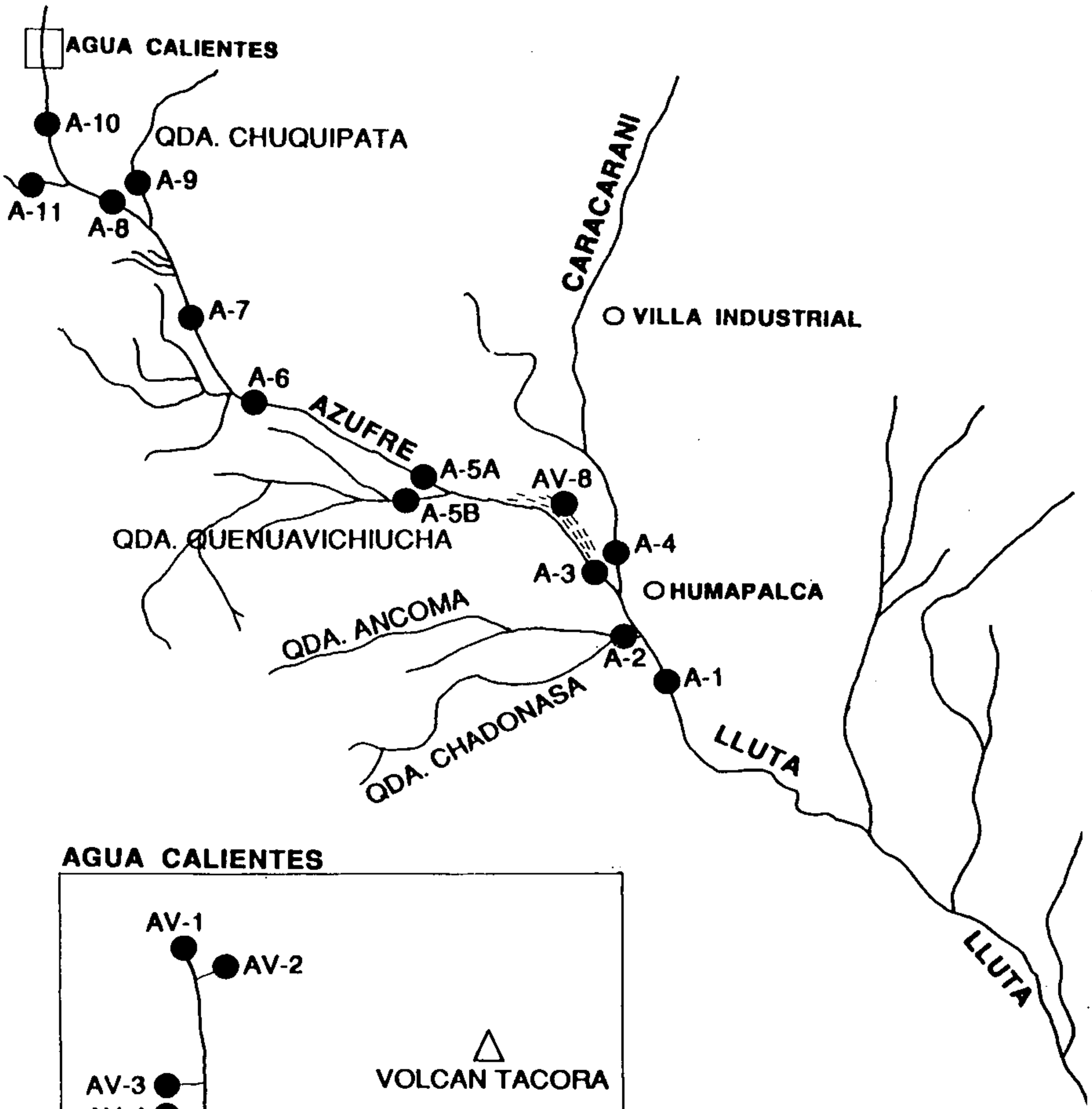


Fig. A, 2.8 Location of Observation Points in Azufre River Basin in November 1993

<Mapa de Ubicacion de Los Puntos el Noviembre 1993 en la Cuenca del Rio Azufre>

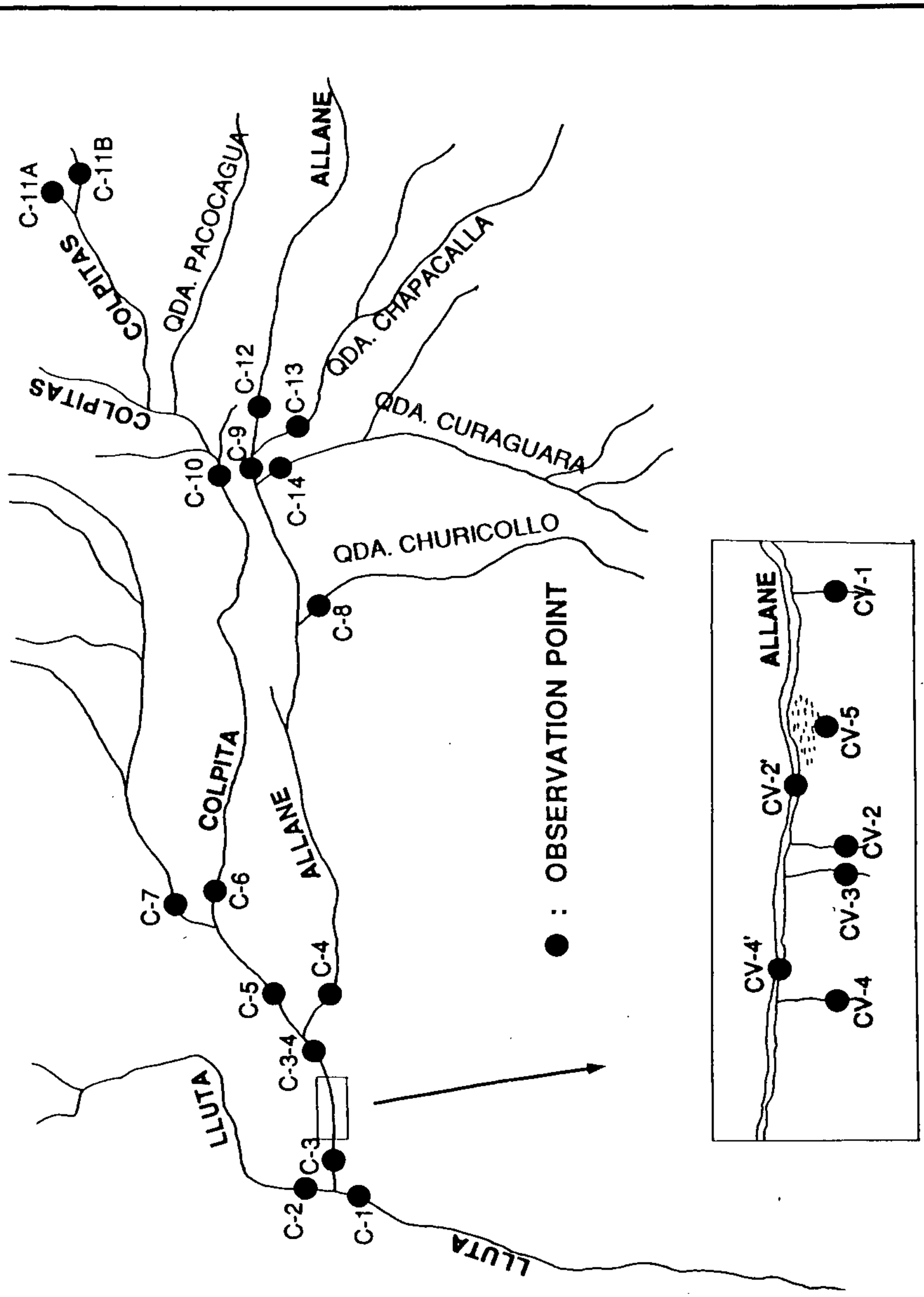
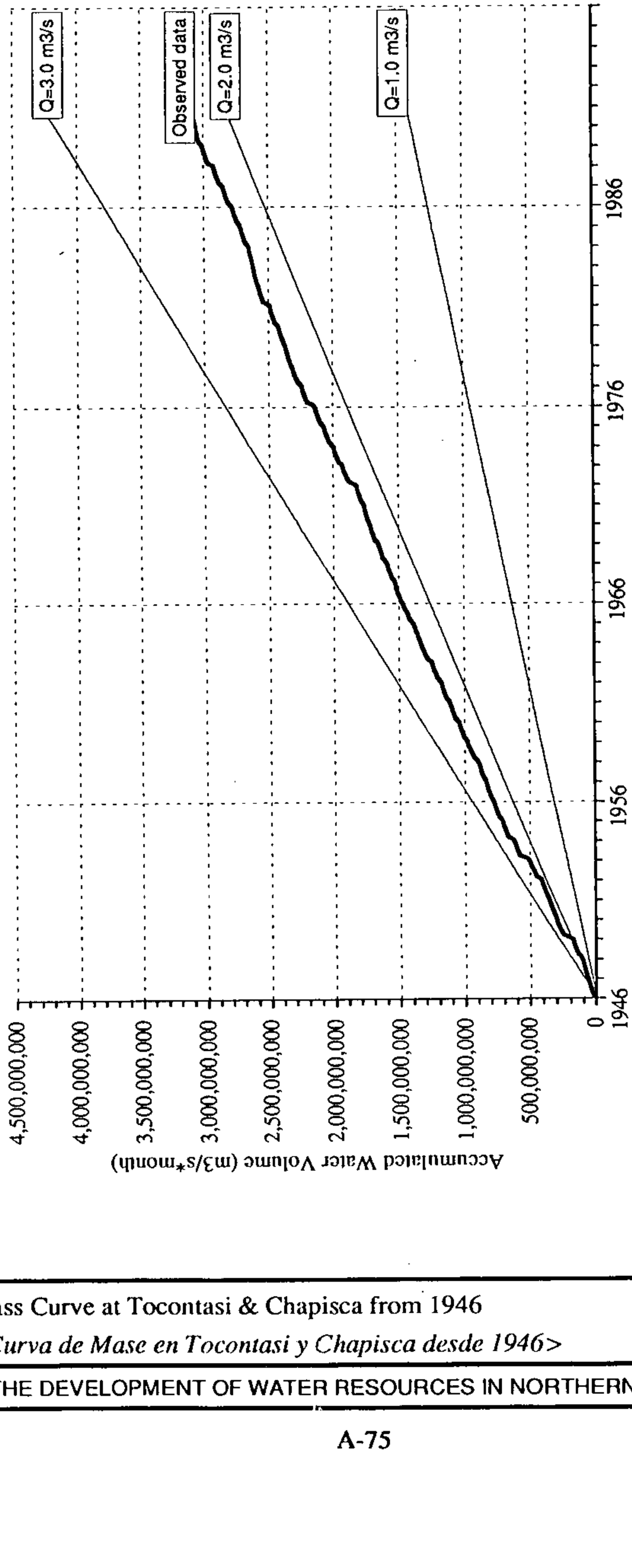


Fig. A, 2.9 Location of Observation Points in Colpitas River Basin in November 1993

<Mapa de Ubicacion de Los Puntos el Noviembre 1993 en la Cuenca del Rio Colpitas>



Mass Curve at Toconiasi & Chapisca from 1946

Fig. A, 2.10 Mass Curve at Tocontasi & Chapisca from 1946

<Curva de Mase en Tocontasi y Chapisca desde 1946>

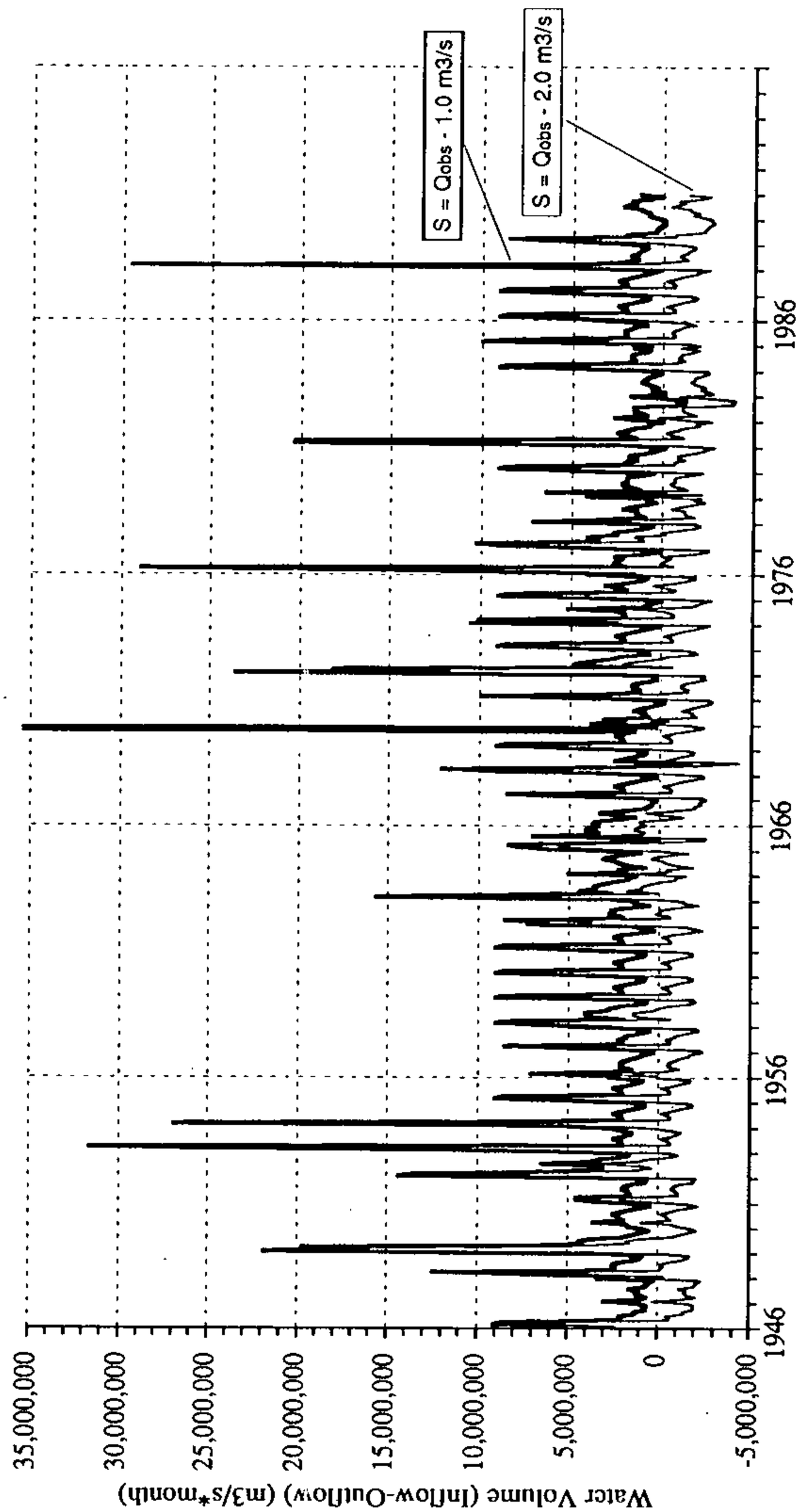


Fig. A, 2.11 Water Storage (Inflow - Outflow) at Tocontasi & Chapisca

<Almacenamiento de Agua (Entrada - Salida) en Tocontasi y Chapisca>

SUPPORTING REPORT A

Chapter III SURFACE WATER OF PAMPA DEL TAMARUGAL BASIN

Chapter III SURFACE WATER OF PAMPA DEL TAMARUGAL BASIN

3.1 General

Pampa del Tamarugal basin located in the Region I in northern Chile has a total drainage basin area of 18,005 km^2, covers the river basin of 7,435 km^2 and residual basin of 10,570 km^2.Drainage basin area is shown in Fig. A, 3.1 and Table A, 3.1.

3.1.1 Climate and Precipitation

Information on climate in the basin is obtained from Pampa Lirima (Pueblo Nuevo) weather station in the upstream of the basin. Average maximum temperature is in March at 22.4 °C and average minimum temperature is in June at 10.0 °C. Humidity does not vary much throughout a year within a range of 35 - 55 %.

Precipitation is observed regularly by DGA and Meteorological Department. Most of the stations are distributed in the upstream of the basin as shown in Fig. A, 3.2. Periods of the observation are as follows;

Station	Observation Period
Puchultiza	1982-1988
Mocha	1988-Present
Poroma	1968-1992
Pampa Lirima (Pueblo Nuevo)	1982-Present
Pampa Lirima	1977-1989
Parca	1977-Present
Mamina	1986-1992
Sagasca	1977-Present
Esmeralda	1966-1972
Iquique	1984-Present

Average precipitation of these stations are shown in Table A, 3.2 and recorded monthly precipitation is shown in Appendix A, 3.1.

3.1.2 River System

Main rivers in the basin are Aroma, Tarapaca, Quipisca, Juan Morales (or Sagasca), Quisma (or Pica), Chacarilla, Ramada and Cahuisa river. All rivers originates in the east and flow westwards to the basin. In downstream, all flows infiltrate to underground and the river courses disappear.

Although there are several rivers in the basin, only these seven (7) rivers are not dried-up according to the information from DGA. Flow model is shown in Fig., A, 3.3.

3.2 Surface Flow Rate

3.2.1 Flow Rate at Major Stations

Daily water levels are observed at DGA's observation stations by automatic recorders. Flow rate at each stations is generally calculated by a so called "Discharge Rating Curve" or "H-Q Curve" which is a calibration curve of water level and flow rate. Major observation stations are as follows;

River	Location	Observation Period
Tarapaca	Mina San Juan	1984 - 1990
Coscaya	Saitoco	1985 - 1990
	Pampa Lirima	1977 - 1989

Average, maximum and minimum surface flow rate of these stations in the recorded years are shown in Table A, 3.3, fluctuation of these flows throughout a year are shown in Fig. A.3.4 and recorded monthly flow rates are shown in Appendix A, 3.2.

Information on flow rate in recent years is limited to only in Tarapaca river basin, a main river in the basin, and Coscaya river, a tributary of Tarapaca river in the south. Average total flow rate is 0.303 m^3/s. All this water amount probably infiltrate and evaporate in the basin.

3.2.2 Calculation of Runoff Coefficient

Runoff, originated from the precipitation or rainfall in the basin, generally flows through water channels as surface flow and infiltrates to

underground as groundwater. An effort is done to find out relationship of rainfall and surface flow for the evaluation of groundwater. Average yearly rainfall contour map prepared by DGA in 1987, as shown in Fig. A, 3.5, is used to calculate the total amount of water entering the basin in comparison with surface flow rate in the basin in Tarapaca river basin at Mina San Juan, the only available observed data in the basin. Runoff coefficient is found to be 0.054 as shown in Table A, 3.4. This can be interpreted that about 5.4 % of rainfall flows through rivers as surface flow in the upstrream of Tarapaca river basin.

3.3 Surface Water Quality

3.3.1 Water Quality at Major Stations

Water quality is observed at DGA's observation stations by sampling method, water samples are taken from the river and analyzed in the laboratory. Observation stations are as follows;

River	Location	Observation Period
Tarapaca	Mocha	1970 - 1981
	Pachica	1970 - 1987
Coscaya	Pampa Lirima	1975 - 1989

The items of the analysis are classified as follows;

(1) Health Significance : As, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_3$

(2) Aesthetic Quality : Cl^-, Cu, Fe, Na, P, SO_4, pH

(3) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

Results of the examination are shown in Table A, 3.5. Average monthly data are shown in Appendix A, 3.3.

3.3.2 Evaluation of Water Quality

According to World Health Organization (WHO), permissible drinking water quality is shown partly as follows;

	pH	Cl^- (mg/l)	SO_4 (mg/l)	Mg (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NH_3$ (mg/l)
Permissible Values	6.0-8.5	250	250	125	0.05	1.0	0.3	9.0	0.5

Water Quality Standard is referred in Appendix A, 5.

The result shows that water quality in Tarapaca river is not so good, especially B, As and Fe. However, information is limited in only this river, supplementary observation on the other rivers was done, as explained in the latter section, for the evaluation of water quality in the whole basin.

3.3.3 Supplementary Observation

1) Objective

The purposes of the observation are to measure flow rate and examine water quality as supplementary data of DGA's regular observation for more information on the available water sources.

2) Location

Observation points are located as follows:

Location	Code	Latitude	Longitude
1. Aroma	AR-1	19° 37′	69° 31′
2. Tarapaca	TR-1	19° 55′	69° 30′
3. Quipisca	QP-1	20° 00′	69° 11′
4. Sagasca	SG-1	20° 11′	69° 20′

Location of these points are shown in Fig. A, 3.3 and A, 3.5.

3) Observation Method

The measurement was conducted by JICA Study Team & DGA. River conditions during the measurement are shown in Appendix A, 3.4. The items of measurement are as follows;

(1) Flow Rate

Flow velocity was measured by a propeller current meter across the river section at a length interval of about 1/10 of the river width. Flow rate was calculated as the product of average velocity times cross sectional area

$$Q = \sum_{i=1}^{m} V_i \times A_i$$

where Q = flow rate (m^3/s),
V = flow velocity (m/s),
A = cross sectional area of the river (m^2) and
m = number of sub-cross sections.

(2) Water Quality

Water Quality was measured by sampling method. Samples were taken from the checking points and analyzed in the laboratory following the standard method of water quality analysis. Items of the analysis are classified as follows;

(i) Health Significance : As, Cd, Cr, CN, F, Pb, NO_3

(ii) Aesthetic Quality : Al, Cl^-, Cu, $CaCO_3$, Fe, Mn, Na, SO_4, TDS, Zn, pH

(iii) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

4) Date of Observation

Observation was carried out on 7th - 10th October 1993

5) Results of Observation

(1) Surface Flow Rate

Flow rate at each points is shown in Table A, 3.6.

Flow rate in Tarapaca river is lower than average flow rate from DGA's record during October and November probably due to the less precipitation in the upstream than usual.

In Sagasca river, flow rate is not from precipitation directly, therefore relationship of rainfall and flow rate is not valid.

Due to the shortage of data, flow rate in Aroma and Quipisca rivers are estimated from average total rainfall as explained in the latter chapter.

(2) Water Quality

Results of the examination is shown in Table A, 3.7.

- Aroma is the most contaminated river in the basin in terms of health significance, aesthetic quality and other.

- Sagasca is also a contaminated river in terms of aesthic quality and other.

- Tarapaca and Quipisca are clean in comparison with Aroma and Sagasca but some items such as B, Ca, Mg, K, etc., are still higher than the standard limit.

Table A, 3.1 Drainage Basin and Sub-Basin Areas in Pampa del Tamarugal Basin

<Cuenca de Drenaje y Area Sub-cuenca en Cuenca del Pampa del Tamarugal>

River/ Quebrada	Sub-Basin (km2)		Total Basin (km2)
Aroma		1,745.6	1,745.6
Tarapaca Upstream of Mina San Juan	1,503.6		
Tarapaca Downstrream of Mina San Juan	212.7	1,716.3	3,461.9
Quipisca		845.6	4,307.5
Juan Morales (or Sagasca)		970.6	5,278.1
Quisma (or Pica)		297.5	5,575.6
Chacarilla		1,221.3	6,796.9
Ramada		244.4	7,041.3
Cahuisa		393.1	7,434.4
Total River Basin			7,434.4
Residual Basin		10,570.6	
Total Pampa del Tamarugal Drainage Basin Area			18,005.0

Table A, 3.2 Average Precipitation observed by DGA in Pampa del Tamarugal Basin

<Precipitacion Promedio observada por DGA en la Cuenca del Pampa del Tamarugal>

Unit : mm

Station	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Puchultiza	1982-1988	51.04	32.06	16.90	1.56	0.47	7.66	2.71	4.21	3.23	3.50	10.99	16.67	151.00
Mocha	1988-Present	0.55	5.35	2.35	0.00	0.20	0.40	0.00	0.00	0.00	0.00	0.00	2.07	10.92
Poroma	1968-1992	16.19	8.09	3.95	0.00	3.83	0.88	0.00	0.05	0.52	0.19	0.21	1.57	35.50
P. Lirima (P.N.)	1982-Present	52.78	28.88	11.41	0.53	0.18	0.98	0.63	0.82	1.26	3.31	2.60	17.58	120.93
P. Lirima	1977-1989	41.61	25.45	10.16	0.85	0.00	1.94	1.22	1.38	0.85	2.80	2.46	10.38	99.10
Parca	1977-Present	9.79	6.62	4.04	0.24	0.00	0.62	0.00	0.50	0.65	0.47	0.00	2.06	24.98
Mamina	1986-1992	6.10	1.33	2.98	0.00	0.00	0.08	0.00	0.00	0.00	0.25	0.00	3.78	14.53
Sagasca	1977-Present	0.21	0.42	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.01	0.76
Esmeralda	1966-1972	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
Iquique	1984-Present	0.78	0.00	0.00	0.00	1.05	0.02	0.05	0.00	0.01	0.00	0.00	0.19	2.10

Table A, 3.3 Average, Maximum and Minimum Surface Flow Rate in Pampa del Tamarugal Basin

<Promedio, Tasa de Flujo de Superficie Maximo y Minimo en la Cuenca del Pampa del Tamarugal>

(Max. and Min. are the maximum and minimum of average values in a month of the recorded years, not instantaneous values)

Unit : m^3 /s

River	Location	Obs. Period	AVG	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Tarapaca	Mina San Juan	1984-1990	Max.	0.752	0.933	1.070	0.306	0.460	0.490	0.471	0.417	0.395	0.258	0.202	0.436	0.516
			Avg.	0.316	0.438	0.429	0.245	0.311	0.329	0.363	0.324	0.276	0.212	0.159	0.229	0.303
			Min.	0.145	0.191	0.087	0.148	0.21	0.265	0.257	0.23	0.224	0.185	0.082	0.125	0.179
Coscaya	Saitoco	1985-1990	Max.	0.417	0.230	0.146	0.149	0.148	0.168	0.175	0.157	0.135	0.125	0.127	0.180	0.180
			Avg.	0.192	0.166	0.135	0.123	0.128	0.134	0.145	0.138	0.127	0.104	0.101	0.123	0.135
			Min.	0.116	0.119	0.118	0.109	0.094	0.118	0.12	0.119	0.114	0.076	0.053	0.092	0.104
	Pampa Lirima	1977-1989	Max.	0.544	0.992	0.369	0.253	0.297	0.343	0.290	0.218	0.236	0.168	0.142	0.154	0.334
			Avg.	0.189	0.244	0.199	0.167	0.174	0.171	0.171	0.151	0.158	0.128	0.117	0.111	0.165
			Min.	0.068	0.113	0.108	0.125	0.112	0.045	0.056	0.057	0.106	0.091	0.078	0.029	0.082

Table A, 3.4 Average Runoff Coefficient in Pampa del Tamarugal Basin
<Coeficientes de Escorrentias Promedios en la Cuenca de Pampa del Tamarugal>

Location : **Tarapaca River at Mina San Juan**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	Upstream Basin of Mina San Juan A (km2)	Average R*A (mm.km2)	Upstream Avg. Rainfall R (mm) (R*A/A)	Flow Rate at Mina San Juan Q (m3/s)	Runoff Coefficient f (= Q/R*A)	Upstream Average Altitude H (m, msl)
0.0 - 10.0	5.0	354.47	141.79	708.95		0.303		
10.0 - 50.0	30.0	281.74	281.74	8,452.13				
50.0 - 100.0	75.0	199.77	199.77	14,982.41				
100.0 - 150.0	125.0	321.47	321.47	40,183.75				
150.0 - 200.0	175.0	327.14	327.14	57,250.20				
200.0 - 250.0	225.0	166.16	166.16	37,386.00				
250.0 - 300.0	275.0	65.55	65.55	18,026.25				
300.0 - 350.0	325.0	0.00	-	-				
> 350.0	-	-	-	-		(m3/year)		
		1,716.30	1,503.62	176,989.68	117.71	9,555,408	0.054	2,905

Note : - Average basin rainfall is calculated from Average Annual Precipitation Map (Isohyetal Map) by DGA in 1987
- Flow rate is obtained from monthly data observed by DGA
- Upstream average altitude of the station is obtained by averaging the altitude of the rainfall stations located in the upstream basin of that station

Table A, 3.5 Water Quality observed by DGA in Pampa del Tamarugal Basin

<Calidad de Agua Observada por DGA en la Cuenca del Pampa del Tamarugal>

River	Location	pH	E.C (mh/cm)	CO_3 (mg/l)	HCO_3 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	B (mg/l)	As (mg/l)	Cu (mg/l)	Fe (mg/l)	$N\text{-}NO_3$ (mg/l)	$N\text{-}NO_2$ (mg/l)	P (mg/l)	$N\text{-}NH_3$ (mg/l)
Quebrada	Mocha	7.68	1,602	3.850	201.3	189	364	93.7	28.3	18.6	224.1	5.07	0.080	0.083	2.89	0.088	6.100		
Tarapaca	Pachica	7.84	1,706	2.633	198.4	199	401	106.9	27.9	21.9	220.1	7.26	0.072	0.025	1.38	0.185	0.002	0.163	0.063
Coscaya	Pampa Lirima	7.51	772	0.000	86.4	81	203	50.4	13.4	15.7	83.6	2.93	0.207	0.023	0.76	0.071	0.003	0.123	0.238
Permissible Value		6.0 - 8.5				250	250		125.0				0.050	1.000	0.30	9.000			0.500

Table A, 3.6 Surface Flow Rate observed on 10th October 1993 in Pampa del Tamarugal Basin
<Nivel de Flujo de Superficie Observado entre el 10 de Octubre de 1993 en la Cuenca del Pampa del Tamarugal>

River	Location/ Quebrada	Average Velocity (m/s)	Cross-section Area (m2)	Flow Rate (m3/s)	Remarks
Aroma	Aroma	0.42	0.135	0.057	
Tarapaca	Tarapaca	0.52	0.167	0.087	including 2 irrigation canals
Quipisca	Quipisca	0.36	0.017	0.006	
Sagasca	Sagasca	0.10	0.014	0.001	

Table A, 3.7 (1) Water Quality observed on 10th October 1993 in Pampa del Tamarugal Basin
<Calidad de Agua Observado entre el 10 de Octubre 1993 en la Cuenca del Pampa del Tamarugal>

River	Code	Health Significance						
		As (mg/l)	Cd (mg/l)	Cr (mg/l)	CN (mg/l)	F (mg/l)	Pb (mg/l)	NO3 (mg/l)
Aroma	AR-1	1.764	0.002	0.02	0.00	1.810	0.02	0.200
Tarapaca	TP-1	0.041	0.004	0.01	0.00	1.310	0.02	0.040
Quipisca	QP-1	0.022	0.003	0.01	0.00	1.130	0.02	0.139
Sagasca	SG-1	0.176	0.050	0.07	0.00	5.100	2.00	0.000

Table A, 3.7 (2) Water Quality observed on 10th October 1993 in Pampa del Tamarugal Basin
<Calidad de Agua Observado entre el 10 de Octubre 1993 en la Cuenca del Pampa del Tamarugal>

River	Code	Aesthetic Quality										
		pH	CaCO3 (mg/l)	Cl (mg/l)	SO4 (mg/l)	Na (mg/l)	Zn (mg/l)	Al (mg/l)	Cu (mg/l)	Fe (mg/l)	Mn (mg/l)	TDS (mg/l)
Aroma	AR-1	8.40	470.5	1,471.6	490.0	772.8	0.025	0.5	0.032	0.33	0.19	3,015
Tarapaca	TP-1	8.15	705.8	391.7	912.6	418.6	0.027	0.6	0.026	0.13	0.04	2,280
Quipisca	QP-1	8.82	213.0	84.0	269.0	174.8	0.035	2.5	0.021	0.10	0.48	818
Sagasca	SG-1	3.90	926.5	277.6	4,034.5	340.4	16.000	190.0	35.800	956.00	727.00	6,835

Table A, 3.7 (3) Water Quality observed on 10th October 1993 in Pampa del Tamarugal Basin
<Calidad de Agua Observado entre el 10 de Octubre 1993 en la Cuenca del Pampa del Tamarugal>

River	Code	Others									
		Temp (C)	EC (mh/cm)	CO3 (mg/l)	HCO3 (mg/l)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Turbidity (mg/l)	DO (mg/l)	B (mg/l)
Aroma	AR-1	22.4	4,900	0.00	255.00	154.00	21.00	86.00	39	5.80	22.87
Tarapaca	TP-1	17.7	3,170	0.00	298.25	218.50	39.00	35.50	41	6.85	6.60
Quipisca	QP-1	18.1	1,200	8.70	273.30	64.00	13.00	12.00	122	6.10	1.64
Sagasca	SG-1	17.0	5,700	0.00	0.00	218.00	93.00	36.00	999	6.60	4.20

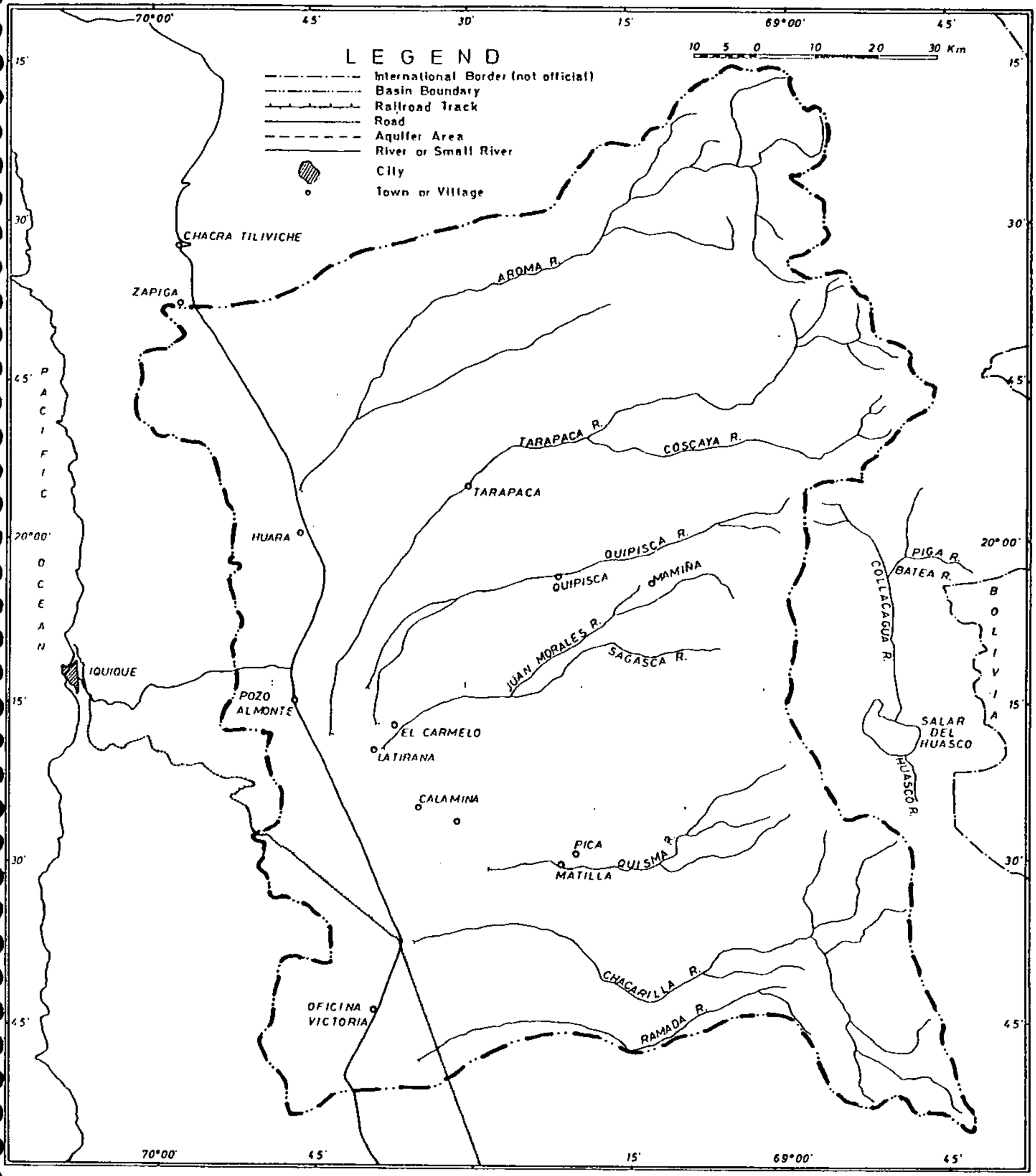


Fig. A, 3.1 River System of Pampa del Tamarugal Basin

<Systema Fluvial de la Cuenca del Pampa del Tamarugal>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Enquelca (ex Caraguano)	19 14 -	68 48	4070
2	Apamilca (ex Camiña)	19 18 -	69 23	2600
3	Camiña	19 19 -	69 25	2780
4	Isluga (Colchane)	19 17 -	68 39	3965
5	Puchuldiza	19 24 -	68 57	4150
6	Huaytani	19 33 -	68 37	3720
7	Mocha	19 49 -	69 17	2930
8	Poroma	19 52 -	69 11	2680
9	Pampa Lirima (Pueblo Nuevo)	19 51 -	68 54	3940
10	Pampa Lirima	19 51 -	68 54	3940
11	Cancosa	19 55 -	68 38	3800
12	Parca	20 01 -	69 12	2570
13	Mamiña	20 04 -	69 13	2730
14	Collacagua	20 03 -	68 50	3990
15	Iquique	20 13 -	70 08	10
16	Sagasca	20 11 -	69 20	1815
17	Salar del Huasco	20 17 -	68 54	3720
18	Esmeralda	20 30 -	69 23	1243
19	Coposa	20 40 -	68 42	3640
20	Guatacondo (D.G.A.)	20 58 -	69 03	2460
21	Copaquire	20 57 -	68 54	3490
22	Ujina	20 58 -	68 39	4200

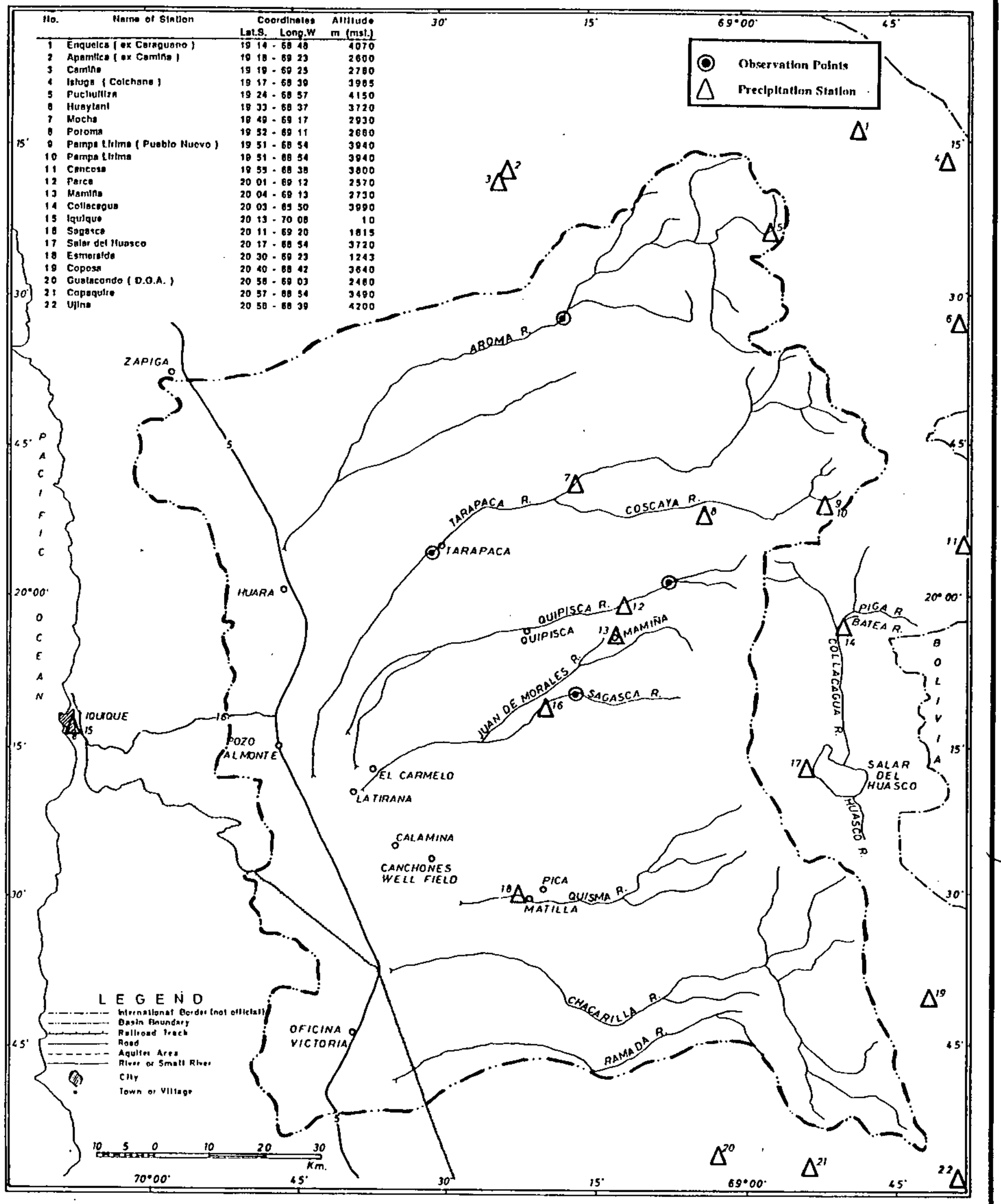
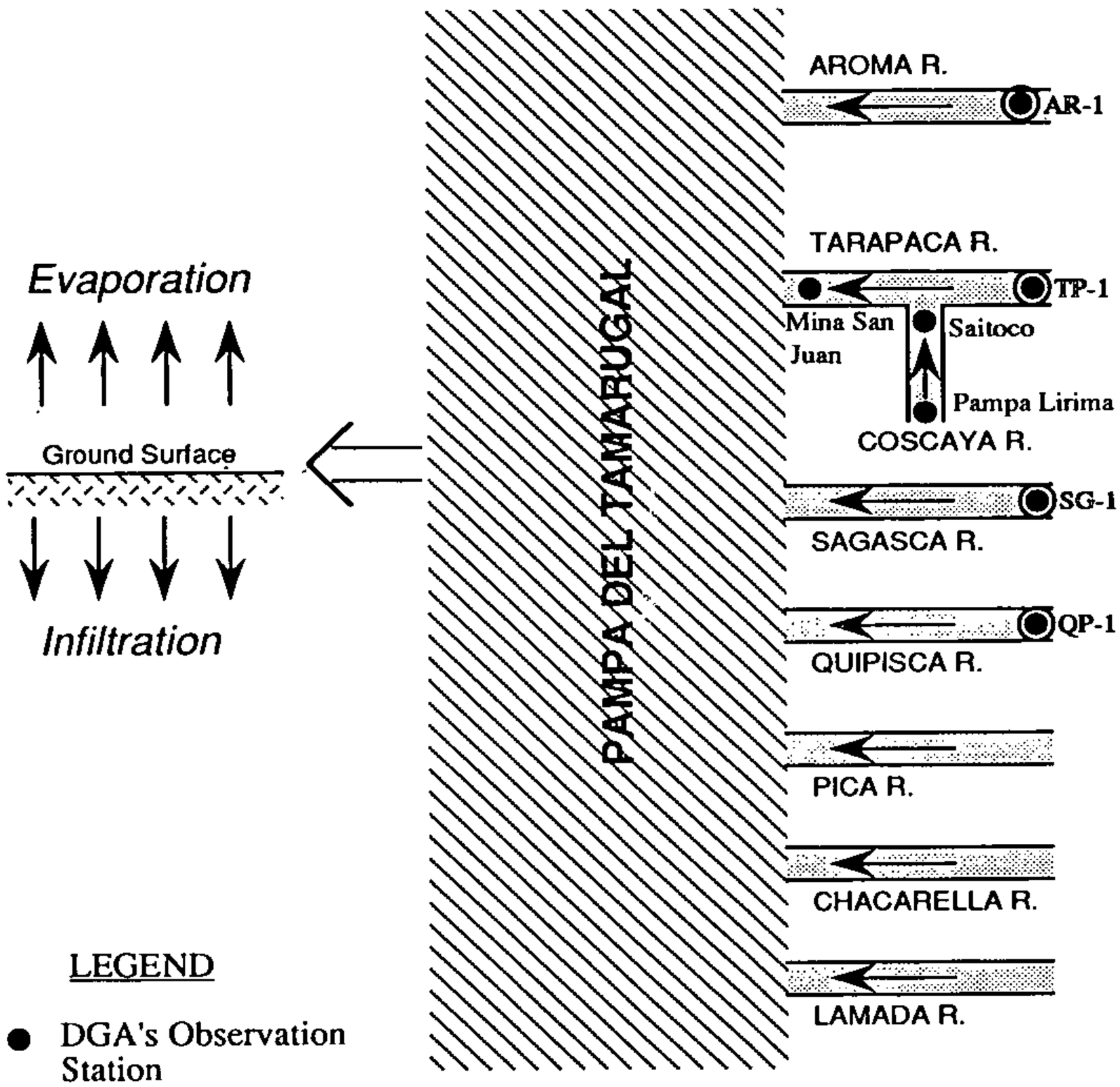


Fig. A, 3.2 Precipitation Stations of DGA in Pampa del Tamarugal Basin

<Estacion de Precipitacion de DGA en la Cuenca del Pampa del Tamarugal>



Flow Model in Pampa del Tamarugal Basin

Fig. A, 3.3 Flow Model in Pampa del Tamarugal Basin
<Modelo de Flujo en la Cuenca del Pampa del Tamarugal>

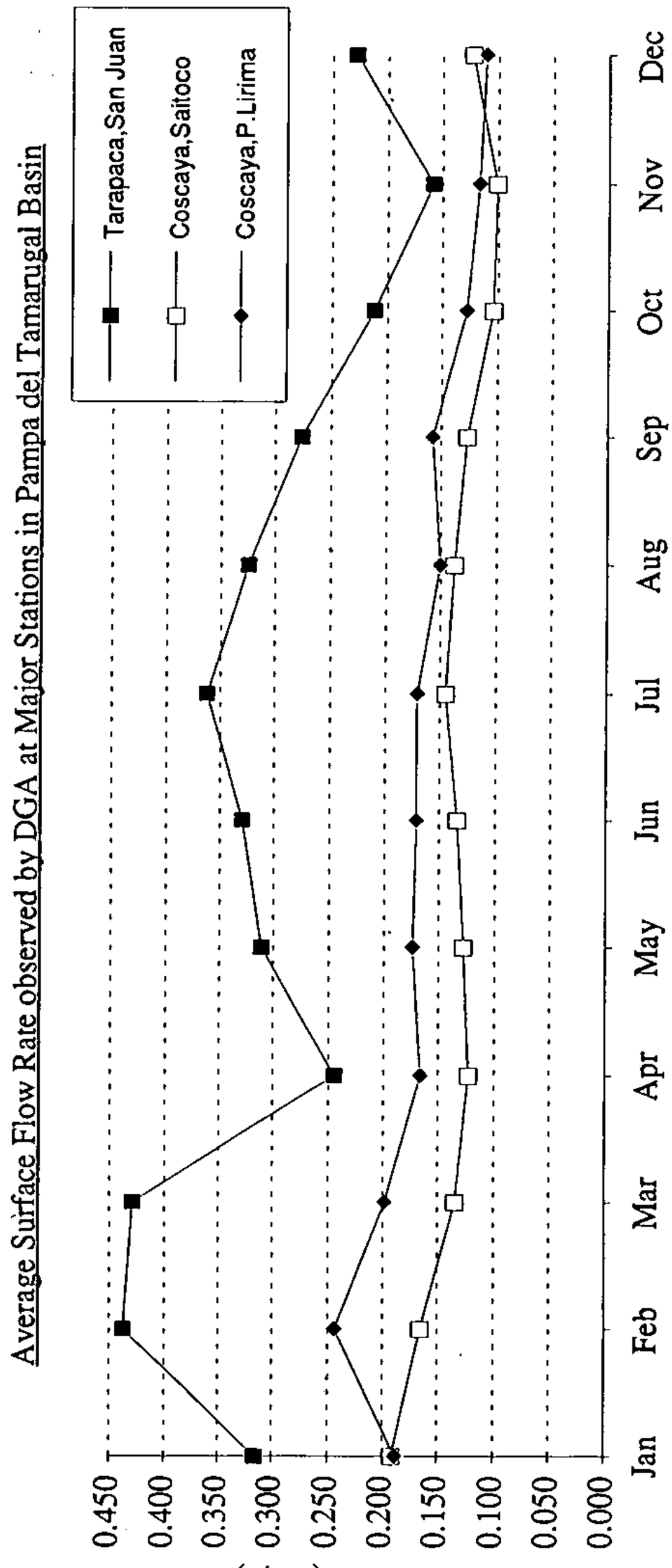


Fig. A, 3.4 Average Surface Flow Rate in Pampa del Tamarugal Basin

<Nivel de Flujo de Superficie Premedio Meansual de la Cuenca del Pampa del Tamarugal>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Enquelca (ex Caraguano)	19 14 -	68 48	4070
2	Apamilca (ex Camiña)	19 18 -	69 23	2600
3	Camiña	19 19 -	69 25	2780
4	Isluga (Colchane)	19 17 -	68 39	3965
5	Puchultiza	19 24 -	68 57	4150
6	Ituaylani	19 33 -	68 37	3720
7	Mocha	19 49 -	69 17	2930
8	Poroma	19 52 -	69 11	2880
9	Pampa Lirima (Pueblo Nuevo)	19 51 -	68 54	3940
10	Pampa Lirima	19 51 -	68 54	3940
11	Cancosa	19 55 -	68 38	3800
12	Parca	20 01 -	69 12	2570
13	Mamiña	20 04 -	69 13	2730
14	Collacagua	20 03 -	68 50	3990
15	Iquique	20 13 -	70 08	10
16	Sagasca	20 11 -	69 20	1815
17	Salar del Huasco	20 17 -	68 54	3720
18	Esmeralda	20 30 -	69 23	1243
19	Coposa	20 40 -	68 42	3640
20	Guatacondo (D.G.A.)	20 56 -	69 03	2460
21	Copequire	20 57 -	68 54	3490
22	Ujina	20 58 -	68 39	4200

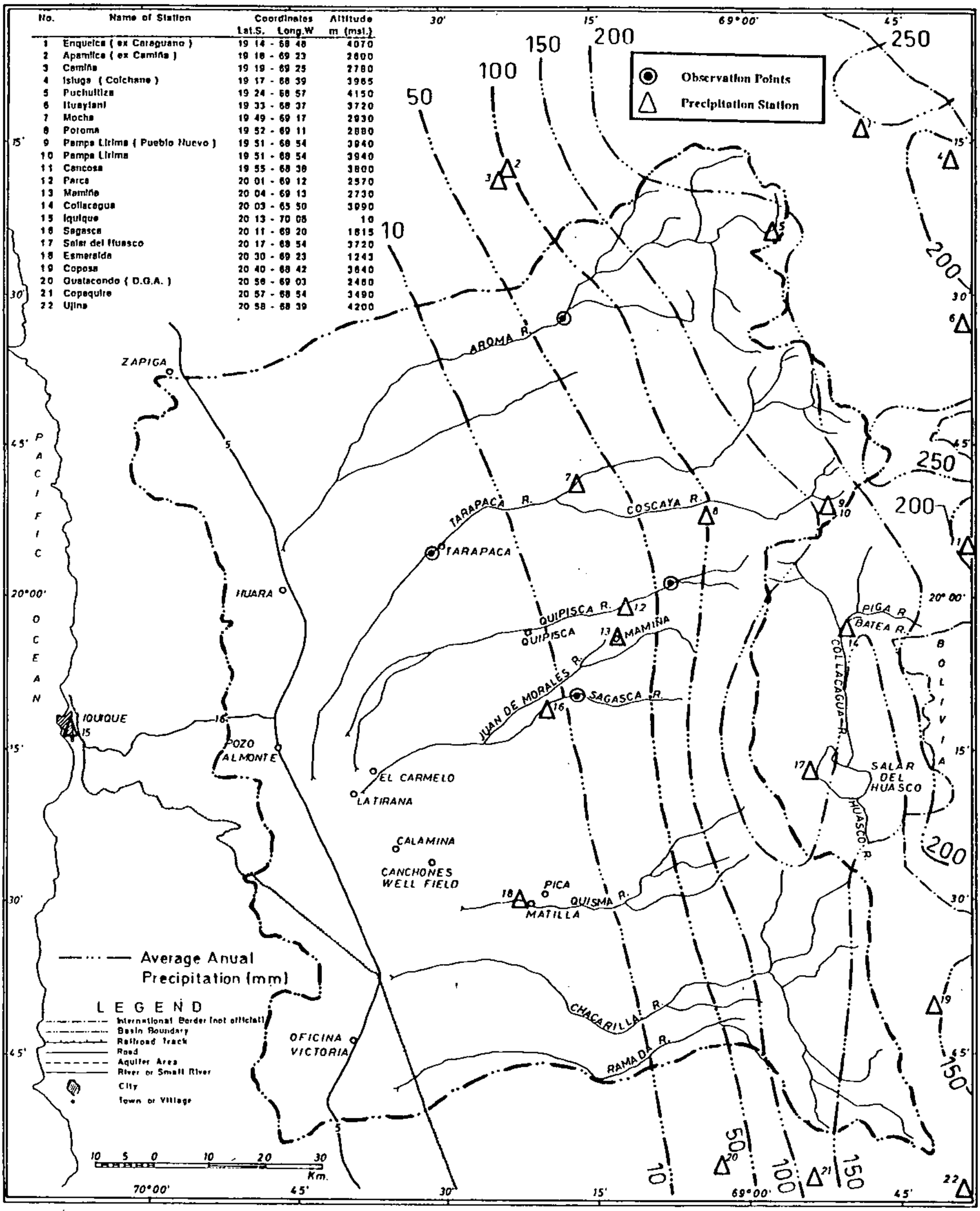


Fig. A, 3.5 Average Precipitation (Isohyetal Map) in Pampa del Tamarugal Basin

<Precipitacion Promedio en Mapa de Isoyeta en la Cuenca del Pampa del Tamarugal>

SUPPORTING REPORT A

Chapter IV SURFACE WATER OF SALAR DE HUASCO BASIN

Chapter IV SURFACE WATER OF SALAR DE HUASCO BASIN

4.1 General

Salar de Huasco basin located in the Region I in northern Chile has a total drainage basin area of 1,712 km^2, covers the river basin of 1,112 km^2 and residual basin of 600 km^2. Drainage basin area is shown in Fig. A, 4.1 and Table A, 4.1.

4.1.1 Climate and Precipitation

Information on climate in the basin is obtained from Collacagua weather station at Collacagua village and Salar de Huasco weather station at Vertiente Laguna. Average maximum temperature is in December at 20.3 °C and average minimum temperature is in July at -15.0 °C. Humidity is not observed in the basin.

Precipitation is observed regularly by DGA and Meteorological Department. Most of the stations are distributed in the upstream of the basin as shown in Fig. A, 4.2. Periods of the observation are as follows;

Station	Observation Period
Collacagua	1961-Present
Salar de Huasco	1981-1982

Average precipitation of these stations are shown in Table A, 4.2 and recorded monthly precipitation is shown in Appendix A, 4.1.

4.1.2 River System

Collacagua river, the main river, flows southwards from the north, meets its tributaries, Batea and Piga, at Pampa Batea and flows down to Salar de Huasco basin, which is a closed basin.. Flow model is shown in Fig., A, 4.3.

4.2 Surface Flow Rate

4.2.1 Flow Rate at Major Stations

Daily water levels are observed at DGA's observation stations by automatic recorders. Flow rate at each stations is generally calculated by a so called "Discharge Rating Curve" or "H-Q Curve" which is a calibration curve of water level and flow rate. Major observation stations are as follows;

River	Location	Observation Period
Piga	Collacagua	1947 - 1990
	Ojos de Agua	1959 - 1967
Batea	Confluencia	1980 - 1990
Collacagua	Pegnablanca	1981 - 1990

Average, maximum and minimum surface flow rate of these stations in the recorded years are shown in Table A, 4.3, fluctuation of these flows throughout a year are shown in Fig. A.4.4 and recorded monthly flow rates are shown in Appendix A, 4.2.

Average flow rate of Collacagua river at Pegnablanca is 0.197 m^3/s. According to DGA, water level in the basin has almost no change in these recent years. Therefore, it is possibly summarized that evaporation rate in the basin is equal to flow rate from Collacagua river.

4.2.2 Calculation of Runoff Coefficient

Runoff, originated from the precipitation or rainfall in the basin, generally flows through water channels as surface flow and infiltrates to underground as groundwater. An effort is done to find out relationship of rainfall and surface flow for the evaluation of groundwater. Average yearly rainfall contour map prepared by DGA in 1987, as shown in Fig. A, 4.5, is used to calculate the total amount of water entering the basin in comparison with surface flow rate in the basin in Collacagua river basin at Pegnablanca, the main river and available observed data source in the basin. Runoff coefficient, the ratio of surface flow to rainfall, is found to be 0.042 at Pegnablanca as shown in Table A, 4.4. This can be

interpreted that about 4.2 % of rainfall flows through Collacagua river as surface flow to the lake in the basin.

4.3 Surface Water Quality at Major Stations

Water quality is observed at DGA's observation stations by sampling method, water samples are taken from the river and analyzed in the laboratory. Observation stations are as follows;

River	Location	Observation Period
Collacagua	Pegnablanca	1983 - 1989

The items of the analysis are classified as follows;

(1) Health Significance : As, $N\text{-}NO_3$, $N\text{-}NO_2$, $N\text{-}NH_3$

(2) Aesthetic Quality : Cl^-, Cu, Fe, Na, P, SO_4, pH

(3) Others : HCO_3, CO_3, Ca, Mg, K, B, E.C.

Results of the examination are shown in Table A, 4.5.

Table A, 4.1 Drainage Basin and Sub-Basin Area in Salar de Huasco Basin

<Cuenca de Drenaje y Area Sub-cuenca en Cuenca del Salar de Huasco>

River/ Quebrada	Sub-Basin (km2)	Total Basin (km2)
Upstream of Collacagua	307.1	307.1
Piga & Batea	244.0	551.1
Upstream of Pegnablanca	273.7	824.8
Downstream of Pegnablanca	287.7	1,112.4
Total River Basin		1,112.4
Residual Basin	599.6	
Total Salar de Huasco Drainage Basin Area		1,712.0

Table A, 4.2 Average Precipitation observed by DGA in Salar de Huasco Basin

<Precipitacion Promedio observada por DGA en la Cuenca del Salar de Huasco>

Unit : mm

Station	Obs. Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Collacagua	1961-Present	48.80	39.74	18.18	1.55	0.68	1.96	0.33	0.56	1.60	1.41	2.70	12.64	130.16
Salar de Huasco	1981-1982	1.35	0.85	5.25	6.85	1.50	2.10	0.00	0.00	0.00	0.00	0.00	14.25	32.15

Table A, 4.3 Average, Maximum and Minimum Surface Flow Rate in Salar de Huasco Basin

<Promedio, Tasa de Flujo de Superficie Maximo y Minimo en la Cuenca del Salar de Huasco>

(Max. and Min. are the maximum and minimum of average values in a month of the recorded years, not instantaneous values)

Unit : m^3 /s

River	Location	Obs. Period	AVG	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
Queb.Piga	Collacagua	1947-1990	Max.	0.462	0.369	0.562	0.472	0.289	0.239	0.245	0.197	0.167	0.167	0.169	0.201	0.295
			Avg.	0.147	0.153	0.151	0.143	0.146	0.162	0.157	0.141	0.127	0.117	0.108	0.116	0.139
			Min.	0.084	0.083	0.085	0.085	0.100	0.118	0.075	0.079	0.071	0.067	0.075	0.079	0.083
	Ojos de Agua	1959-1967	Max.	0.077	0.086	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.081	0.072	0.079	0.082
			Avg.	0.068	0.073	0.068	0.066	0.070	0.078	0.076	0.078	0.078	0.075	0.066	0.067	0.072
			Min.	0.060	0.060	0.060	0.052	0.060	0.072	0.072	0.072	0.072	0.069	0.060	0.060	0.064
Collacagua	Pegnablanca	1981-1990	Max.	0.281	0.490	0.499	0.259	0.254	0.329	0.459	0.442	0.823	1.070	0.172	1.020	0.508
			Avg.	0.159	0.180	0.186	0.147	0.170	0.203	0.219	0.232	0.244	0.276	0.124	0.229	0.197
			Min.	0.078	0.092	0.050	0.094	0.091	0.125	0.127	0.123	0.094	0.081	0.075	0.076	0.092
Batea	Confluencia	1980-1990	Max.	0.029	0.047	0.027	0.028	0.035	0.037	0.031	0.033	0.029	0.037	0.029	0.033	0.033
			Avg.	0.023	0.025	0.022	0.021	0.024	0.025	0.024	0.025	0.023	0.023	0.022	0.023	0.023
			Min.	0.018	0.019	0.017	0.013	0.014	0.018	0.020	0.021	0.020	0.017	0.018	0.016	0.018

Table A, 4.4 Average Runoff Coefficient in Salar de Huasco Basin
<Coeficientes de Escorrentias Promedios en la Cuenca de Salar de Huasco>

Location : **Collacagua River at Pegnablanca**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	Upstream Basin of Pegnablanca A (km2)	Average R*A (mm.km2)	Upstream Avg. Rainfall R (mm) (R*A/A)	Flow Rate at Pegnablanca Q (m3/s)	Runoff Coefficient f (= Q/R*A)	Upstream Average Altitude H (m, msl)
0.0 - 10.0	-	-	-	-		0.197		
10.0 - 50.0	30.0	-	-	-				
50.0 - 100.0	75.0	-	-	-				
100.0 - 150.0	125.0	76.37	-	-				
150.0 - 200.0	175.0	945.90	734.62	128,557.85				
200.0 - 250.0	225.0	90.13	90.13	20,280.27				
250.0 - 300.0	275.0	-	-	-				
300.0 - 350.0	325.0	-	-	-				
> 350.0	-	-	-	-		(m3/year)		
		1,112.40	824.75	148,838.12	180.46	6,212,592	0.042	-

Note : - Average basin rainfall is calculated from Average Annual Precipitation Map (Isohyetal Map) by DGA in 1987
- Flow rate is obtained from monthly data observed by DGA
- Upstream average altitude of the station is obtained by averaging the altitude of the rainfall stations located in the upstream basin of that station

Table A, 4.5 Water Quality observed by DGA in Salar de Huasco Basin
<Calidad de Agua Observada por DGA en la Cuenca del Salar de Huasco>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Collacagua River in Penablanca																		
1983	7.67	628	0.000	278.0	26	80	38.9	22.4	8.0	60.4	1.74	0.085	0.035	0.735				
1984	7.73	544	0.000	249.5		79	40.3	22.3	9.0	61.9	0.83	0.101	0.000	6.500	5.540			
1985	7.70	611	0.000	278.0		68	40.0	21.0	15.3	68.3	1.68	0.104						
1986	7.70	582	0.000	269.5		62	40.3	19.8	10.0	56.8	1.12	0.078	0.080	3.280	0.221			
1987	7.73	636	0.000	273.3		73			9.5	68.5	1.16	0.107		0.910				
1989	7.90	700	0.000	293.0		90			9.9	68.1	1.04	0.143			0.162			
Average	7.74	617	0.000	273.6	26	75	39.9	21.4	10.3	64.0	1.26	0.103	0.038	2.856	1.974			

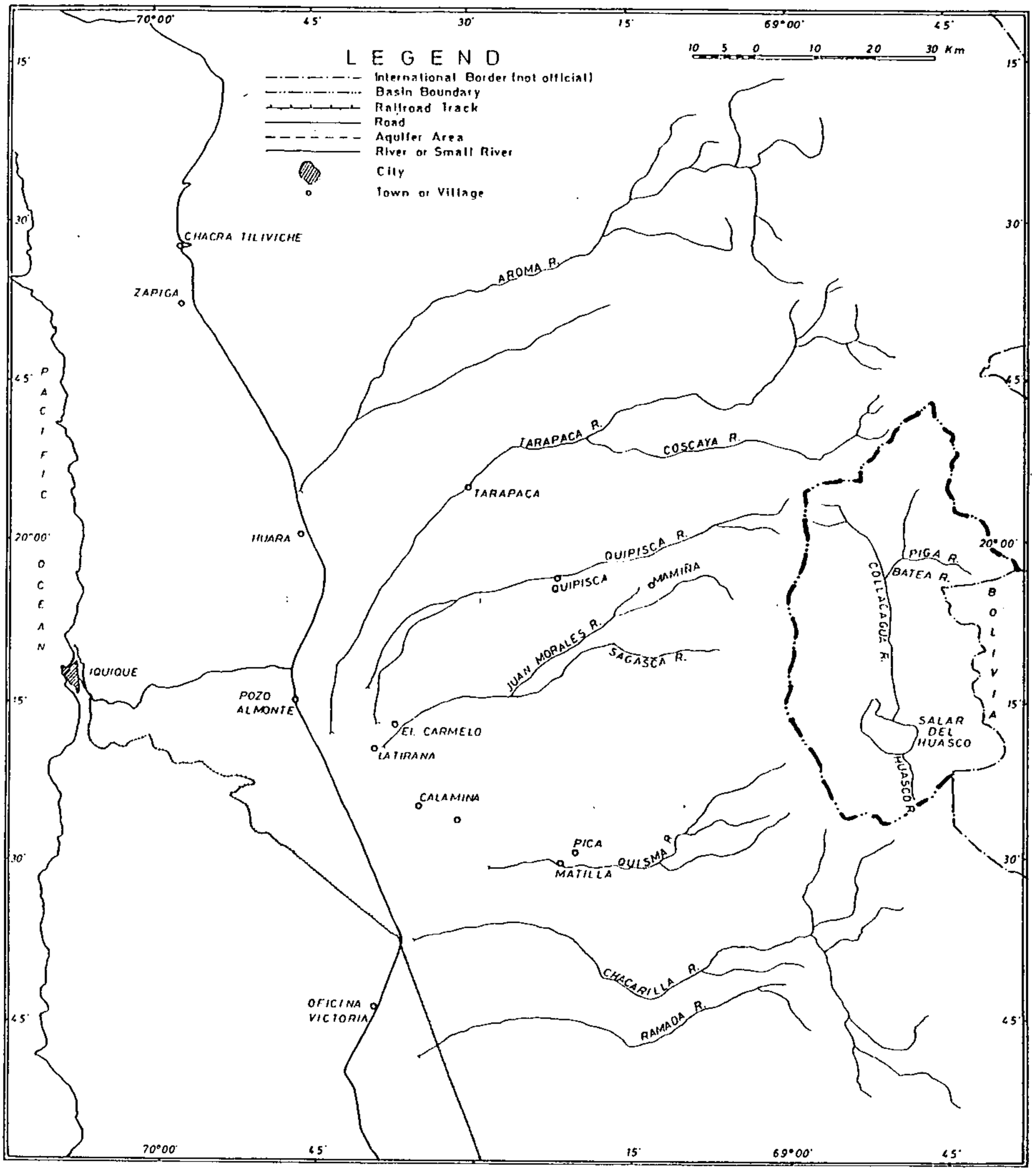


Fig. A, 4.1 River System of Salar de Huasco Basin

<Systema Fluvial de la Cuenca del Salar de Huasco>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Enquelca (ex Caraguano)	19 14 -	68 48	4070
2	Apamilca (ex Camiña)	19 18 -	69 23	2600
3	Camiña	19 19 -	69 25	2780
4	Isluga (Colchane)	19 17 -	68 39	3965
5	Puchultiza	19 24 -	68 57	4150
6	Huaytani	19 33 -	68 37	3720
7	Mocha	19 49 -	69 17	2930
8	Poroma	19 52 -	69 11	2680
9	Pampa Lirima (Pueblo Nuevo)	19 51 -	68 54	3940
10	Pampa Lirima	19 51 -	68 54	3940
11	Cancosa	19 55 -	68 38	3800
12	Parca	20 01 -	69 12	2570
13	Mamiña	20 04 -	69 13	2730
14	Collacagua	20 03 -	65 50	3990
15	Iquique	20 13 -	70 08	10
16	Sagasca	20 11 -	69 20	1815
17	Salar del Huasco	20 17 -	68 54	3720
18	Esmeralda	20 30 -	69 23	1243
19	Coposa	20 40 -	68 42	3640
20	Quetacondo (D.G.A.)	20 56 -	69 03	2460
21	Copequire	20 57 -	68 54	3490
22	Ujina	20 50 -	68 39	4200

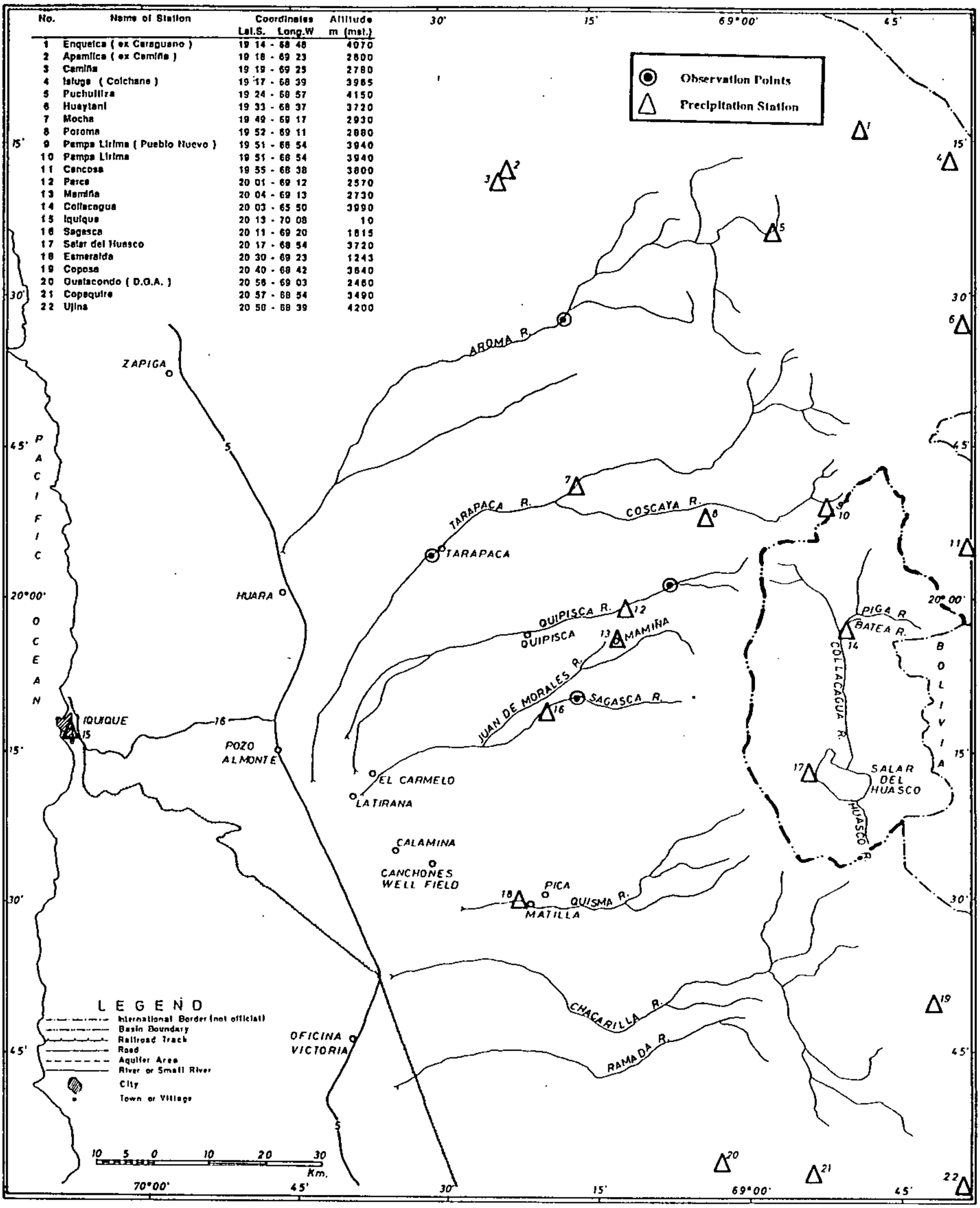
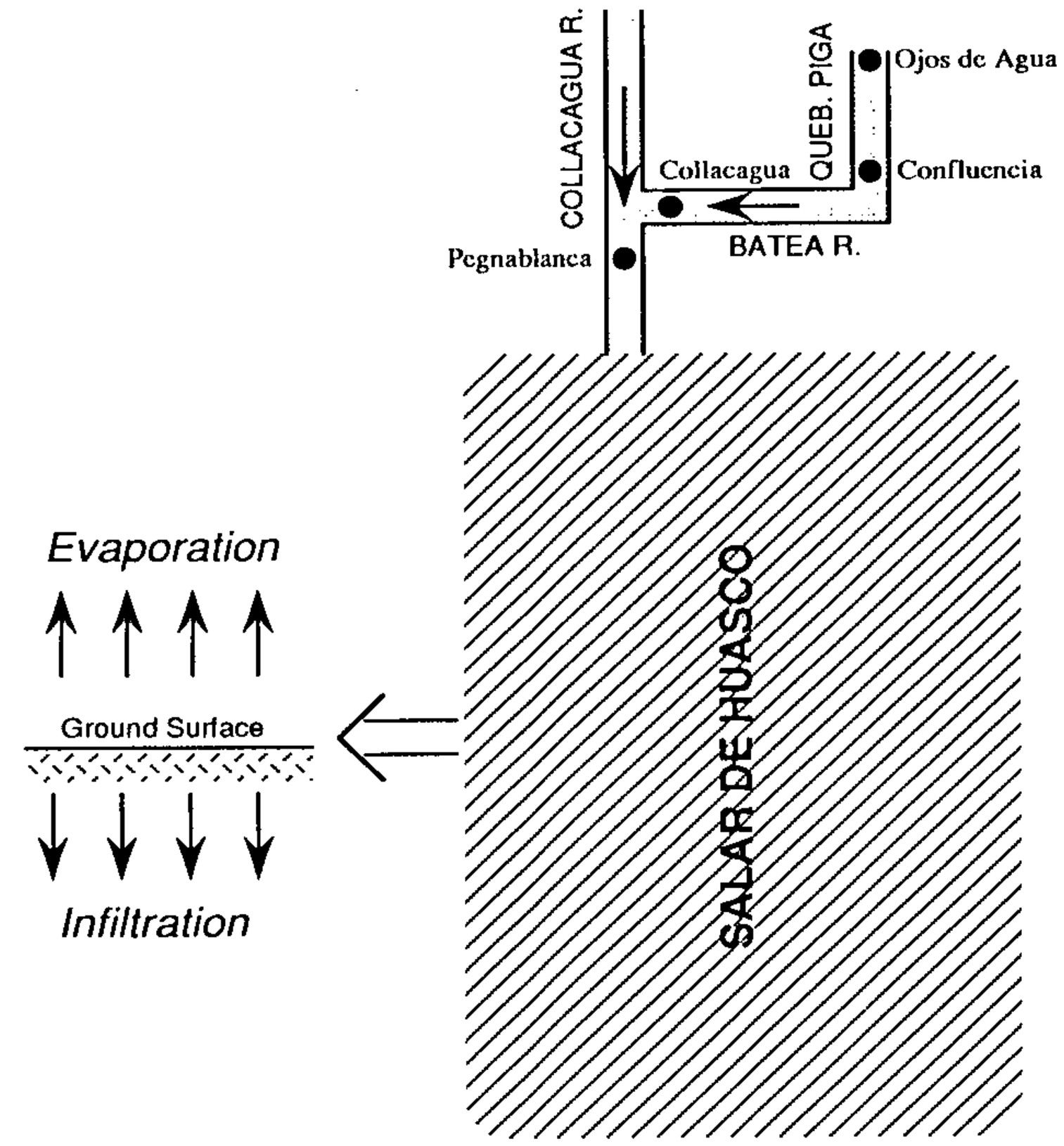


Fig. A, 4.2 Precipitation Stations of DGA in Salar de Huasco Basin

<Estacion de Precipitacion de DGA en la Cuenca del Salar de Huasco>



LEGEND

● DGA's Observation Station

Flow Model in Salar de Huasco

Fig. A, 4.3 Flow Model in Salar de Huasco Basin

<Modelo de Flujo en la Cuenca del Salar de Huasco>

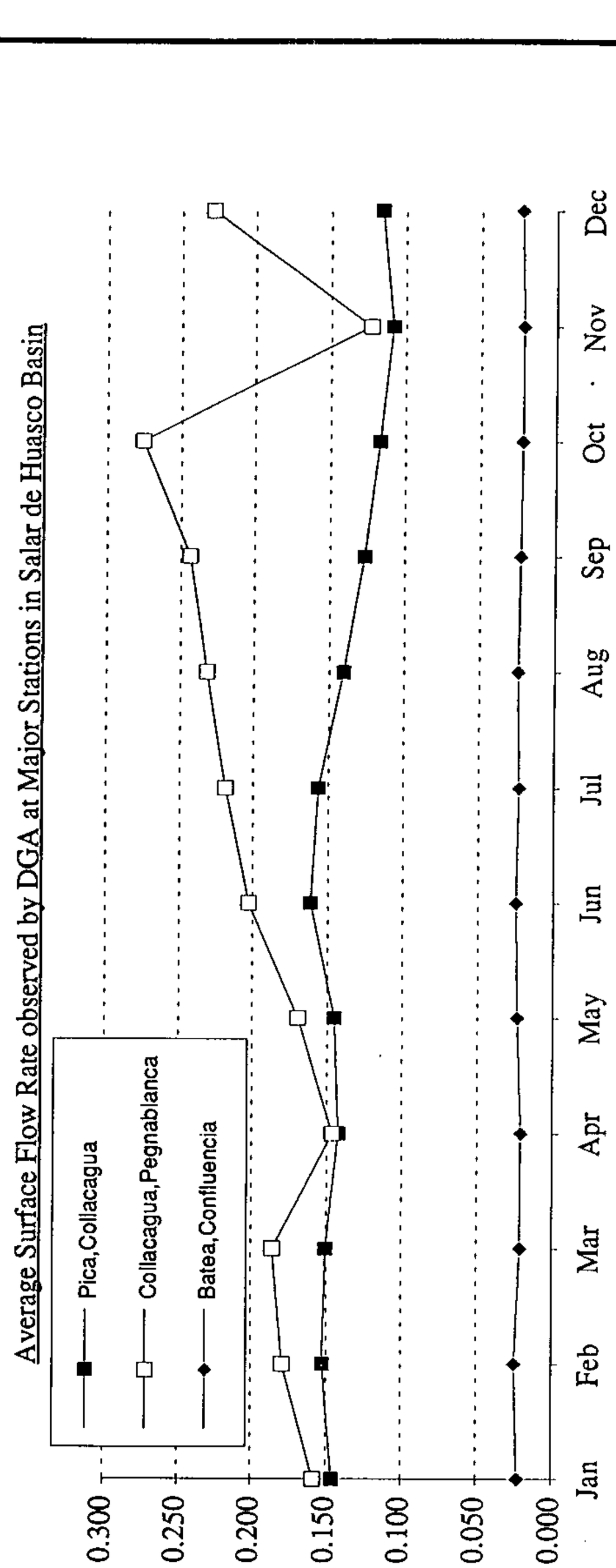


Fig. A, 4.4 Average Surface Flow Rate in Salar de Huasco Basin

<Nivel de Flujo de Superficie Premedio Meansual de la Cuenca del Salar de Huasco>

No.	Name of Station	Coordinates Lat.S.	Long.W	Altitude m (msl.)
1	Enquelca (ex Careguano)	19 14 -	68 48	4070
2	Apamilca (ex Camiña)	19 18 -	69 23	2000
3	Camiña	19 19 -	69 25	2760
4	Isluga (Colchane)	19 17 -	68 39	3965
5	Puchultiza	19 24 -	68 57	4150
6	Huaytani	19 33 -	68 37	3720
7	Mocha	19 49 -	69 17	2930
8	Poroma	19 52 -	69 11	2000
9	Pampa Lirima (Pueblo Nuevo)	19 51 -	68 54	3940
10	Pampa Lirima	19 51 -	68 54	3940
11	Cancosa	19 55 -	68 38	3800
12	Parca	20 01 -	69 12	2570
13	Mamiña	20 04 -	69 13	2730
14	Collacagua	20 03 -	68 50	3990
15	Iquique	20 13 -	70 08	10
16	Sagasca	20 11 -	69 20	1815
17	Salar del Huasco	20 17 -	68 54	3720
18	Esmeralda	20 30 -	69 23	1243
19	Coposa	20 40 -	68 42	3840
20	Guatacondo (D.G.A.)	20 56 -	69 03	2460
21	Copequire	20 57 -	68 54	3490
22	Ujina	20 58 -	68 39	4200

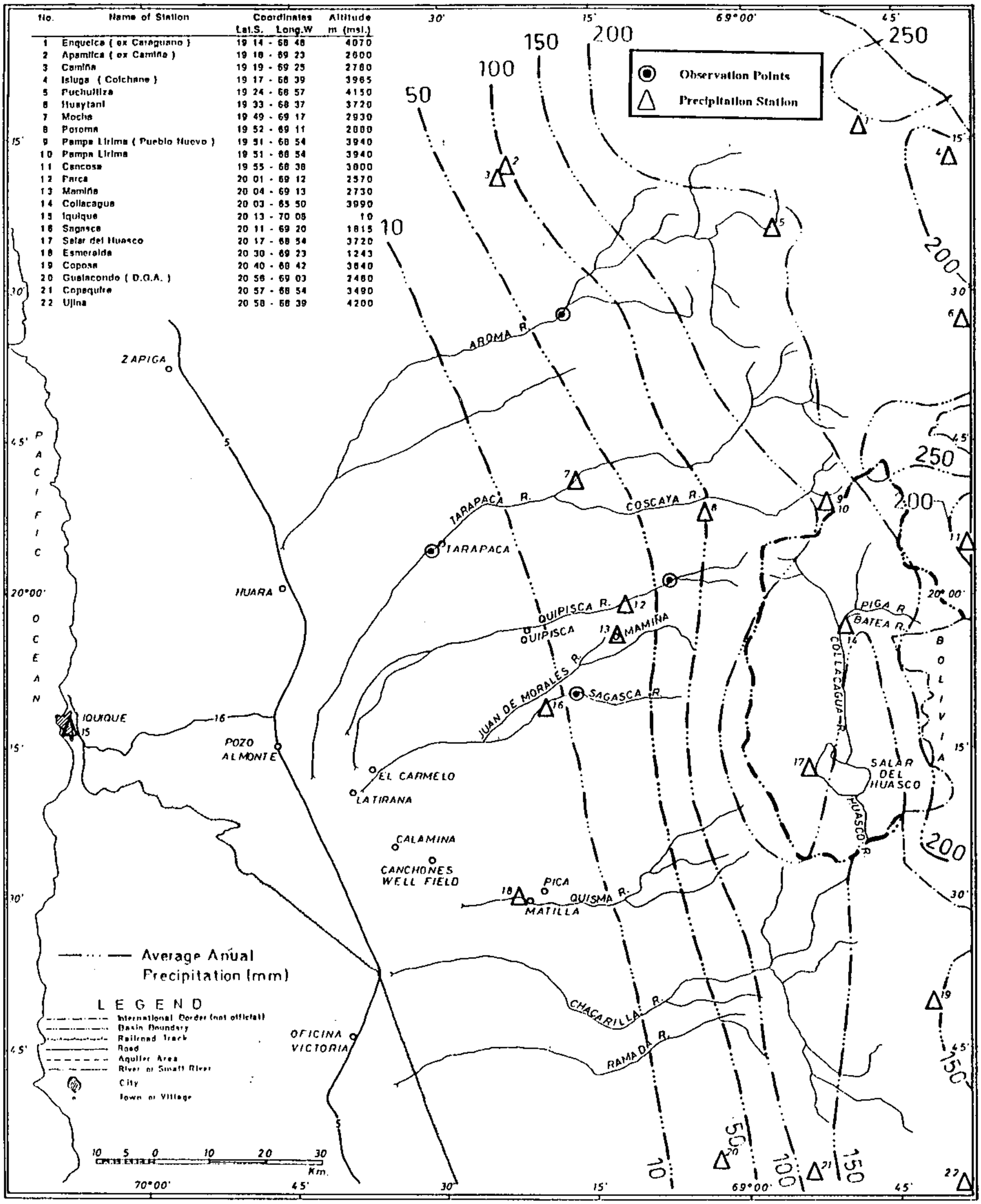


Fig. A, 4.5 Average Precipitation (Isohyetal Map) in Salar de Huasco Basin

<Precipitacion Promedio en Mapa de Isoyeta en la Cuenca del Salar de Huasco>

SUPPORTING REPORT A

Chapter V EVALUATION OF RUNOFF FROM RAINFALL IN PAMPA DEL TAMARUGAL AND SALAR DE HUASCO BASIN

Chapter V EVALUATION OF RUNOFF FROM RAINFALL IN PAMPA DEL TAMARUGAL AND SALAR DE HUASCO BASIN

5.1 General

Runoff is generally calculated from rainfall observed from the rainfall stations distributing in the drainage basin. Various methods are used for weighting the point rainfall to get the basin average rainfall including arithmetic averages, the Thiessen method, and the Isohyetal method.

Simple arithmetic averages are of satisfactory accuracy only when the rainfall varies slightly or when stations are equally spaced.

In the Thiessen method, the weighted of each station is proportional to its area of influence, which is best determined by plotting perpendicular bisectors to the lines joining adjacent stations, and measuring the basin area falling within the resulting polygon.

In the Isohyetal method, lines of equal rainfall are drawn by interpolating the station values. Straight-line interpolations are generally used unless known topographic influences indicate otherwise. From the isohyetal map, the average basin rainfall is computed by measuring the areas within successive isohyets.

In this study, rainfall isohyetal maps prepared by DGA in 1987 are used to calculate runoff in all the basin including San Jose river, Lluta river, Pampa del Tamarugal and Salar de Huasco basins due to the enormous different rainfall in the upper basin and lower basin.

5.2 Relationship of Rainfall and Runoff Coefficient

The summary result of runoff coefficient calculation is shown in Table A, 5.1. Rainfall is pretty high in the altitude of about 3,900 m, as shown in Fig. A, 5.1.

Relationship of rainfall and runoff coefficient, plotted in Fig. A, 5.2, is assumed and expressed by a linear equation as follows;

$$R = af + b$$

where R = Average total rainfall in a year (mm/year),
f = Runoff coefficient,
a, b = constant

Parameter a and b are calculated by Least Square Method using rainfall and runoff coefficient as values of samples. The result is shown below

$$R = 1{,}192.39\, f + 38.960$$

where Correlation coefficient (r) = 0.9778

From this equation, average yearly flow rate in other tributaries in Pampa del Tamarugal including Aroma, Quipisca, Sagasca (Juan Morales), Quisma (Pica), Chacarilla and Ramada rivers can be estimated as shown in Table A, 5.2.

Calculated yearly average flow rate of the rivers in Pampa del Tamarugal are as follow;

River	Flow Rate (m^3/s)
Aroma	0.297
Quipisca	0.078
Sagasca	0.058
Quisma	0.017
Chacarilla	0.145
Ramada	0.003
Tarapaca	0.307
Total	0.905

Total flow rate was estimated by Chile University as well in 1988 as shown in the Inception Report of this project in April, 1993. Flow rate in the whole basin, reportedly about 1.002 m^3/s, is about 10 % different from this calculation.

In order to estimate the amount of water entering the lake in Salar de Huasco basin, flow rate in the whole basin, not only in the upstream of observation station, is also calculated by the same method as shown in Table A, 5.2. It is found that average amount of water entering the basin is 0.855 m^3/s.

Table A, 5.1 Average Runoff, Total Rainfall and Runoff Coefficient in the Study Basin

<Promedio de Escorrentias, Total de Lluvias Caidas y Coeficiente de Escorrentias en la Cuenca Estudiada>

Basin	Location	Average Flow Rate Q		Rainfall Area	Total Rainfall	Runoff	Altitude
		(m3/s)	(m3/year)	A (km2)	R (mm/year)	Coefficient f	(m, msl.)
San Jose	Antes Bocatoma	0.305	9,618,480	1,278	110.32	0.0680	3,464
Lluta	Alcerreca	1.885	59,445,360	1,169	273.51	0.1860	4,007
	Tocontasi	2.216	69,883,776	2,550	192.07	0.1430	3,899
Pampa del Tamarugal	Tarapaca River at Mina San Juan	0.303	9,555,408	1,504	117.71	0.0540	2,905
Salar de Huasco	Collacagua River at Pegnablanca	0.197	6,212,592	825	180.46	0.0420	-

Note :
- Average flow rate is calculated from DGA regular observed data in the basin
- Total rainfall is calculated from the isohyetal map prepared by DGA in 1987
- Runoff coefficient is calculated from equation f = Q/RA
- Altitude is calculated by averaging the altitude of rainfall stations in the basin

Table A, 5.2 (1) Calculated Runoff in Pampa del Tamarugal and Salar de Huasco Basin

<Escorrentias Calculadas en la Cuenca de la Cuenca del Pampa del Tamarugal y Salar de Huasco>

(Liner Equation of Average Rainfall and Runoff Coefficient : R = 1,192.39 f + 38.960)

River : **Aroma River (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	(m3/s)
0.0 - 10.0	5.0	595.14	2975.688				
10.0 - 50.0	30.0	312.00	9,360.00				
50.0 - 100.0	75.0	301.47	22,610.25				
100.0 - 150.0	125.0	298.34	37,292.50				
150.0 - 200.0	175.0	451.34	78,985.20				
200.0 -250.0	225.0	130.45	29,351.70				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		1,745.60	177,599.65	101.74	0.053	9,350,873	0.297

River : **Tarapaca River (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	(m3/s)
0.0 - 10.0	5.0	354.47	1,772.37				
10.0 - 50.0	30.0	281.74	8,452.13				
50.0 - 100.0	75.0	199.77	14,982.41				
100.0 - 150.0	125.0	321.47	40,183.75				
150.0 - 200.0	175.0	327.14	57,250.20				
200.0 -250.0	225.0	166.16	37,386.00				
250.0 - 300.0	275.0	65.55	18,026.25		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		1,716.30	178,053.10	103.74	0.054	9,673,559	0.307

River : **Quipisca River (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	(m3/s)
0.0 - 10.0	5.0	70.14	350.70				
10.0 - 50.0	30.0	284.82	8,544.69				
50.0 - 100.0	75.0	146.81	11,010.83				
100.0 - 150.0	125.0	221.20	27,650.00				
150.0 - 200.0	175.0	122.63	21,459.38				
200.0 -250.0	225.0	0.00	0.00				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		845.60	69,015.60	81.62	0.036	2,468,993	0.078

River : **Sagasca River (or Juan Morales) (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	(m3/s)
0.0 - 10.0	5.0	237.23	1,186.13				
10.0 - 50.0	30.0	258.78	7,763.28				
50.0 - 100.0	75.0	152.52	11,439.00				
100.0 - 150.0	125.0	164.82	20,601.88				
150.0 - 200.0	175.0	157.26	27,520.94				
200.0 -250.0	225.0	0.00	0.00				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		970.60	68,511.23	70.59	0.027	1,817,152	0.058

Table A, 5.2 (2) Calculated Runoff in Pampa del Tamarugal and Salar de Huasco Basin

<Escorrentias Calculadas en la Cuenca de la Cuenca del Pampa del Tamarugal y Salar de Huasco>

(Liner Equation of Average Rainfall and Runoff Coefficient : R = 1,192.39 f + 38.960)

River : **Quisma River (or Pica) (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	Estimated Runoff Q (m3/s)
0.0 - 10.0	5.0	64.57	322.84				
10.0 - 50.0	30.0	84.46	2,533.74				
50.0 - 100.0	75.0	54.89	4,117.05				
100.0 - 150.0	125.0	53.31	6,664.13				
150.0 - 200.0	175.0	40.27	7,046.64				
200.0 -250.0	225.0	0.00	0.00				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		297.50	20,684.40	69.53	0.026	530,249	0.017

River : **Chacarilla River (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	Estimated Runoff Q (m3/s)
0.0 - 10.0	5.0	313.36	1,566.82				
10.0 - 50.0	30.0	141.24	4,237.20				
50.0 - 100.0	75.0	109.93	8,244.90				
100.0 - 150.0	125.0	401.13	50,141.00				
150.0 - 200.0	175.0	255.64	44,736.30				
200.0 -250.0	225.0	0.00	0.00				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)		
Total		1,221.30	108,926.22	89.19	0.042	4,588,431	0.145

River : **Ramada River (Pampa del Tamarugal Basin)**

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	Estimated Runoff Q (m3/s)
0.0 - 10.0	5.0	80.85	404.26				
10.0 - 50.0	30.0	66.32	1,989.54				
50.0 - 100.0	75.0	49.41	3,705.75				
100.0 - 150.0	125.0	47.82	5,977.50				
150.0 - 200.0	175.0	0.00	0.00				
200.0 -250.0	225.0	0.00	0.00				
250.0 - 300.0	275.0	0.00	0.00		(from Linear		
300.0 - 350.0	325.0	0.00	0.00		Equation of		
> 350.0	-	-	-		R and f)	(Q = fIA)	
Total		244.40	12,077.05	49.42	0.009	105,892	0.003

Salar de Huasco Basin

Rainfall Range (mm)	Average Rainfall R (mm)	Total River Basin (km2)	R*A (mm.km2)	Average Rainfall (mm (R*A/A)	Runoff Coefficient f	Estimated Runoff Q (Q =fRA) (m3/year)	Estimated Runoff Q (m3/s)
0.0 - 10.0	5.0	-	-				
10.0 - 50.0	30.0	-	-				
50.0 - 100.0	75.0	-	-				
100.0 - 150.0	125.0	676.87	84,608.75				
150.0 - 200.0	175.0	945.00	165,375.00				
200.0 -250.0	225.0	90.13	20,279.25				
250.0 - 300.0	275.0	-	-		(from Linear		
300.0 - 350.0	325.0	-	-		Equation of		
> 350.0	-	-	-		R and f)	(Q = fIA)	
Total		1,712.00	270,263.00	157.86	0.100	26,950,239	0.855

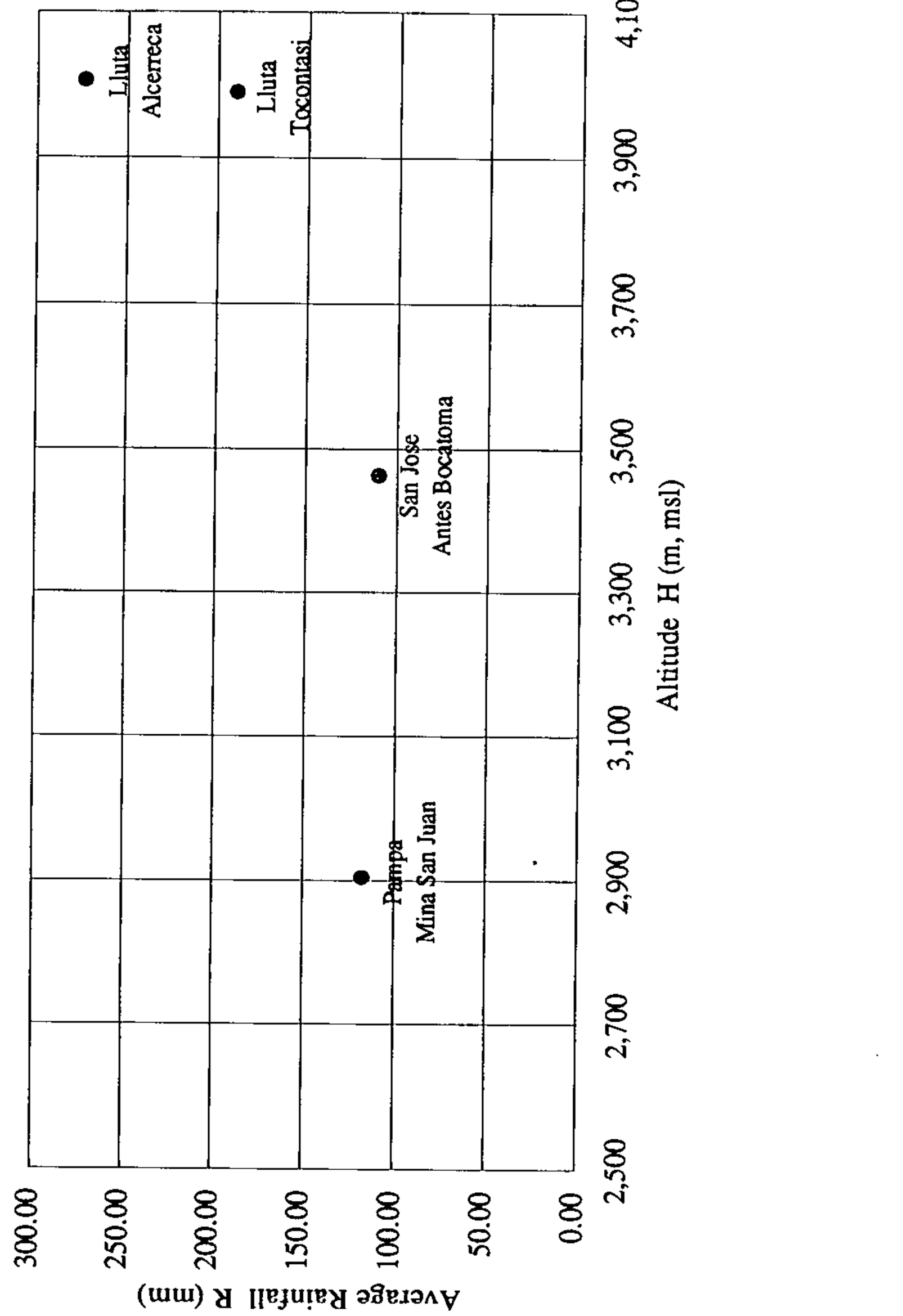


Fig. A, 5.1 Relationship of Average Rainfall and Altitude in the Study Area

<Relacion Promedio de las Lluvias y Altitud en el Area Estudiada>

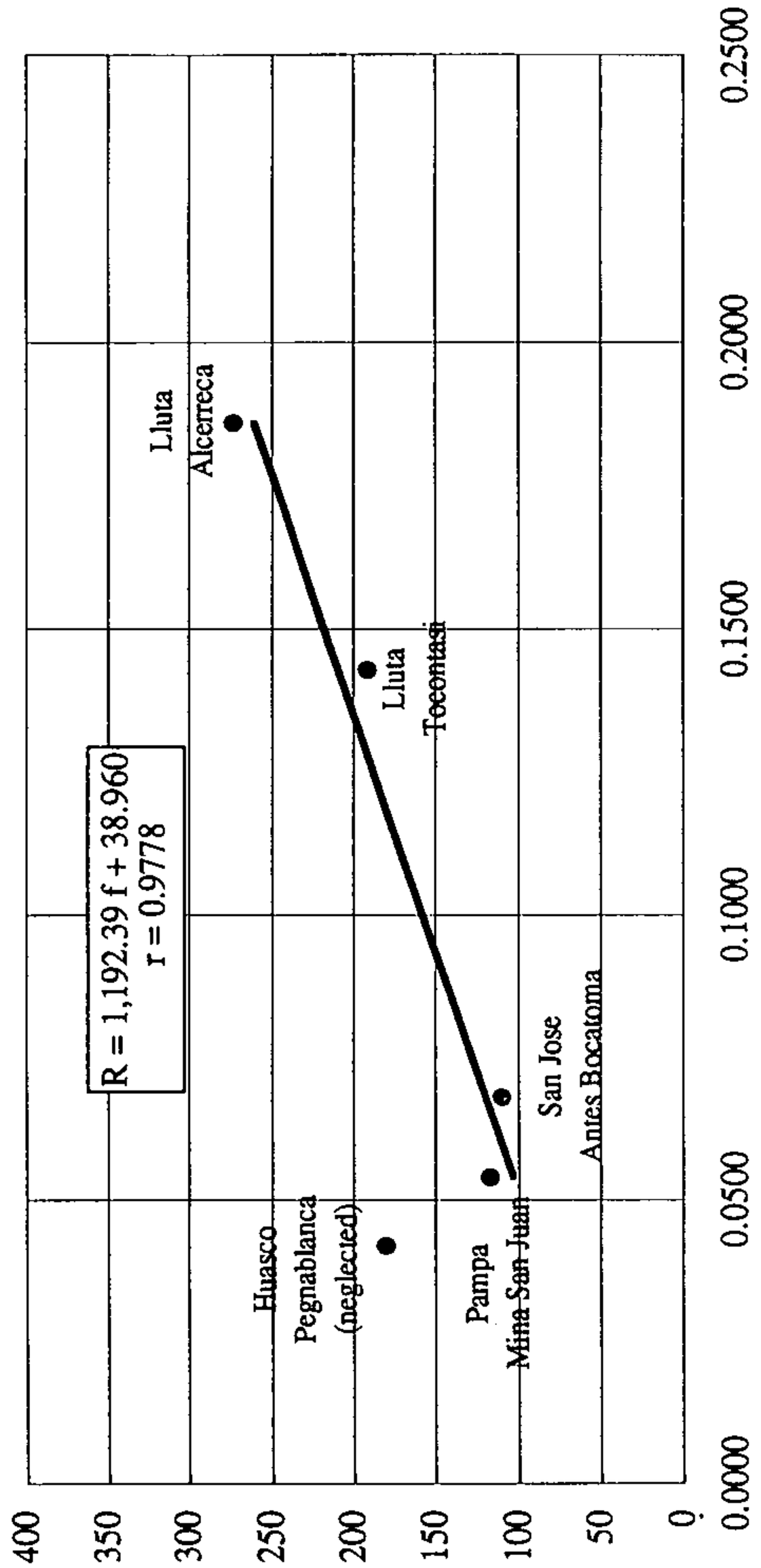


Fig. A, 5.2 Relationship of Average Rainfall and Runoff Coefficient in the Study Area

<Relacion Promedio de las Lluvias y Coeficiente de Escorrentias en el Area Estudiada>

SUPPORTING REPORT A

APPENDICES

Appendix A, 1.1 (1) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01300050-6 MURMUNTANE													
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50	0.00	7.40	11.90
1971	63.90	109.60	0.10	3.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.40
1972	107.50	95.20	42.00	1.20	0.00	0.00	0.00	0.00	5.00	0.00	0.00	10.00	260.90
1973	127.00	48.40	19.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	195.20
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	4.00
1979	48.40	2.00	11.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.30	103.80
1980	0.00	0.00	7.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50
1981	1.50	114.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	3.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	9.00
1984	69.10	53.00	29.00	0.00	0.00	23.50	0.00	15.00	0.00	17.80	17.00	0.00	224.40
1985	9.00	127.70	49.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.50	34.00	235.40
1986	78.00	0.00	32.30	1.50	0.00	0.00	0.00	13.00	0.00	0.00	0.00	23.30	148.10
1987	174.70	0.00	0.00	0.00	1.50	2.50	11.00	0.00	0.00	0.00	0.00	0.00	189.70
Avg.	48.51	39.31	13.64	0.46	0.11	1.86	0.79	2.00	0.36	1.59	2.54	9.29	120.45
Max.	174.70	127.70	49.20	3.80	1.50	23.50	11.00	15.00	5.00	17.80	17.00	42.30	260.90
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00

Appendix A, 1.1 (2) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01300051-4 PORTEZUELO CHAPIQUIGNA													
1976	0.00	0.00	0.00	0.00	0.00	1.30	1.30	0.00	0.00	0.00	0.00	1.30	3.90
1977	106.30	191.30	95.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.80	424.40
1978	65.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	65.50
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	79.70	79.70
Avg.	42.95	47.83	23.75	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	28.20	143.38
Max.	106.30	191.30	95.00	0.00	0.00	1.30	1.30	0.00	0.00	0.00	0.00	79.70	424.40
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.90

Appendix A, 1.1 (3) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01300052-2 CENTRAL CHAPIQUIGNA													
1963	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1969	73.80	74.90	0.00	0.00	0.00	12.00	0.00	0.10	0.00	0.00	0.50	0.00	161.30
1970	0.00	14.90	42.10	0.00	5.20	0.00	0.00	0.00	0.00	4.20	0.00	0.30	66.70
1971	125.90	75.30	3.10	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	54.90	284.20
1972	128.10	55.70	19.60	3.50	0.00	0.00	0.00	0.00	5.10	6.40	0.00	12.00	230.40
1973	0.00	87.40	10.60	5.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	105.00
1974	0.00	43.30	11.00	6.50	0.00	0.00	0.00	22.80	2.00	0.00	0.00	0.00	85.60
1975	84.00	82.50	98.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	132.00	397.00
1976	112.50	83.50	50.10	0.00	0.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00	274.10
1977	255.10	110.80	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	12.50	381.40
1978	39.50	0.00	14.50	0.00	6.30	0.00	0.00	1.00	0.00	0.00	0.00	0.00	61.30
1979	61.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	39.50	115.50
1980	9.50	5.50	12.50	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	1.50	31.00
1981	52.50	122.00	17.20	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	12.50	205.20
1982	32.00	15.80	20.00	0.00	0.00	0.00	0.00	0.00	1.50	11.00	1.00	0.00	81.30
1983	0.00	0.00	2.50	0.00	0.00	0.00	0.00	16.00	6.50	0.00	0.00	14.00	39.00
1984	62.00	51.80	37.80	1.50	0.00	20.60	0.00	5.00	0.00	22.30	15.00	0.00	216.00
1985	19.60	83.10	35.30	0.00	0.00	0.00	0.00	2.00	0.20	0.00	9.70	24.80	174.70
1986	48.20	62.30	23.20	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.70	25.30	174.70
1987	82.00	58.00	1.00	0.00	0.00	0.00	4.00	0.00	0.00	4.00	0.00	0.00	149.00
1988	52.80	0.00	29.00	5.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	8.00	102.80
1989	31.00	113.50	16.30	0.50	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	163.30
1990	7.00	24.10	12.60	0.00	0.60	7.20	0.00	0.00	0.00	0.20	1.40	57.10	110.20
1991	43.50	4.30	30.60	0.00	0.00	0.20	0.00	0.00	0.00	0.10	0.30	2.70	81.70
1992	7.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.60	76.80
1993	138.30	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	143.90
Avg.	47.27	37.70	16.39	0.71	0.39	2.16	0.13	2.19	1.65	1.62	0.92	15.05	126.20
Max.	255.10	122.00	98.50	6.50	6.30	25.00	4.00	22.80	28.00	22.30	15.00	132.00	397.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 1.1 (4) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01300053-0 BELEN													
1938	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1939	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1940	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1941	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1942	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1943	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1944	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1945	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1946	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1947	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1948	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1949	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1950	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1951	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1952	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1953	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1962	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1964	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	51.70	90.50	97.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.50	297.00
1976	161.60	40.10	52.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	253.70
1977	37.80	62.90	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	150.70
1978	41.80	8.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.80
1979	0.00	0.00	5.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	34.30	40.00
1980	8.00	19.80	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.80
1981	32.00	79.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90	120.90
1982	11.00	21.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	54.00
1983	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	12.00	16.00
1984	86.00	97.00	48.00	0.00	0.00	21.00	0.00	11.00	0.00	27.00	0.00	0.00	290.00
1985	13.00	105.00	52.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	42.00	219.00
1986	85.10	6.50	2.50	0.00	0.00	0.00	0.00	13.00	0.00	0.00	3.00	51.00	161.10
1987	86.00	28.00	0.00	0.00	3.00	2.00	8.00	0.00	0.00	5.00	0.00	0.00	132.00
1988	88.00	0.00	32.00	0.00	0.00	0.00	0.00	0.00	2.20	0.00	0.00	14.00	136.20
1989	41.00	143.00	21.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	208.00
1990	7.00	21.00	29.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	2.00	54.00	115.00
1991	14.50	0.50	17.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.80
1992	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.00	59.00
1993	93.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	113.00
Avg.	20.65	17.20	11.44	0.00	0.07	0.67	0.19	0.57	0.10	1.00	0.29	7.52	59.69
Max.	161.60	143.00	97.30	0.00	3.00	21.00	8.00	13.00	2.20	27.00	7.00	57.50	297.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 1.1 (5) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01300054-9 TIGNAMAR													
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	29.00
1976	47.50	12.50	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.00
1977	26.00	95.40	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	150.40
1978	45.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	45.50
1979	44.00	5.00	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.50	87.50
1980	4.00	7.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	41.50
1981	185.00	40.00	54.50	6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	286.50
1982	12.50	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	23.60
1983	2.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00	1.00	10.50
1984	41.00	69.80	53.50	0.00	0.00	4.50	0.00	9.00	0.00	1.20	4.30	0.20	183.50
1985	5.00	104.20	21.80	0.00	0.00	0.00	0.00	0.10	0.10	0.00	4.80	22.40	158.40
1986	42.30	33.90	16.80	0.00	0.00	0.00	0.00	11.50	0.00	0.00	2.30	16.40	123.20
1987	86.00	36.00	0.00	0.00	0.00	0.00	5.40	0.00	0.00	0.00	0.00	0.00	127.40
1988	33.50	0.00	21.00	0.00	0.00	0.00	0.00	0.00	27.50	0.00	0.00	0.20	82.20
1989	18.10	54.30	0.00	9.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.90
1990	0.00	25.00	0.00	2.30	1.00	1.60	0.00	0.00	0.00	0.00	2.00	49.70	81.60
1991	32.50	11.70	14.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	58.30
1992	4.60	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	115.50	122.30
1993	59.10	0.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.10
Avg.	36.24	26.74	14.83	0.96	0.05	0.32	0.28	1.08	1.64	0.07	0.71	13.89	96.81
Max.	185.00	104.20	54.50	9.50	1.00	4.50	5.40	11.50	27.50	1.20	4.80	115.50	286.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.50

Appendix A, 1.1 (6) Average Monthly Precipitation observed by DGA in San Jose River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio San Jose >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01310051-9 AZAPA													
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	5.00
1969	0.80	0.00	0.00	0.00	0.00	0.50	0.00	0.00	1.00	0.00	0.00	0.00	2.30
1970	0.00	0.50	0.50	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.70
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.20	1.00	0.40	0.00	0.00	0.00	1.60
1974	0.30	0.00	0.00	0.00	0.60	0.00	0.00	0.20	0.00	0.00	0.00	0.00	1.10
1980	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00
1981	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.10	0.02	0.02	0.00	0.06	0.02	0.05	0.05	0.06	0.00	0.22	0.00	0.60
Max.	1.10	0.50	0.50	0.00	0.70	0.50	1.00	1.00	1.00	0.00	5.00	0.00	5.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 1.2 (1) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

ST: Bocatoma Lauca

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1979	1.235	1.182	1.258	0.827	1.000	1.047	1.088	0.975	0.991	1.064	1.122	1.037	1.069
1980	1.227	1..081	1.171	1.028	0.914	0.854	0.748	0.734	0.667	0.745	0.646	0.614	0.850
1981	0.802	1.219	1.149	0.614	0.754	0.730	0.756	0.771	0.758	0.773	0.895	1.010	0.853
1982	0.929	0.988	0.843	0.714	0.731	0.762	0.830	0.739	0.805	0.822	0.900	0.827	0.824
1983	0.691	0.678	0.535	0.442	0.466	0.552	0.575	0.687	0.742	0.619	0.615	0.531	0.594
1984	0.865	1.041	1.150	1.029	1.110	1.203	1.144	0.902	0.871	1.405	1.776	1.132	1.136
1985	1.171	1.275	1.023	0.886	1.013	0.860	0.820	0.810	0.956	1.024	1.125	1.224	1.016
1986	1.031	1.279	1.584	1.093	1.112	1.132	1.188	1.290	1.327	1.396	1.426	1.528	1.282
1987	1.485	1.374	1.357	1.546	1.396	1.070	1.124	1.240	1.350	1.452	1.275	1.313	1.332
1988	1.365	1.236	1.355	1.262	1.217	1.100	1.057	1.143	1.195	1.218	1.178	1.135	1.205
1989	1.144	1.104	1.255	1.093	1.111	1.143	1.108	1.157	1.186	1.073	0.774	0.653	1.067
1990	0.892	0.809	0.804	0.670	0.670	0.738	0.686	0.677	0.664	0.701	0.732	0.804	0.737
1991	1.015	0.737	0.986	0.963	0.916	0.775	0.751	0.826	0.971	1.076	0.940	0.725	0.890
1992	0.848	0.731	0.520	0.502	0.547	0.570	0.632	0.639	0.579	0.668	0.843	0.671	0.646
AVG	1.050	1.050	1.071	0.905	0.926	0.895	0.893	0.899	0.933	1.003	1.018	0.943	0.965

Appendix A, 1.2 (2) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

ST: Central Chapiquina

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1967				0.462	0.480	0.480	0.480	0.560	0.580	0.590	0.590	0.600	0.536
1968	0.645	0.595	0.550	0.470	0.510	0.720	0.810	0.770	0.690	0.770	0.740	0.750	0.668
1969	0.750	0.700	0.690	0.690	0.570	0.600	0.600	0.520	0.580	0.450	0.490	0.490	0.594
1970	0.450	0.450	0.500	0.500	0.500	0.550	0.620	0.630	0.500	0.430	0.380	0.460	0.498
1971	0.500	0.840	0.680	0.560	0.609	0.680	0.620	0.550	0.550	0.460	0.490	0.500	0.587
1972	0.950	0.600	0.830	0.700	0.570	0.550	0.630	0.650	0.620	0.570	0.670	0.600	0.662
1973	0.630	0.830	0.880	0.720	0.370	0.200	0.980	0.800	0.780	0.730	0.760	0.770	0.704
1974	0.960	0.950	0.980	0.890	0.930	0.940	0.920	0.970	0.850	0.830	0.890	0.890	0.917
1975	1.076	1.166	1.130	0.900	0.960	1.046	1.028	0.975	0.990	0.940	0.979	1.056	1.021
1976	1.120	1.090	0.940	0.880	0.974	0.908	1.036	1.080	0.983	0.823	0.887	0.930	0.971
1977	1.000	1.062	0.950	1.030	1.055	1.067	1.065	1.190	1.190	0.944	0.862	0.929	1.029
1978	1.118	1.001	0.980	0.929	0.957	1.036	1.012	0.875	0.807	0.828	0.874	0.831	0.937
1979	1.094	1.028	1.097	0.718	0.860	0.882	0.900	0.862	0.860	0.897	0.985	0.968	0.929
1980	1.073	0.942	1.000	0.894	0.795	0.743	0.650	0.638	0.580	0.648	0.562	0.534	0.755
1981	0.697	1.060	0.999	0.534	0.656	0.635	0.657	0.670	0.659	0.672	0.778	0.878	0.741
1982	0.808	0.859	0.733	0.621	0.636	0.663	0.722	0.643	0.700	0.715	0.783	0.719	0.717
1983	0.601	0.591	0.465	0.384	0.405	0.480	0.500	0.597	0.645	0.538	0.535	0.462	0.517
1984	0.752	0.905	1.000	0.895	0.965	1.046	0.995	0.784	0.757	1.058	1.065	0.955	0.931
1985	0.938	1.215	1.055	1.121	0.980	0.788	0.817	0.869	0.877	0.844	0.908	1.035	0.954
1986	1.147	1.081	1.231	0.899	0.953	0.955	1.012	1.049	1.009	1.110	1.124	1.193	1.064
1987	1.260	1.178	1.043	1.069	1.079	0.877	0.865	1.034	1.176	1.240	1.066	1.071	1.080
1988	1.102	1.056	1.070	1.024	1.008	0.933	0.895	0.920	1.003	1.003	0.982	0.914	0.993
1989	0.957	0.997	1.076	0.943	0.946	0.910	0.939	0.920	0.965	0.906	0.669	0.567	0.900
1990	0.754	0.716	0.710	0.609	0.605	0.664	0.619	0.600	0.591	0.613	0.595	0.650	0.644
1991	0.891	0.643	0.825	0.799	0.808	0.700	0.662	0.699	0.764	0.888	0.755	0.660	0.758
1992	0.682	0.631	0.500	0.471	0.492	0.511	0.538	0.528	0.518	0.500	0.593	0.520	0.540
1993	0.900	0.623	0.808	0.589									0.730
AVG	0.879	0.877	0.874	0.752	0.757	0.752	0.791	0.784	0.778	0.769	0.770	0.767	0.796

Appendix A, 1.2 (3) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Ausipar													
1967					0.841	0.655	0.494	0.553	0.627	0.484	0.498	0.587	0.592
1968	1.330	0.923	2.250	1.070	0.830	1.050	1.030						1.212
1969					0.931	0.806						0.935	0.891
1970	0.604	0.718	0.470	0.507	0.547	0.663	0.811	0.777	0.463	0.391	0.349	0.508	0.567
1971	0.666	3.170	0.120	0.117			0.718	0.692	0.589	0.503	0.622	0.578	0.778
1972	6.700				1.300	0.989	0.812	0.796	0.664	0.644	0.556		1.558
AVG	2.325	1.604	0.947	0.565	0.890	0.833	0.773	0.705	0.586	0.506	0.506	0.652	0.907

Appendix A, 1.2 (4) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

ST: Antes Bocatoma Azapa

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1974									0.809	0.881	1.030	1.010	0.933
1975	1.600				1.450	1.450	1.430	1.280	1.210	1.030	1.000	1.540	1.332
1976	2.720	5.820	5.360	1.630	1.450	1.500	1.480	1.420	1.280		0.934	0.913	2.228
1977	1.870	7.220		2.110	2.040	1.670	1.500	1.130	1.150	1.070	1.030	0.987	1.980
1978	1.230			0.910	1.030	1.070	1.150	1.120	0.850	0.851	0.780	0.924	0.992
1979	1.450	1.100	1.820	0.748	0.812	0.867	0.858	0.721	0.683	0.926	0.956	0.964	0.992
1980	1.100	0.954	1.220	0.748	0.829	0.808	0.597	0.527	0.475	0.557	0.545	0.489	0.737
1981	0.872	1.400		0.600	0.544	0.976	0.833	0.688	0.763		0.629	0.803	0.811
1982	0.551	0.620	0.804	0.575	0.594	0.569	0.661	0.578	0.620	0.578	0.645	0.709	0.625
1983	0.606	0.794	0.540	0.398	0.259	0.357	0.407	0.443	0.587	0.414	0.467		0.479
1984			3.080	1.100	1.090		0.733					0.954	1.391
AVG	1.333	2.558	2.137	0.980	1.010	1.030	0.965	0.879	0.843	0.788	0.802	0.929	1.188

Appendix A, 1.2 (5) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Ausipar & Antes Bocatoma Azapa													
1967					0.841	0.655	0.494	0.553	0.627	0.484	0.498	0.587	0.592
1968	1.330	0.923	2.250	1.070	0.830	1.050	1.030						1.212
1969					0.931	0.806						0.935	0.891
1970	0.604	0.718	0.470	0.507	0.547	0.663	0.811	0.777	0.463	0.391	0.349	0.508	0.567
1971	0.666	3.170	0.120	0.117			0.718	0.692	0.589	0.503	0.622	0.578	0.778
1972	6.700				1.300	0.989	0.812	0.796	0.664	0.644	0.556		1.558
1973													-
1974									0.809	0.881	1.030	1.010	0.933
1975	1.600				1.450	1.450	1.430	1.280	1.210	1.030	1.000	1.540	1.332
1976	2.720	5.820	5.360	1.630	1.450	1.500	1.480	1.420	1.280		0.934	0.913	2.228
1977	1.870	7.220		2.110	2.040	1.670	1.500	1.130	1.150	1.070	1.030	0.987	1.980
1978	1.230			0.910	1.030	1.070	1.150	1.120	0.850	0.851	0.780	0.924	0.992
1979	1.450	1.100	1.820	0.748	0.812	0.867	0.858	0.721	0.683	0.926	0.956	0.964	0.992
1980	1.100	0.954	1.220	0.748	0.829	0.808	0.597	0.527	0.475	0.557	0.545	0.489	0.737
1981	0.872	1.400		0.600	0.544	0.976	0.833	0.688	0.763		0.629	0.803	0.811
1982	0.551	0.620	0.804	0.575	0.594	0.569	0.661	0.578	0.620	0.578	0.645	0.709	0.625
1983	0.606	0.794	0.540	0.398	0.259	0.357	0.407	0.443	0.587	0.414	0.467		0.479
1984			3.080	1.100	1.090		0.733					0.954	1.391
AVG	1.638	2.272	1.740	0.876	0.970	0.959	0.901	0.825	0.769	0.694	0.717	0.850	1.101

Appendix A, 1.2 (6) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Acueducto Azapa en Bocatoma													
1963				0.386	0.692	0.486	0.655	0.592	0.561	0.379	0.150	0.202	0.456
1964	0.485	0.051	0.224	0.000	0.015	0.239		0.287	0.221	0.188	0.129	0.575	0.219
1965	0.510	0.000	0.015	0.200	0.156	0.227	0.185	0.226	0.201	0.285	0.167	0.240	0.201
1966	0.057	0.000	0.013	0.238	0.366	0.383	0.109	0.381	0.367	0.166	0.211	0.040	0.194
1967	0.000	0.000	0.000	0.189			0.558	0.501	0.563	0.462	0.444	0.529	0.325
1968	0.269	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.050	0.646	0.584	0.129
1969	0.351	0.222	0.000	0.000	0.574	0.649	0.629	0.649	0.553	0.589	0.378	0.416	0.418
1970	0.108	0.328	0.417	0.454	0.523	0.555	0.607	0.591	0.438	0.359	0.314	0.353	0.421
1971	0.379	0.179	0.345	0.534	0.544	0.597	0.594	0.546	0.467	0.366	0.384	0.249	0.432
1972	0.268			0.228	0.000	0.000	0.000	0.112	0.083	0.000	0.000	0.000	0.069
1973	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.589	0.053
1974	0.231	0.000	0.105	0.756	0.835	0.867	0.837	0.839	0.686	0.697	0.733	0.358	0.579
1975	0.611	0.000	0.000	0.000	0.018	0.094	0.093	0.536		0.824	0.765	0.918	0.351
1976	0.629	0.351	0.506	0.859	0.925	0.877	0.897	0.830	0.789	0.797	0.736	0.711	0.742
1977	0.686	0.301	0.000	0.408	0.415	0.278	0.256	0.262	0.283	0.460	0.774	0.711	0.403
1978	0.782	0.234	0.739	0.806	0.886	1.040	1.040	0.830	0.654	0.597	0.400	0.686	0.725
1979	0.925	0.976	0.747	0.747	0.886	0.902	0.895	0.775	0.741	0.755	0.801	0.785	0.828
1980	0.943	0.857	0.852	0.634	0.591	0.629	0.524	0.477	0.421	0.453	0.411	0.374	0.597
1981	0.503	0.700	0.232	0.603	0.727	0.708	0.733	0.695	0.604	0.578	0.597	0.680	0.613
1982	0.633	0.633	0.655	0.513	0.578	0.625	0.633		0.551	0.500	0.417		0.574
1983	0.508	0.491	0.400	0.373	0.346	0.438	0.496	0.542	0.620		0.163	0.380	0.432
1984	0.550	0.427	0.549	0.512	0.770	0.192	0.361	0.761	0.683	0.889	0.866	0.800	0.613
1985	0.798	0.613	0.233	0.819	1.050	0.761	0.830	0.863	0.805	0.753	0.792	0.854	0.764
1986	0.827	0.217	0.401	0.665	0.483	0.332	0.741	0.340	0.723	0.867	0.942	1.000	0.628
1987	0.412	0.833	1.010	1.030	1.090	0.918	0.910	0.280	0.096	0.254	0.916	0.903	0.721
1988	0.815	0.632	1.000	0.947	0.901	0.855	0.785	0.775	0.777	0.312	0.920	0.777	0.791
1989	0.815	0.820	0.923	0.955	0.900	0.844	0.842	0.825	0.817	0.736	0.514	0.343	0.778
1990	0.513	0.551	0.503	0.453	0.472	0.552	0.500	0.450	0.420	0.434	0.418	0.416	0.474
AVG	0.504	0.362	0.380	0.475	0.546	0.520	0.545	0.517	0.486	0.472	0.501	0.536	0.487

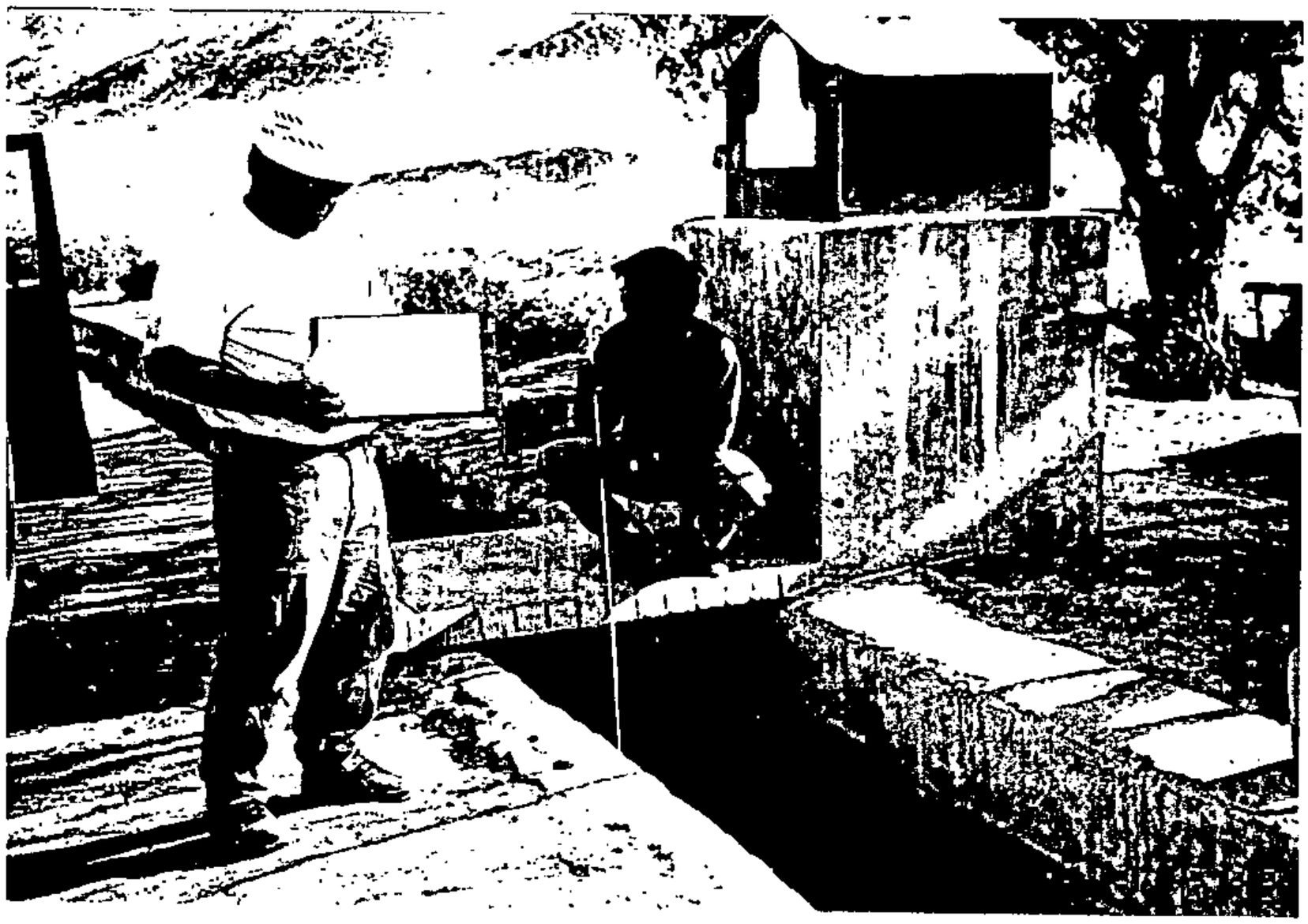
Appendix A, 1.2 (7) Average Monthly Surface Flow Rate observed by DGA at Major Stations in San Jose River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio San Jose>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Puente Saucache													
1971		8.930	1.450										5.190
1972	0.910	4.740	2.990	1.200									2.460
1973	8.260	10.650	6.940										8.617
1974	4.200	0.960	0.910					0.040					1.528
1975	0.790	7.950	8.940	1.160	0.150	0.400		0.060					2.779
1976	3.260	3.150	1.430	0.110	0.190	0.180	0.190						1.216
1977	1.650	14.330	7.710	0.350	0.360	0.340	0.280	0.160					3.148
1978	1.900												1.900
1979													-
1980			1.300										1.300
1981			7.200										7.200
1982													-
1983													-
1984		3.430											3.430
1985		5.240	0.360										2.800
1986		1.550											1.550
1987	1.950												1.950
1988		9.320											9.320
1989													-
AVG	2.865	6.386	3.923	0.705	0.233	0.307	0.235	0.087	-	-	-	-	1.843

Note : Puente Saucache is not a DGA's permanent observation station and observation is not regular, only during flood periods.



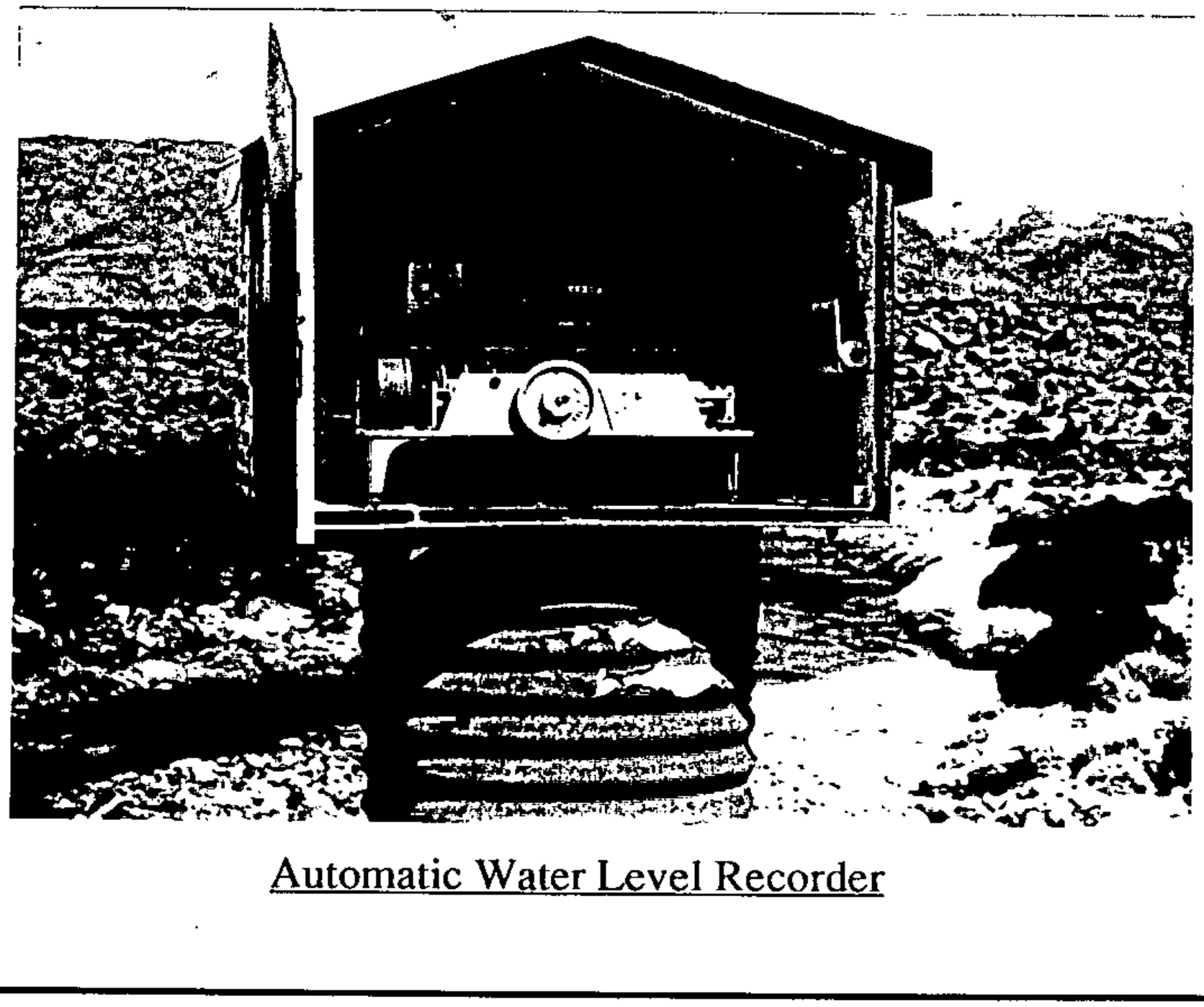
Acueducto Azapa

San Jose River at Ausipar

Appendix A, 1.3(1) Field Observation in San Jose River Basin on 12th June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 12 Junio 1993>

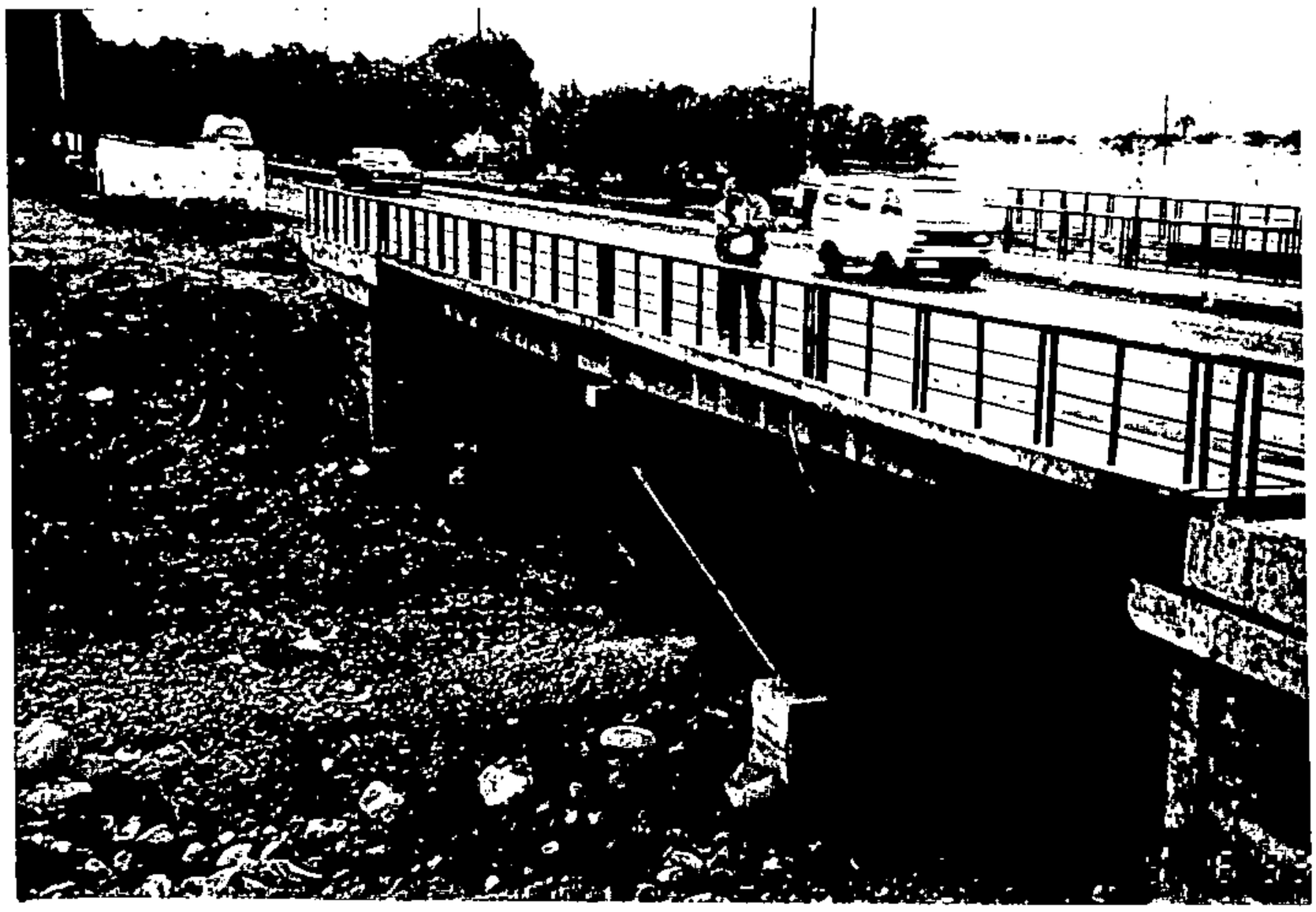
Tignamar River



Automatic Water Level Recorder

Appendix A, 1.3(2) Field Observation in San Jose River Basin on 12th June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 12 Junio 1993>



Saucache Bridge

Field Water Quality Examination

Appendix A, 1.3(3) Field Observation in San Jose River Basin on 12th June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 12 Junio 1993>

Appendix A, 1.4 (1) Average Water Quality observed by DGA at Major Stations in San Jose River Basin

<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San Jose>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Canal Lauca at Sifon N 1																		
1959	8.37	676.67	6.50	144.30	76.90	105.93	31.83	34.13	0.00	47.00								
1960	7.73	617.14	0.00	189.87	57.56	86.01	30.53	22.11	0.56	63.60	1.23							
1961	7.65	640.00	0.00	186.30	52.30	81.65	32.15	29.85	11.34	43.70	3.50							
1967	9.00	840	48.00	231.0	36	114	34.1	45.0	8.2	68.5								
1968	7.20	680									0.00							
1969	8.18	730.00	7.02	291.80	45.16	67.73	35.82	44.64	10.15	61.73	0.00	0.05						
1970	7.65	770.00	6.90	291.86	33.87	108.23	33.19	48.49	9.72	66.21	1.17							
1971	8.17	846.67	15.90	283.00	60.73	152.33	39.23	47.67	10.97	82.93	1.73	0.00						
1972	7.70	590	1.50	220.0	42	45	30.9	15.0	4.7	71.3	0.00							
1974	7.12	720	0.00	283.0	40	107	46.3	41.3	8.2	48.5	0.70	0.037	0.000					
1975	7.76	646.50	9.23	212.50	29.60	83.83	30.38	36.70	5.67	42.15	0.59	0.09	0.00	0.36	0.30			
1976	7.64	650.67	0.00	254.50	32.10	109.00	35.80	40.80	7.04	49.40	0.56	0.05	0.06	0.09	0.15	0.00		0.00
1977	7.76	612.17	0.00	228.20	28.56	98.94	32.62	35.00	4.93	48.66	2.48	0.04	0.01	0.31	0.08	0.00		0.15
1978	8.10	607.50	0.00	229.50	30.70	91.00	22.95	43.45	9.58	43.70	5.49	0.09	0.03	0.00	0.09	0.01	0.10	0.20
1985	7.81	647.33	0.00	265.67	34.30	135.67	42.17	37.77	14.87	62.53	1.75	0.09	0.04	0.48				
1986	8.35	590.00	0.00	215.33	27.03	97.60	34.17	29.13	9.14	47.97	1.02	0.07	0.01	0.27	0.00		0.15	
1987	8.52	610.00	8.00	193.00	29.87	101.87	33.20	30.53	7.56	49.20	1.19	0.13	0.07	0.38	0.11		0.21	
1988	7.85	661	0.00	222.0	45	91	35.1	28.1	8.4	61.2	1.59	0.271	0.140		0.008		0.249	
1989	8.80	700	0.00	244.0	32	135	37.7	35.2	9.3	38.0	0.89	0.134	0.250		0.002		0.122	
AVG	7.97	676	5.72	232.5	41	101	34.3	35.8	7.8	55.3	1.41	0.087	0.059	0.268	0.092	0.003	0.166	0.117

Appendix A, 1.4 (2) Average Water Quality observed by DGA at Major Stations in San Jose River Basin

<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San Jose>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: San Jose River at Ausipar																		
1969	8.05	885.00	0.00	302.00	61.30	111.05	59.70	42.50	10.90	85.85	1.00	0.05						
1970	8.06	866.84	2.81	263.88	60.70	148.25	58.41	38.60	9.21	80.28	1.10							
1971	7.60	908	0.00	289.0	66	161	71.7	35.3	6.7	75.9								
1972	8.08	530.67	2.10	148.00	54.13	83.77	56.10	16.63	4.69	37.70	0.90							
1974	7.54	778.50	0.00	274.00	49.25	84.55	51.30	37.40	5.67	60.90	0.00	0.04	0.03					
1975	7.91	809.00	4.80	232.50	41.85	139.50	46.90	37.85	6.45	62.45	0.50	0.07	0.00	1.63	0.23			
1980	7.91	827.00	8.85	226.50	50.35	174.50	49.10	40.05	10.36	71.50	2.12	0.10		0.32				
1981	8.28	805.25	3.00	214.75	54.60	170.25	48.20	38.70	11.94	73.00	1.53	0.13		0.44				
AVG	7.93	801.28	2.70	243.83	54.76	134.11	55.18	35.88	8.23	68.45	1.02	0.08	0.02	0.80	0.23			

Appendix A, 1.4 (3) Average Water Quality observed by DGA at Major Stations in San Jose River Basin

<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San Jose>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: San Jose River at Bocatoma																		
1967	7.70	1,110	0.00	240.0	85	191	54.5	51.4	6.3	75.9	2.00							
1968	8.49	854.29				116.11				78.29	0.60	0.05						
1969	8.01	868.33	1.46	135.13	65.73	114.35	81.24	33.85	8.82	79.72	2.55	0.01						
1970	8.21	964.00	4.56	237.60	66.22	179.20	50.22	37.16	7.43	88.68	1.90							
1971	8.30	935	0.00	143.0	73	240	70.7	39.3	6.3	69.0								
1972	7.85	460	0.00	156.0	31	73	50.3	13.9	5.1	31.0	1.20							
1974	7.77	775.00	2.70	225.40	50.04	88.86	57.46	34.44	5.40	62.42	0.45	0.08	0.02					
1975	7.77	796.60	11.28	198.20	44.50	134.60	46.24	36.78	5.08	54.32	1.00	0.25	0.00	0.51	0.25			
1976	7.66	598.10	0.81	170.29	35.96	102.87	49.21	23.64	5.70	45.33	1.35	0.05	0.03	1.56	0.21	0.01	0.00	0.00
1977	7.25	526.00	0.00	196.75	42.80	107.60	30.65	41.75	4.50	45.85	1.46	0.04	0.01	0.63	0.01	0.00		0.12
1978	7.67	738.50	0.00	215.00	43.60	140.50	59.30	31.90	4.89	54.50	3.14	0.03	0.01	0.26	0.04	0.01	0.10	0.07
1985	8.05	772	0.00	232.0	38	169	63.3	30.1	16.8	62.5	1.92	0.081						
1986	8.48	650.00	0.00	203.50	43.10	128.50	55.00	22.25	8.63	56.55	1.76	0.09	0.01	0.59				
1987	7.95	530	0.00	140.0	32	107	52.5	11.9	6.7	42.3	1.44	0.131	0.040	4.850	0.116		0.127	
AVG	7.94	755.56	1.60	191.76	50.09	135.19	55.43	31.41	7.04	60.45	1.60	0.08	0.02	1.40	0.13	0.01	0.08	0.06

Appendix A, 1.4 (4) Average Water Quality observed by DGA at Major Stations in San Jose River Basin

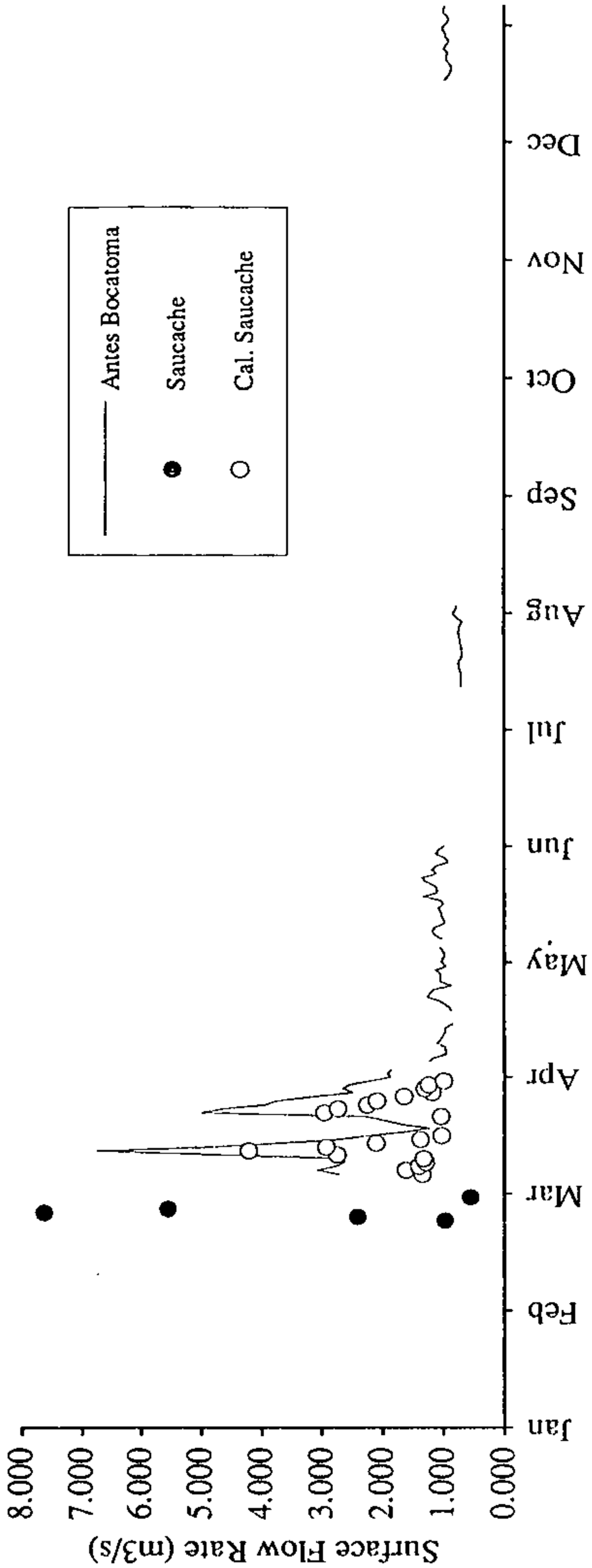
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San Jose>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Acueducto Azapa at Bocatoma																		
1970	7.70	1165.00	11.25	213.50	83.30	210.00	52.40	36.95	11.54	103.50	2.50							
1971	8.20	984.50	0.00	178.00	85.80	262.00	72.85	41.00	6.06	80.95								
1974	7.52	735.60	2.70	218.20	47.28	100.72	53.22	32.86	5.47	59.54	0.48	0.05	0.01					
1975	7.77	788.50	10.28	202.00	46.33	134.50	46.58	35.75	5.38	55.53	1.13	0.08	0.00	0.38	0.17			
1976	7.93	655.00	1.43	165.00	52.53	119.53	57.03	26.65	4.89	53.18	1.08	0.04	0.02	1.64	0.23	0.01	0.16	0.00
1977	7.55	637.75	0.00	193.75	42.35	127.50	44.58	33.33	4.20	47.78	1.90	0.02	0.02	0.17	0.00	0.00		0.10
1978	7.60	748	0.00	224.0	46	161	58.9	33.4	5.1	57.5	2.48	0.008	0.000	0.480	0.059	0.001		0.120
1980	7.94	835.50	7.50	225.00	51.20	173.50	47.70	40.60	10.36	76.80	2.14	0.14		0.41				
1981	8.23	812.50	3.00	213.25	54.15	176.50	58.08	32.90	11.92	74.03	1.94	0.12		0.42				
1983	8.62	867	31.50	212.0	51	105	56.1	36.5	12.1	71.3	2.66	0.118	0.030	1.130				
1985	7.95	820.00	1.26	234.00	56.46	163.80	57.38	34.14	12.42	74.22	1.47	0.23	0.06	1.48				
1986	8.20	659.60	11.82	187.90	38.96	126.30	52.62	24.70	9.03	56.13	1.45	0.16	0.05	1.36	0.37		0.11	
1987	8.15	786.67	3.90	235.33	40.77	156.00	54.23	32.50	8.47	62.20	0.85	0.38	0.17		0.10		0.20	
1989	7.71	853	0.00	201.0	52	155	48.9	35.8	7.7	72.7	1.80	0.067	0.245		0.020		0.058	
AVG	7.93	810.62	6.05	207.35	53.45	155.10	54.33	34.08	8.19	67.52	1.68	0.12	0.06	0.83	0.13	0.00	0.13	0.07

Appendix A, 1.4 (5) Average Water Quality observed by DGA at Major Stations in San Jose River Basin

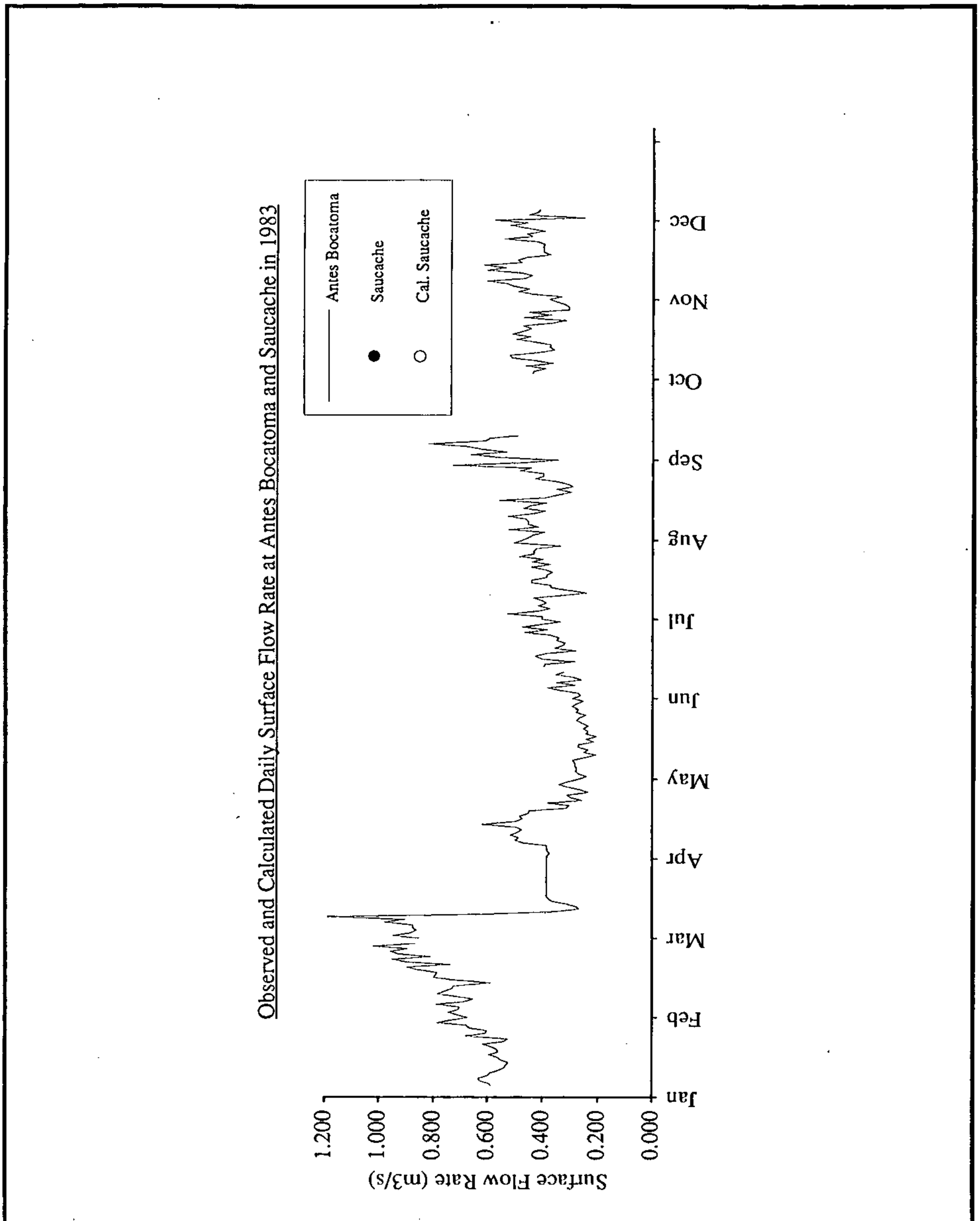
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San Jose>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: San Jose River at Saucache																		
1972	7.20	609	0.00	214.0	31	127	85.4	12.6	8.2	31.0	1.20							
1974	7.72	697.89	0.00	169.56	59.79	133.67	67.90	18.09	11.13	54.02	0.27	0.00	0.00					
1975	7.65	665.50	0.50	143.17	55.17	121.47	71.66	14.64	4.30	41.83	1.18	0.02	0.12	0.46	0.35			
1976	7.40	681.83	0.00	170.29	52.47	114.59	69.02	18.97	3.98	46.40	2.27	0.04	0.00	0.04	0.49	0.01		0.00
1977	7.36	515	0.00	167.0	80	154	92.4	14.7	3.9	63.2	0.74	0.274	0.331	1.976	0.361			
AVG	7.47	633.84	0.10	172.80	55.68	130.14	77.28	15.80	6.31	47.29	1.13	0.08	0.11	0.82	0.40	0.01		0.00



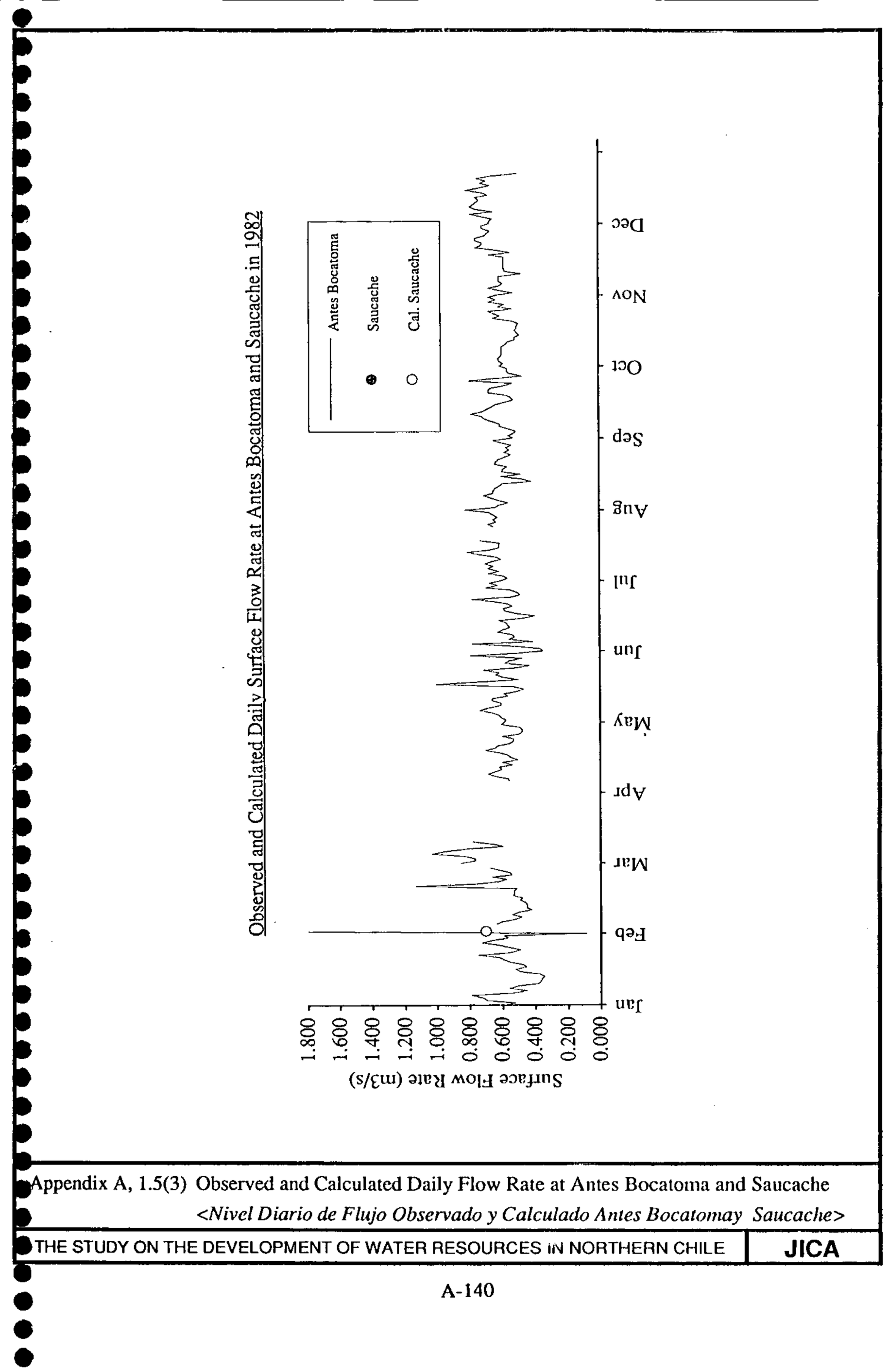
Appendix A, 1.5(1) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



Appendix A, 1.5(2) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

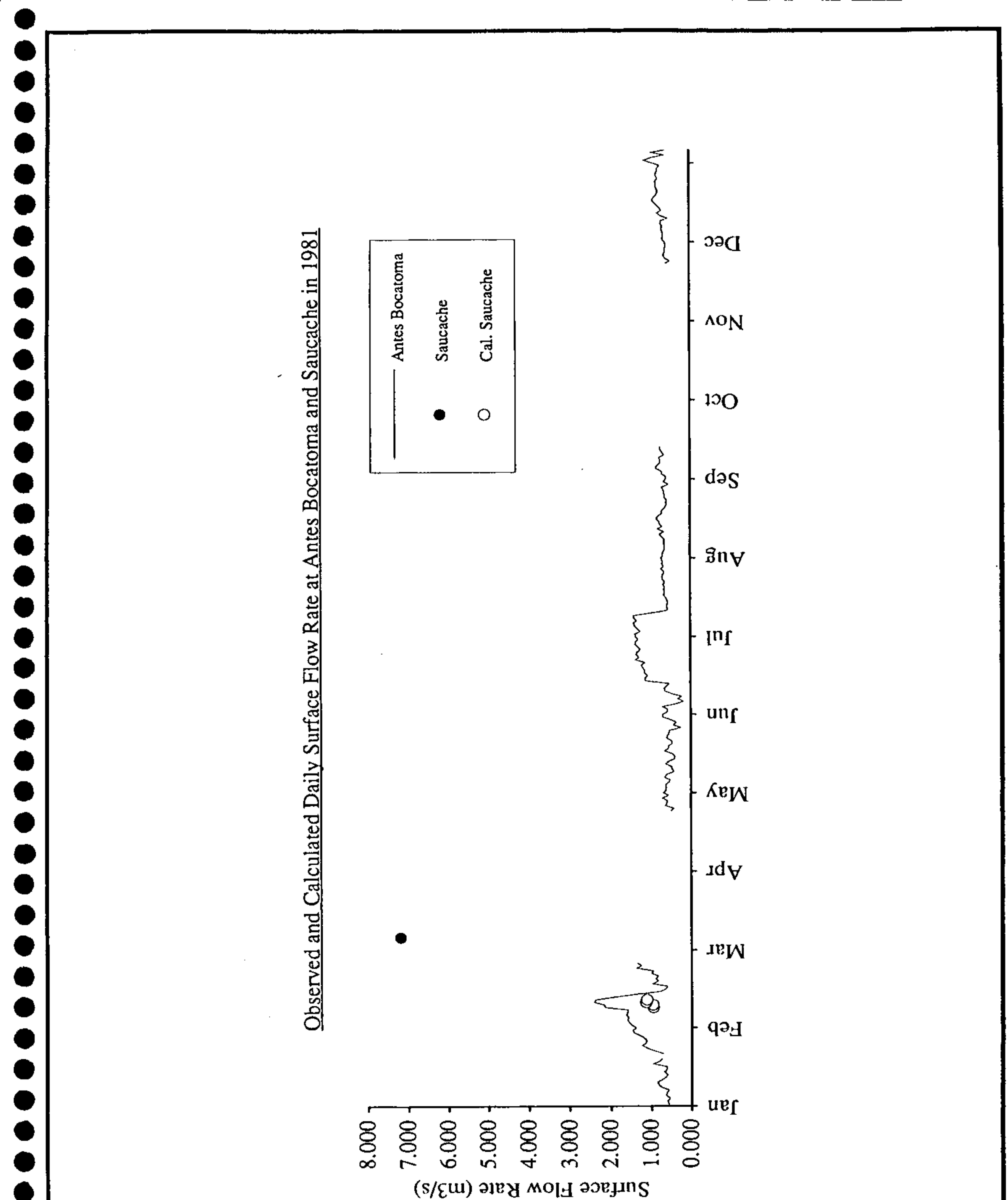
<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



Appendix A, 1.5(3) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

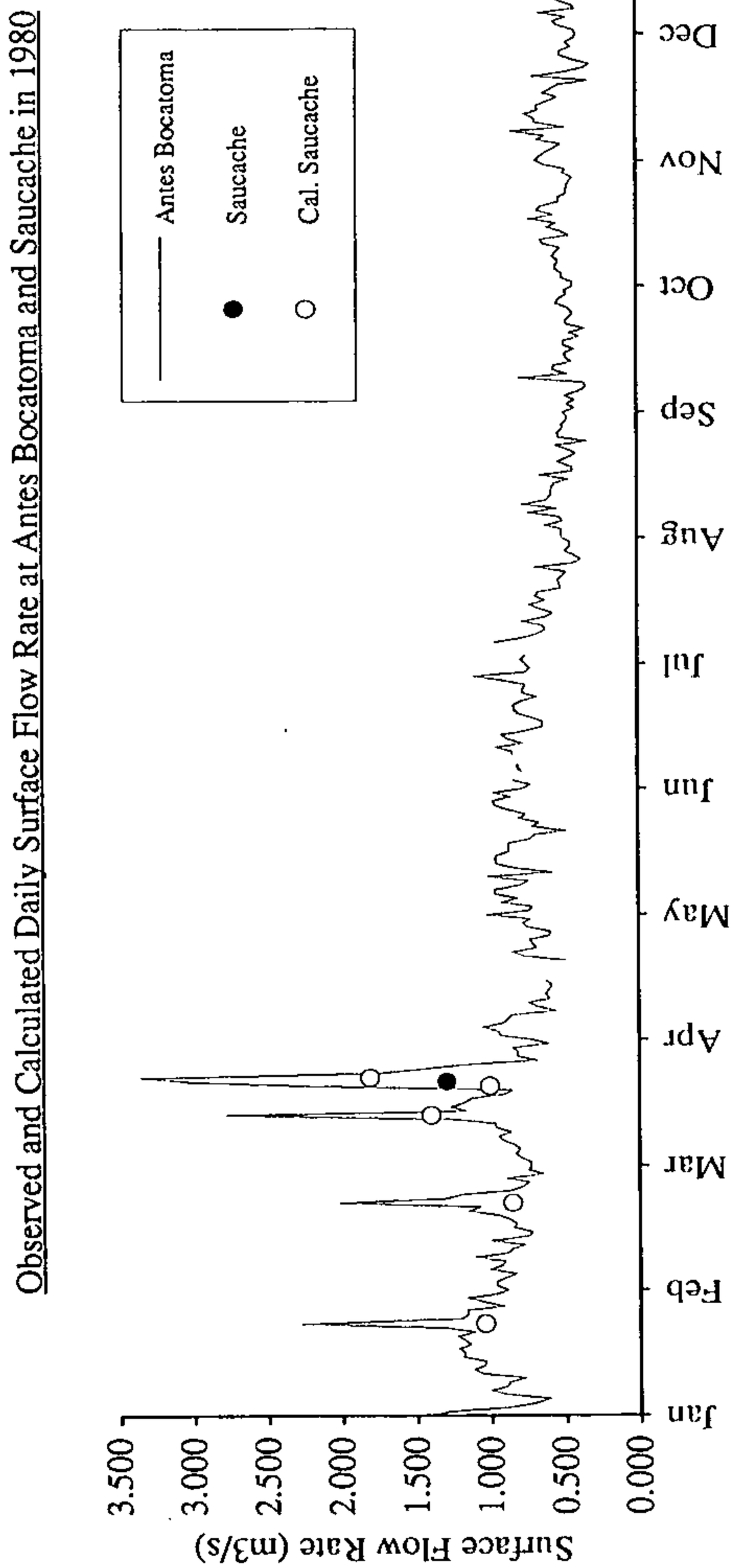
<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1981



Appendix A, 1.5(4) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

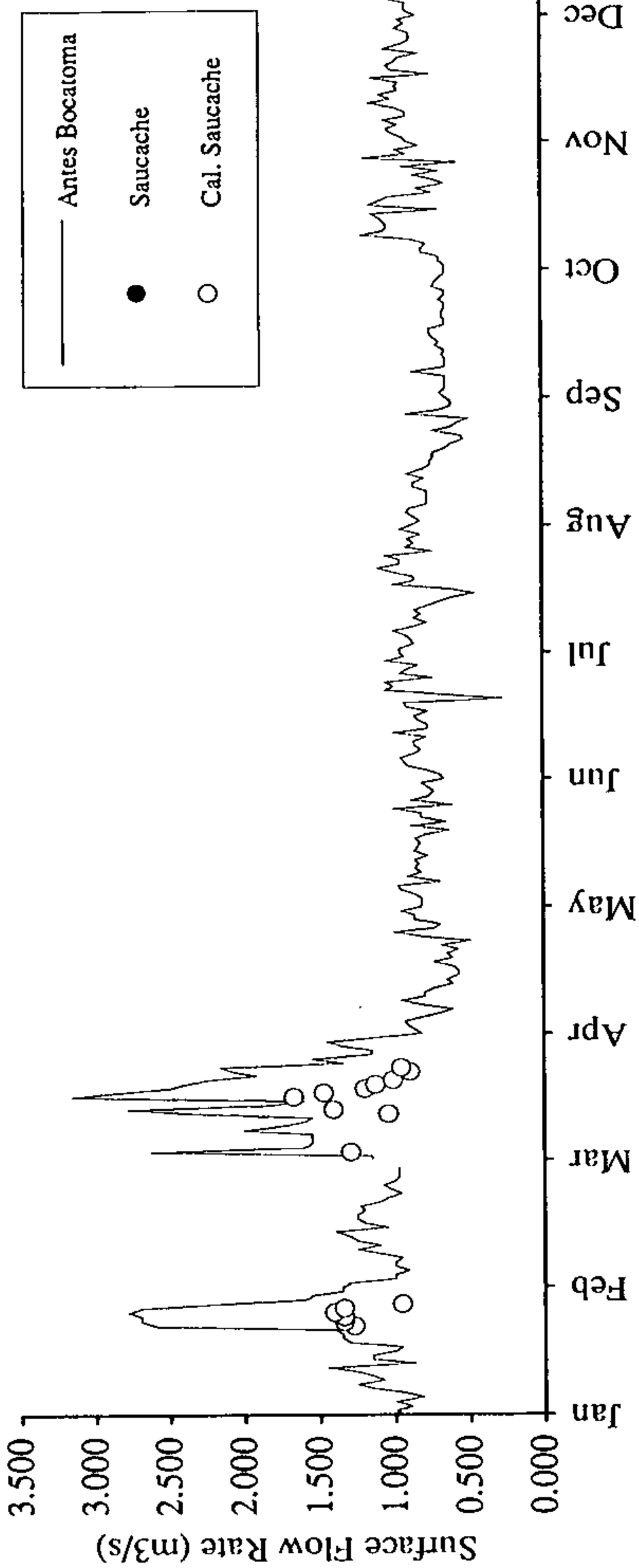
<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



Appendix A, 1.5(5) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

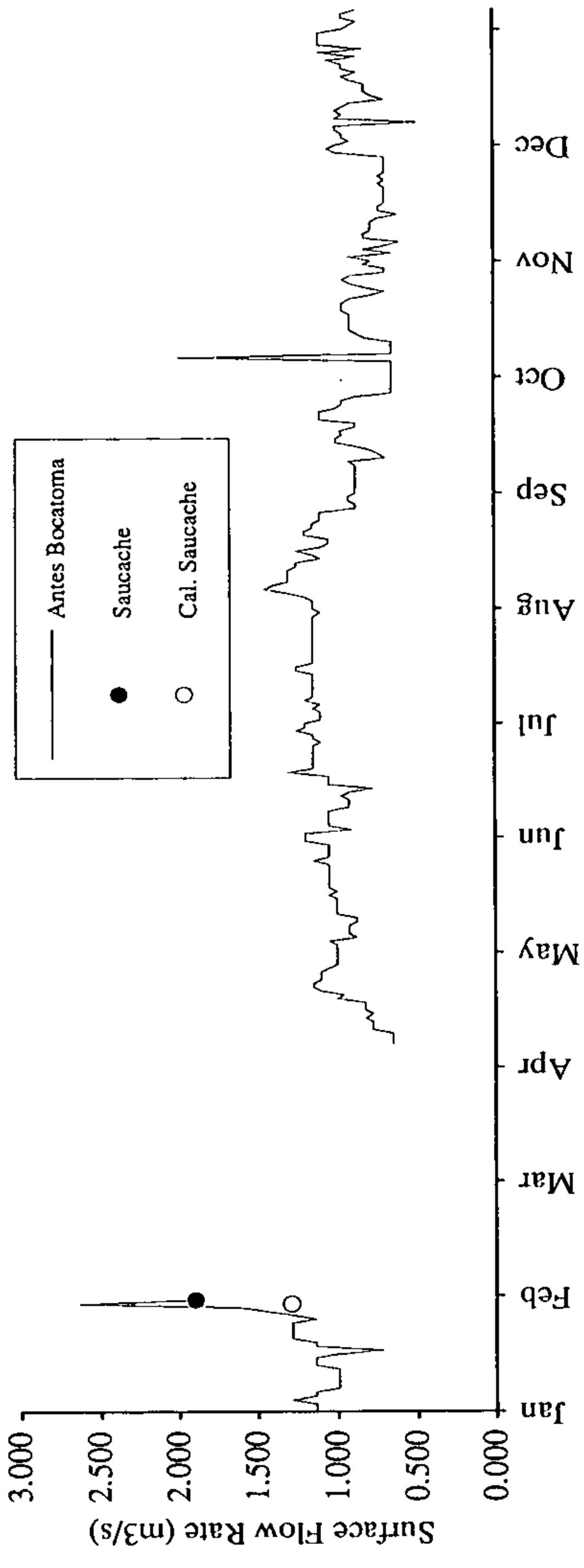
<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1979



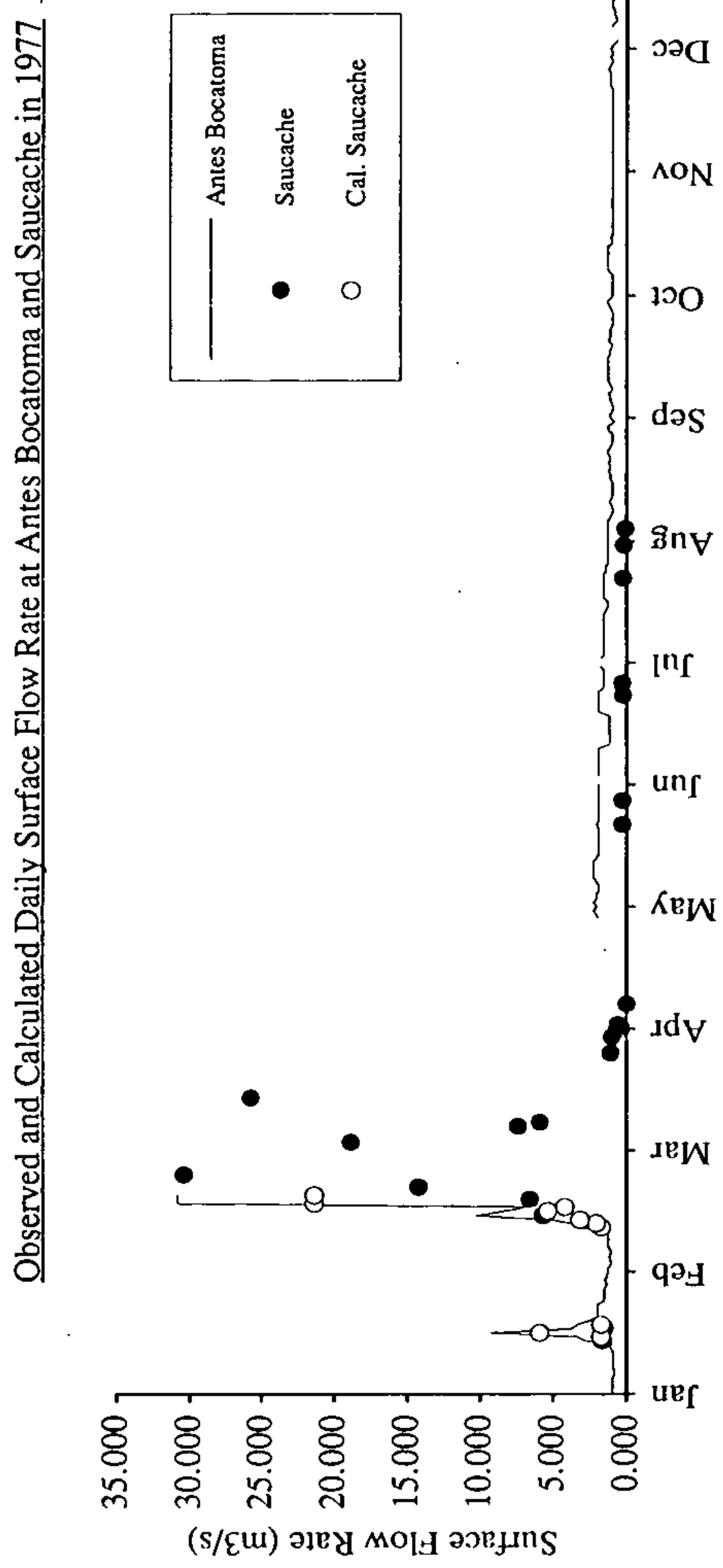
Appendix A, 1.5(6) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



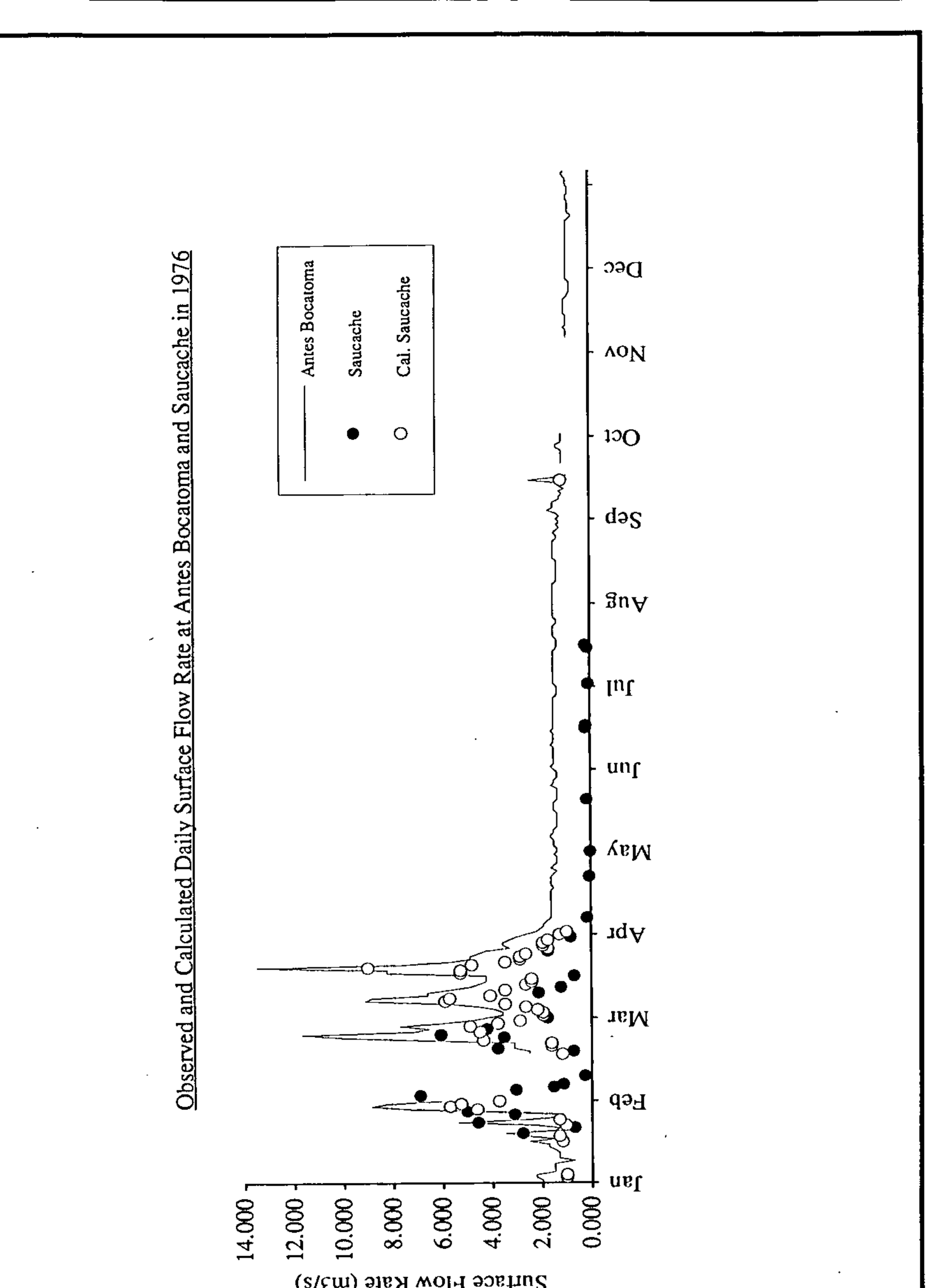
Appendix A, 1.5(7) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



Appendix A, 1.5(8) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>



Appendix A, 1.5(9) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo Observado y Calculado Antes Bocatomay Saucache>

Appendix A, 1.5 (10) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Jan	1	2.010			1.020			1.140			0.956			1.420			0.564			0.584						
	2	2.010			1.020			1.140			1.000			1.290			0.588			0.526						
	3	2.260		1.032	1.020			1.140			0.895			0.893			0.618			0.698						
	4	2.260		1.032	1.020			1.290			1.000			0.712			0.545			0.720						
	5	1.500			1.020			1.140			0.818			0.609			0.657			0.794			0.589			
	6	1.500			0.860			1.140			0.935			0.910			0.630			0.535			0.596			
	7	1.500			0.954			0.994			1.150			1.010			0.579			0.453			0.629			
	8	1.500			0.930			0.994			1.250			0.905			0.767			0.558			0.634			
	9	0.716			0.930			0.994			1.080			0.890			0.833			0.502			0.601			
	10	1.340			0.930			0.994			1.150			0.774			0.858			0.384			0.592			
	11	1.340			0.930			0.994			1.250			1.060			0.736			0.369			0.562			
	12	1.340			1.120			0.994			1.450			1.120			0.654			0.362			0.541			
	13	1.500			1.120			1.140			0.875			1.050			0.613			0.351			0.535			
	14	1.750			2.900	1.710		1.140			1.150			1.040			0.697			0.375			0.526			
	15	1.750			3.360		1.815	1.140			1.150			1.190			0.625			0.496			0.552			
	16	2.520		1.217	9.280		6.030	0.994			1.000			1.180			0.619			0.522			0.565			
	17	1.500			3.800	1.580		0.722			0.956			1.220			0.977			0.455			0.595			
	18	2.680		1.331	3.360		1.815	1.140			1.300			1.140			0.818			0.478			0.561			
	19	3.490	2.810		2.560			1.140			1.350			1.180			0.749			0.557			0.567			
	20	1.500			2.000			1.290			1.350			1.230						0.593			0.586			
	21	1.340	0.710		2.000			1.290			1.400			1.110			0.709			0.622			0.618			
	22	2.320		1.075	2.000			1.290			2.600		1.274	1.300			0.922			0.747			0.545			
	23	5.380	4.600		2.000			1.290			2.700		1.345	2.280		1.046	1.090			0.562			0.527			
	24	2.680		1.331	1.520			1.290			2.700		1.345	1.200			1.250			0.489			0.683			
	25	1.170			1.520			1.140			2.790		1.409	1.160			1.150			0.554			0.608			
	26	1.170	3.150		1.520			1.290			2.700		1.345	1.160			1.130			0.624			0.603			
	27	3.860	5.030		1.520			1.450			2.160		0.961	0.923			1.190			0.724			0.668			
	28	7.340		4.649	1.410			1.620			1.600			1.050			1.300			0.660			0.679			
	29	8.860		5.731	1.520			2.630		1.296	1.550			1.160			1.440			0.566			0.786			
	30	8.240		5.290	1.410			1.940	1.900		1.350			0.966			1.480			0.592			0.738			
	31	6.100		3.766	1.310						1.350			0.894			1.380			0.091			0.675			

Appendix A, 1.5 (11) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Feb	1				1.310						1.300			0.970			1.500			1.800		0.705	0.712			
	2		6.920		1.120						1.000			0.974			1.560						0.745			
	3				1.210						1.000			0.907			1.600						0.711			
	4		3.090		1.210						0.911			0.840			1.580			0.639			0.706			
	5		1.560		1.120						1.000			1.010			1.630			0.606			0.789			
	6		1.170		1.310						1.000			0.931			1.600			0.525			0.688			
	7				1.310						0.956			0.915			1.590			0.483			0.653			
	8				1.310						1.100			1.110			2.160		0.961	0.542			0.715			
	9		0.290		1.310						1.250			0.891			2.180		0.975	0.506			0.785			
	10				1.310						1.100			0.868			2.420		1.146	0.421			0.758			
	11				3.360		1.815				1.250			0.780			2.380		1.118	0.451			0.733			
	12				3.800		2.129				1.300			1.000			1.940			0.448			0.726			
	13				5.310		3.204				1.400			0.747			1.350			0.459			0.589			
	14				10.300	5.810					1.050			0.731			0.772			0.493			0.712			
	15				8.460		5.447				1.200			0.856			0.645			0.480			0.800			
	16				6.820		4.279				1.250			0.838			0.615			0.536			0.792			
	17	2.520		1.217	30.900		21.424				1.250			0.879			0.987			0.528			0.788			
	18	2.520	0.750		30.900	6.710					1.200			0.959			0.839			0.531			0.860			
	19	3.130	3.820		30.900		21.424				1.230			1.150			0.909			0.512			0.897			
	20	3.130		1.652							1.100			1.070			0.840			1.130			0.738			
	21	3.130		1.652		14.300					1.050			2.020		0.861	1.010			0.767			0.902			
	22	6.980		4.393							0.956			1.310			0.960			0.622			0.950			
	23	10.100	3.580								1.030			1.200			1.370			0.575			0.809		0.980	
	24	11.700	6.100			30.500					1.080			0.871			1.250			0.661			0.928		2.420	
	25	7.170		4.528							1.000			0.788			1.350			0.544			0.957		7.640	
	26	6.550	4.240								0.980			0.749						0.556			0.894		5.550	
	27	7.720		4.920							0.980			0.897						0.619			1.020			
	28	6.160		3.809							0.980			0.650						0.675			0.868			
	29	4.900		2.912										0.755											0.570	

Appendix A, 1.5 (12) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Mar	1	4.240	1.810								1.150			0.733						0.851			0.852			
	2	3.590		1.979							1.150			0.744						0.765			0.948			
	3	3.590		1.979		18.900					2.630		1.296	0.804						0.769			0.886			
	4	3.920		2.214							1.600			0.845						0.831			0.862			
	5	4.570		2.677							1.550			0.815						1.030			0.876			
	6	5.740		3.510							1.550			0.839			7.200			0.956			0.874	2.710		1.353
	7	9.120		5.916		7.510					1.550			0.922						0.817			0.978	3.090		1.623
	8	8.860		5.731		6.010					2.000			0.954						0.594			0.903	2.780		1.402
	9	6.580		4.108							1.760			0.867						0.654			1.190	2.630		1.296
	10	6.580	2.160								1.600			0.970						0.778			0.615	2.680		1.331
	11	5.740		3.510							1.550			0.980									0.364	4.680		2.755
	12	4.900	1.250								2.280		1.046	1.250									0.268	6.750		4.229
	13	4.570		2.677							2.790		1.409	2.780		1.402							0.281	4.930		2.933
	14	4.240		2.442		25.850					1.840			1.170									0.317	3.780		2.114
	15	4.240		2.442							1.600			1.270									0.366	2.760		1.388
	16	4.240	0.710								3.160		1.673	1.180									0.380	2.260		1.032
	17	8.240		5.290							2.880		1.474	1.130									0.387	1.640		
	18	8.240		5.290							2.500		1.203	0.912									0.384	1.230		
	19	13.500		9.035							2.400		1.132	0.863									0.384	1.690		
	20	7.620		4.848							2.240		1.018	2.230		1.011							0.384	1.990		
	21	5.740		3.510							1.920			3.040	1.300								0.384	2.270		1.039
	22	4.900		2.912							2.080		0.904	3.360		1.815							0.384	4.990		2.976
	23	4.900		2.912							2.160		0.961	1.780									0.384	4.660		2.741
	24	4.570		2.677							1.340			1.480									0.384	3.980		2.257
	25	4.240	1.790			1.160					1.550			1.220									0.384	3.760		2.100
	26	3.320		1.787							1.150			0.688									0.384	3.140		1.659
	27	3.590		1.979							1.150			0.829									0.384	2.480		1.189
	28	3.590		1.979							1.350			0.825									0.384	2.660		1.317
	29	3.320		1.787		1.050					1.450			0.857									0.384	2.560		1.246
	30	3.050	0.850			0.780					1.150			0.613									0.384	2.210		0.997
	31	2.640		1.303		0.400					0.818			0.730									0.384	1.870		

Appendix A, 1.5 (13) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Apr	1	2.230		1.011		0.640					0.863			0.938									0.382	1.930		
	2	2.080									0.908			0.952									0.374	1.850		
	3	1.930									0.932			1.050									0.382			
	4	1.930									0.818			0.924									0.384	1.250		
	5	1.780									0.694			0.891						0.554			0.384	1.170		
	6	1.630	0.190			0.050		0.650			0.610			0.859						0.563			0.471	0.947		
	7	1.630						0.650			0.821			0.562						0.640			0.502	0.970		
	8	1.630						0.650			0.956			0.690						0.683			0.488	0.977		
	9	1.630						0.650			0.797			0.747						0.644			0.519	1.110		
	10	1.630						0.779			0.797			0.602						0.601			0.493	1.040		
	11	1.630						0.779			0.734			0.635						0.616			0.476	1.010		
	12	1.630						0.779			0.610			0.614						0.536			0.499	0.964		
	13	1.630						0.827			0.650			0.588						0.597			0.620	0.980		
	14	1.630						0.779			0.570			0.626						0.503			0.498	0.839		
	15	1.630						0.827			0.570									0.546			0.475			
	16	1.630						0.827			0.610									0.564			0.485			
	17	1.500						0.827			0.739									0.616			0.452	0.879		
	18	1.630						1.000			0.610									0.699			0.449	0.887		
	19	1.630						0.956			0.650			0.496						0.640			0.314	0.965		
	20	1.630						1.100			0.570			0.780						0.622			0.303	1.060		
	21	1.630	0.080					1.150			0.692			0.854						0.552			0.379	1.260		
	22	1.500						1.150			0.493			0.687						0.530			0.257	1.230		
	23	1.370						1.100			0.821			0.719			0.506			0.529			0.297	1.160		
	24	1.630						1.100			1.000			0.740			0.435			0.595			0.311	0.868		
	25	1.500						1.100			0.734			0.608			0.644			0.494			0.235	1.050		
	26	1.370						1.050			0.692			0.602			0.618			0.474			0.264	1.050		
	27	1.370			1.940			1.000			0.869			0.757			0.606			0.478			0.310	1.040		
	28	1.370			2.110			1.000			0.863			0.785			0.723			0.495			0.340	1.120		
	29	1.500			2.280			1.000			0.956			0.734			0.570			0.604			0.310	0.957		
	30	1.370	0.050		2.110			1.000			0.818			1.020			0.697			0.585			0.273	1.030		

Appendix A, 1.5 (14) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
May	1	1.370			2.280			1.000			0.821			0.741			0.636			0.576			0.242	1.010		
	2	1.500			2.110			1.000			0.821			0.723			0.620			0.605			0.270	0.981		
	3	1.500			2.110			1.050			0.863			0.924			0.649			0.618			0.282	1.010		
	4	1.500			1.940			0.875			0.959			0.817			0.563			0.657			0.277	1.060		
	5	1.630			1.940			0.925			0.980			0.966			0.536			0.733			0.285			
	6	1.630			2.110			0.925			0.692			0.969			0.667			0.687			0.284	1.010		
	7	1.500			2.280			0.925			0.911			0.800			0.600			0.606			0.293	1.150		
	8	1.500			2.280			0.875			0.821			0.748			0.434			0.605			0.250	1.180		
	9	1.370			2.280			0.875			0.863			1.010			0.480			0.659			0.207	1.150		
	10	1.370			2.280			1.000			0.839			0.582			0.502			0.656			0.252	0.981		
	11	1.370			2.280			1.000			0.863			0.829			0.635			0.562			0.237	1.000		
	12	1.370			2.110			1.000			0.776			0.956			0.571			0.587			0.272	1.030		
	13	1.370			1.940			1.000			0.869			0.967			0.410			0.507			0.271	1.050		
	14	1.370			1.940			1.000			0.848			0.959			0.412			0.464			0.216	1.090		
	15	1.500			1.940			1.050			0.827			0.874			0.490			0.522			0.243	1.000		
	16	1.500			1.940			1.000			0.863			0.882			0.666			1.000			0.206	1.050		
	17	1.500			1.940			1.050			0.787			0.880			0.562			0.753			0.244	1.330		
	18	1.500			1.940			1.050			0.630			0.740			0.563			0.495			0.237	1.110		
	19	1.370	0.190		1.940			1.050			0.890			0.704			0.467			0.590			0.254	1.100		
	20	1.370			2.110	0.370		1.050			0.650			0.490			0.504			0.635			0.235	1.160		
	21	1.370			1.940			1.050			0.818			0.718			0.616			0.615			0.258	1.300		
	22	1.370			1.940			1.050			0.818			0.675			0.586			0.710			0.277	1.350		
	23	1.370			1.940			1.050			1.000			0.810			0.556			0.521			0.269	1.110		
	24	1.630			1.940			1.150			0.610			0.764			0.536			0.429			0.243	1.190		
	25	1.500			1.940			1.050			0.887			0.873			0.251			0.577			0.281	1.110		
	26	1.500			1.940	0.350		1.050			0.776			0.968			0.441			0.554			0.271	0.918		
	27	1.370			1.940			1.050			0.734			0.983			0.374			0.473			0.294	0.994		
	28	1.370			1.940			1.050			0.776			0.858			0.521			0.788			0.277	1.120		
	29	1.370			1.940			1.200			0.821			0.978			0.718			0.520			0.254	1.080		
	30	1.500			1.940			1.200			0.672			0.789			0.705			0.350			0.292	0.983		
	31	1.630						1.200			0.692			0.724			0.598			0.362			0.264			

Appendix A, 1.5 (15) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Jun	1	1.500			1.940			0.908			0.776			0.842			0.579			0.505			0.273			
	2	1.500			1.940			1.050			0.908						0.712			0.779			0.335			
	3	1.500			1.940			1.050			0.932			0.790			0.382			0.407			0.383			
	4	1.500			1.940			1.050			0.956			0.815			0.186			0.555			0.282			
	5	1.500			1.940			1.050			0.863			0.812			0.329			0.518			0.348			
	6	1.500			1.940			1.050			0.818						0.239			0.536			0.259			
	7	1.500			1.940			0.925			0.863			0.848			0.474			0.622			0.289			
	8	1.630			1.940			0.925			0.863			0.848			0.646			0.589			0.353			
	9	1.500			1.200			0.925			0.779			0.956			0.673			0.548			0.324			
	10	1.500			1.200			0.975			1.000			0.779			0.614			0.561						
	11	1.500			1.200			0.925			0.776			0.879			0.543			0.568			0.396			
	12	1.500			1.200			0.779			0.776			0.924			1.120			0.615			0.392			
	13	1.630			1.200			1.050			0.839			0.758			1.130			0.467			0.283			
	14	1.500	0.230		1.200			1.050			0.863			0.645			1.080			0.396			0.401			
	15	1.500	0.200		1.200			1.050			0.767			0.645			1.150			0.518			0.429			
	16	1.500			1.200			1.300			0.911			0.721			1.150			0.577			0.384			
	17	1.500			1.940			1.150			0.932			0.815			1.190			0.586			0.279			
	18	1.500			1.940			1.150			0.266			0.838			1.230			0.531			0.355			
	19	1.500			1.940			1.150			0.666			0.842			1.130			0.559			0.328			
	20	1.500			1.940			1.150			1.050			0.789			1.370			0.644			0.319			
	21	1.500			1.940	0.330		1.150			1.000			0.683			1.280			0.777			0.348			
	22	1.500			1.940			1.150			1.050			0.784			1.360			0.538			0.341			
	23	1.500			1.620			1.150			0.734			0.782			1.330			0.486			0.374			
	24	1.500			1.620	0.340		1.100			0.956			0.766			1.250			0.502			0.466			
	25	1.500			1.620			1.150			0.911			0.912			1.300			0.544			0.381			
	26	1.370			1.620			1.150			0.835			1.100			1.380			0.693			0.475			
	27	1.370			1.620			1.250			1.050			0.766			1.360			0.622			0.406			
	28	1.370			1.780			1.200			0.932			0.730			1.320			0.671			0.336			
	29	1.370						1.200			0.956			0.761			1.370			0.602			0.404			
	30	1.500	0.100		1.780			1.100			0.956			0.794			1.390			0.560			0.402			

Appendix A, 1.5 (16) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Jul	1	1.500			1.620			1.100			0.863			0.762			1.250			0.588			0.527			
	2	1.500			1.620			1.100			0.884						1.330			0.675			0.423			
	3	1.500			1.620			1.150			0.911						1.380			0.613			0.372			
	4	1.500			1.620			1.100			1.000			0.965			1.430			0.682			0.416			
	5	1.500			1.620			1.200			0.869			0.788			1.340			0.649			0.387			
	6	1.500			1.620			1.150			0.776			0.682			1.410			0.700			0.401			
	7	1.500			1.620			1.150			0.869			0.624			1.420			0.659			0.434			
	8	1.500			1.620			1.150			0.821			0.545			0.964			0.599			0.333			
	9	1.500			1.620			1.150			0.863			0.786			0.577			0.631			0.241			
	10	1.500			1.620			1.150			0.776			0.629			0.592			0.732			0.304	0.711		
	11	1.500			1.620			1.150			0.694			0.571			0.592			0.807			0.368	0.707		
	12	1.500			1.450			1.150			0.610			0.665			0.584			0.671			0.372	0.715		
	13	1.370	0.140		1.290			1.250			0.459			0.733			0.595			0.613			0.442	0.704		
	14	1.370	0.230		1.290			1.250			0.618			0.625			0.628			0.615			0.440	0.712		
	15	1.370			1.620			1.150			1.000			0.697			0.685			0.609			0.387	0.741		
	16	1.370			1.620			1.150			0.863			0.676			0.645			0.728			0.384	0.746		
	17	1.500			1.620			1.150			0.869			0.515			0.674						0.364	0.721		
	18	1.500			1.620			1.150			1.000			0.534			0.645						0.392	0.691		
	19	1.500			1.620			1.150			1.100			0.542			0.695						0.442	0.689		
	20	1.500			1.620	0.310		1.150			0.959			0.505			0.653						0.371	0.698		
	21	1.500			1.620			1.150			0.956			0.482			0.700						0.439	0.720		
	22	1.370			1.450			1.150			1.050			0.693			0.712			0.645			0.398	0.720		
	23	1.370			1.450			1.150			0.734			0.440			0.689			0.680			0.487	0.738		
	24	1.500			1.290			1.150			0.917			0.382			0.660			0.631			0.432	0.750		
	25	1.500			1.290			1.150			0.863			0.425			0.750			0.648			0.433	0.737		
	26	1.500			1.290			1.150			0.908			0.496			0.676			0.622			0.424	0.721		
	27	1.500			1.290			1.150			0.821			0.455			0.713			0.645			0.334	0.683		
	28	1.500			1.290	0.240		1.100			0.956			0.459			0.709			0.675			0.505	0.793		
	29	1.500			1.290			1.150			0.890			0.513			0.732			0.817			0.476	0.842		
	30	1.500			1.290			1.150			0.821			0.517			0.694			0.635			0.452	0.794		
	31	1.500			1.290			1.150			0.863			0.512			0.696			0.613			0.435	0.786		

Appendix A, 1.5 (17) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Aug	1	1.500			1.290	0.160		1.200			0.911			0.623			0.658			0.556			0.393			
	2	1.500			1.290			1.300			0.887			0.500			0.651			0.611			0.524			
	3	1.500			1.290			1.450			0.776			0.530			0.660			0.659			0.417			
	4	1.500			1.140			1.400			0.779			0.737			0.672			0.703			0.454			
	5	1.500			0.994			1.300			0.776			0.539			0.646			0.647			0.455			
	6	1.370			0.994			1.300			0.776			0.782			0.712			0.645			0.462			
	7	1.370			1.140			1.300			0.863			0.615			0.771			0.635			0.527			
	8	1.370			1.140			1.300			0.863			0.589			0.656			0.610			0.441			
	9	1.370			0.994			1.250			0.787			0.585			0.832			0.590			0.390			
	10	1.370			0.994			1.250			0.911			0.581			0.702			0.413			0.472			
	11	1.370			0.994			1.100			0.818			0.562			0.774			0.469			0.445			
	12	1.370			0.994			1.150			0.755			0.467			0.787			0.598			0.387			
	13	1.370			1.140			1.250			0.755			0.661			0.847			0.478			0.559			
	14	1.500			1.140			1.100			0.734			0.435			0.803			0.591			0.390			
	15	1.500			1.290			1.050			0.734			0.448			0.719			0.590			0.349			
	16	1.500			1.140			1.050			0.650			0.540			0.711			0.560			0.294			
	17	1.500			1.290			1.200			0.612			0.482			0.651			0.636			0.349			
	18	1.500			1.140			1.200			0.530			0.414			0.599			0.630			0.289			
	19	1.500			1.290			1.150			0.550			0.465			0.618			0.615			0.309			
	20	1.500			1.290			1.150			0.739			0.558			0.596			0.575			0.353			
	21	1.370			1.140			1.100			0.610			0.336			0.656			0.539			0.428			
	22	1.370			0.994			1.100			0.570			0.538			0.646			0.576			0.396			
	23	1.500			0.994			1.100			0.490			0.541			0.670			0.548			0.399			
	24	1.370			0.994			0.875			0.911			0.508			0.685			0.570			0.484			
	25	1.260			1.290			0.875			0.692			0.513			0.717			0.533			0.443			
	26	1.370			1.290			0.925			0.610			0.484			0.548			0.598			0.732			
	27	1.260			0.871			0.925			0.610			0.475			0.669			0.646			0.481			
	28	1.370			1.140			0.875			0.650			0.502			0.629			0.526			0.344			
	29	1.260			1.140			0.875			0.692			0.421			0.615			0.554			0.559			
	30	1.370			0.994			0.875			0.650			0.479			0.720			0.523			0.667			
	31	1.730			0.994			0.875			0.650			0.422			0.718			0.508			0.533			

Appendix A, 1.5 (18) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Sep	1	1.500			1.140			0.875			0.650			0.490			0.867			0.559			0.624			
	2	1.500			1.140			0.875			0.650			0.399			0.840			0.606			0.679			
	3	1.500			1.290			0.875			0.875			0.348			0.760			0.605			0.822			
	4	1.260			0.994			0.875			0.650			0.364			0.749			0.661			0.610			
	5	1.260			1.140			0.917			0.650			0.801			0.780			0.700			0.595			
	6	1.150			1.290			0.694			0.650			0.466			0.659			0.716			0.492			
	7	1.260			1.290			0.734			0.671			0.569			0.704			0.781						
	8	1.040			1.290			0.779			0.650			0.560			0.753			0.711						
	9	1.260			1.290			0.875			0.713			0.443			0.758			0.683						
	10	1.260			1.290			1.000			0.692			0.481						0.657						
	11	2.480		1.189	1.290			1.000			0.734			0.492						0.632						
	12	1.500			1.290			0.959			0.755			0.420						0.577						
	13	0.930			1.140			0.975			0.755			0.495						0.523						
	14				1.140			0.875			0.650			0.495						0.535						
	15				0.994			0.875			0.650			0.388						0.565						
	16				1.290			1.100			0.671			0.459						0.672						
	17	1.150			1.140			1.100			0.671			0.346						0.675						
	18	1.150			1.140			1.100			0.650			0.479						0.658						
	19	1.150			1.140			1.000			0.650			0.484						0.578						
	20	1.150			0.994			0.959			0.692			0.440						0.528						
	21	1.150			0.994			0.959			0.650			0.438						0.787						
	22	1.150			0.994			0.875			0.650			0.470						0.638						
	23	1.370			0.994			0.650			0.734			0.546						0.469						
	24	1.370			1.140			0.650			0.713			0.527						0.552						
	25	1.150			1.290			0.650			0.692			0.477						0.560						
	26	1.150			1.290			0.650			0.650			0.490						0.561						
	27	1.150			0.994			0.650			0.650			0.431						0.606						
	28	1.150			0.994			0.650			0.650			0.435						0.584						
	29				0.994			0.650			0.692			0.510						0.608			0.440			
	30				0.994			0.650			0.692			0.506						0.616			0.434			

Appendix A, 1.5 (19) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Oct	1				0.994			0.650			0.803			0.551						0.600			0.389			
	2				0.994			1.990			0.803			0.547						0.592			0.464			
	3				1.290			0.650			0.776			0.533						0.592			0.362			
	4				1.290			0.650			0.875			0.571						0.592			0.432			
	5				1.290			0.650			1.200			0.551						0.592			0.512			
	6				1.290			0.650			1.050			0.518						0.568			0.523			
	7				1.290			0.818			1.030			0.630						0.558			0.416			
	8				1.290			0.863			1.050			0.654						0.512			0.358			
	9				1.290			0.908			1.080			0.457						0.512			0.375			
	10				0.994			0.908			1.130			0.510						0.486			0.371			
	11				1.140			0.908			0.690			0.604						0.500			0.434			
	12				0.994			0.908			1.150			0.547						0.513			0.496			
	13				0.994			0.908			1.080			0.725						0.499			0.446			
	14				0.994			0.956			1.020			0.563						0.501			0.512			
	15				0.994			0.956			0.734			0.674						0.491			0.476			
	16				0.994			0.956			0.839			0.650						0.530			0.444			
	17				0.994			0.911			0.652			0.523						0.645			0.474			
	18				0.994			0.779			0.734			0.534						0.603			0.367			
	19				0.994			0.694			0.860			0.478						0.637			0.315			
	20				0.994			0.818			0.690			0.477						0.673			0.471			
	21				0.994			0.908			0.932			0.472						0.527			0.369			
	22				0.994			0.956			0.571			0.456						0.613			0.452			
	23				0.994			0.911			1.180			0.431						0.575			0.307			
	24				0.994			0.692			0.908			0.496						0.671			0.304			
	25				0.994			0.692			0.980			0.481						0.624			0.318			
	26				0.994			0.827			0.821			0.628						0.671			0.351			
	27				0.994			0.779			0.908			0.679						0.623			0.378			
	28				0.994			0.917			0.932			0.657						0.523			0.332			
	29				0.994			0.652			1.000			0.611						0.605			0.442			
	30				0.994			0.821			1.030			0.557						0.672			0.491			
	31				0.994			0.692			0.956			0.513						0.606			0.451			

Appendix A, 1.5 (20) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Nov	1	0.930			0.994			0.594			1.050			0.670						0.583			0.509			
	2	0.930			0.994			0.821			0.908			0.619						0.608			0.533			
	3	0.930			0.994			0.827			0.908			0.846						0.608			0.606			
	4	0.930			0.994			0.779			0.980			0.487						0.608			0.472			
	5	1.040			0.994			0.779			1.150			0.683						0.473			0.440			
	6	0.930			0.994			0.779			1.000			0.687						0.568			0.480			
	7	0.930			0.994			0.739			1.080			0.756						0.576			0.606			
	8	0.930			0.994			0.610			0.956			0.666						0.576			0.536			
	9	0.930			0.994			0.734			0.980			0.673						0.576			0.617			
	10	1.040			0.994			0.734			0.956			0.600						0.576			0.479			
	11	1.040			0.994			0.692			1.130			0.533						0.576			0.495			
	12	1.040			0.994			0.692			0.751			0.631						0.576			0.461			
	13	1.040			0.994			0.692			1.000			0.574						0.666			0.373			
	14	1.040			0.994			0.692			1.030			0.526						0.538			0.398			
	15	1.040			0.994			0.692			0.980			0.326						0.622			0.398			
	16	0.900			0.994			0.734			0.959			0.702						0.748			0.401			
	17	0.860			1.140			0.692			0.818			0.492						0.715			0.396			
	18	0.790			1.140			0.734			1.050			0.364			0.603			0.710			0.423			
	19	0.790			1.140			0.692			0.956			0.315			0.504			0.750			0.545			
	20	0.790			1.140			0.692			0.887			0.431			0.615			0.751			0.441			
	21	0.790			1.290			0.692			0.884			0.515			0.658			0.693			0.462			
	22	0.930			1.140			0.692			0.890			0.518			0.639			0.681			0.394			
	23	0.930			0.994			0.692			0.980			0.440			0.623			0.662			0.450			
	24	0.930			1.140			1.000			0.911			0.482			0.607			0.711			0.523			
	25	0.930			0.994			1.050			0.959			0.423			0.601			0.712			0.460			
	26	0.930			1.140			1.000			0.839			0.407			0.628			0.668			0.579			
	27	0.930			0.994			0.911			0.908			0.429			0.682			0.667			0.250			
	28	0.930			0.722			0.956			0.917			0.532			0.666			0.649			0.456			
	29	0.930						0.956			0.908			0.563			0.668			0.716			0.422			
	30	0.930						1.000			1.050			0.474			0.682			0.782			0.413			

Appendix A, 1.5 (21) Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache

<Nivel Diario de Flujo de Superficie Observado y Calculado Antes Bocatoma y Saucache>

(No observation at Saucache in 1983) Unit : m3/s

Date		1976			1977			1978			1979			1980			1981			1982			1983	1984		
		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Saucache		Ant.B	Ant.B	Saucache	
		Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qcal	Qobs	Qobs	Qobs	Qcal
Dec	1	0.930			0.994			1.000			0.755			0.654			0.709			0.642						
	2	0.930			0.994			0.490			0.776			0.411			0.685			0.748						
	3	0.930			0.722			1.000			0.692			0.446			0.725			0.783						
	4	0.930			0.858			0.956			0.755			0.543			0.718			0.763						
	5	0.930			0.858			1.000			0.776			0.509			0.549			0.744						
	6	0.930			0.994			0.956			0.908			0.658			0.727			0.729						
	7	0.930			0.994			0.911			0.956			0.400			0.805			0.751						
	8	0.930			0.994			0.692			0.932			0.505			0.709			0.676						
	9	0.930			0.722			0.776			0.980			0.435			0.754			0.709						
	10	0.930			0.994			0.818			0.908			0.437			0.821			0.806						
	11	0.930			0.994			0.818			0.908			0.484			0.875			0.733						
	12	0.930			0.994			0.818			0.932			0.493			0.934			0.661				0.986		
	13	0.930			0.994			0.911			0.908			0.409			0.889			0.719				0.937		
	14	0.790			0.994			0.956			0.779			0.376			0.833			0.687				0.888		
	15	0.720			0.994			0.863			0.824			0.445			0.789			0.739				0.875		
	16	0.860			0.994			0.956			0.908			0.436			0.811			0.660				0.890		
	17	0.860			0.994			0.956			0.908			0.444			0.855			0.496				0.953		
	18	0.860			0.994			1.050			0.893			0.509			0.844							0.949		
	19	0.860			0.994			0.869			1.030			0.574			0.851							0.937		
	20	0.860			0.994			1.100			0.821			0.491			0.800							1.000		
	21	0.930			0.994			0.827			1.050			0.536			0.827							0.950		
	22	0.930			0.994			1.100			0.956			0.466			0.833							0.910		
	23	0.860			0.994			1.100			1.100			0.478			0.812							0.970		
	24	0.860			0.994			1.100			1.100			0.528			0.790							0.972		
	25	0.860			0.994			1.100			1.000			0.505			0.740							1.020		
	26	0.930			1.140			0.959			0.713			0.505			0.912							1.000		
	27	0.930			0.994			0.908			0.683			0.522			1.140							0.928		
	28	0.930			1.140			0.863			1.170			0.508			0.957							0.923		
	29	1.020			1.140			0.956			1.080			0.498			0.630							1.000		
	30	1.120			1.140			0.956			2.700		1.345	0.485			0.948							1.010		
	31	1.020			0.994			0.869						0.465			0.605							0.975		

Appendix A, 2.1 (1) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01000050-5 VISVIRI													
1974	227.20	167.00	52.00	0.00	0.00	0.00	0.00	46.00	0.00	0.00	0.00	6.00	498.20
1975	86.80	109.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	117.60	313.70
1976	209.70	144.50	64.50	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	24.50	444.70
1977	86.50	157.60	44.50	14.50	0.00	0.00	0.00	0.00	1.50	16.00	28.60	31.00	380.20
1978	147.50	8.00	33.00	16.50	0.00	0.00	1.00	1.00	0.00	13.50	71.00	58.00	349.50
1979	157.50	0.00	102.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50	5.80	123.50	397.30
1980	38.00	29.00	91.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00	48.00	241.00
1981	174.50	181.30	27.00	25.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00	99.80	519.60
1982	79.50	26.00	98.50	0.00	0.00	0.00	0.00	0.00	0.80	63.40	0.20	28.00	296.40
1983	17.00	13.40	0.00	0.00	0.00	0.00	0.00	0.00	1.50	3.00	0.00	10.00	44.90
1984	167.00	206.00	149.50	2.00	0.00	3.00	0.00	5.00	0.00	60.00	89.00	42.00	723.50
1985	71.00	165.00	37.00	0.20	0.00	0.00	0.00	0.00	0.00	60.00	93.00	81.00	507.20
1986	156.00	96.60	133.00	11.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	60.90	462.50
1987	103.50	22.00	1.00	0.00	0.00	0.00	20.00	0.00	0.00	26.00	8.00	0.50	181.00
1988	136.00	3.00	64.00	49.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	252.00
1989	114.00	73.00	58.00	65.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	313.00
1990	67.00	19.60	13.00	0.00	2.00	16.00	0.00	0.00	0.00	2.00	9.00	69.00	197.60
1991	92.00	30.00	27.00	10.00	0.00	0.00	0.00	0.00	0.00	2.00	5.00	1.00	167.00
1992	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	27.00	54.00	91.00
1993	145.00	19.00	57.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	221.00
Avg.	113.79	73.67	52.60	9.66	0.10	0.95	1.05	3.45	0.27	14.82	16.98	42.74	330.07
Max.	227.20	206.00	149.50	65.00	2.00	16.00	20.00	46.00	1.50	63.40	93.00	123.50	723.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44.90

Appendix A, 2.1 (2) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01001050-0 CAQUENA													
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	17.00	0.00	0.00	47.90	79.90
1977	78.00	274.00	133.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	24.00	0.00	512.00
1978	133.40	9.40	39.00	0.00	24.00	0.00	0.00	0.00	0.00	0.00	29.30	86.50	321.60
1979	105.50	17.00	81.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.30	64.20	270.30
1980	15.20	34.00	62.30	0.00	0.00	0.00	2.00	0.00	0.00	14.20	0.00	10.10	137.80
1981	36.80	99.20	59.40	26.60	0.00	0.00	0.00	26.00	4.00	0.00	2.00	58.00	312.00
1982	141.00	92.00	62.50	2.00	0.00	0.00	0.00	0.00	6.00	31.50	34.40	8.50	377.90
1983	13.00	11.50	17.60	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	23.00	67.10
1984	131.50	114.50	89.00	2.00	0.00	0.00	0.00	5.00	0.00	20.00	68.00	5.00	435.00
1985	37.00	207.00	89.50	24.00	0.00	0.00	0.00	0.00	2.00	0.00	6.00	129.00	494.50
1986	85.50	73.80	124.00	11.50	1.90	0.00	0.00	18.00	0.00	0.00	6.00	120.50	441.20
1987	312.20	102.50	18.00	5.00	0.00	0.00	213.00	0.00	0.00	10.00	0.00	2.00	662.70
1988	121.50	16.80	110.40	57.50	0.00	0.00	0.00	0.00	0.20	0.80	0.00	41.70	348.90
1989	106.90	72.20	115.90	20.90	0.00	8.30	0.00	0.00	0.00	0.00	0.00	0.00	324.20
1990	0.00	14.00	42.20	15.70	6.00	32.40	0.00	0.00	0.00	19.60	23.80	168.40	322.10
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	13.00	0.00	18.00
Avg.	82.34	71.12	65.26	10.33	1.99	2.54	13.44	4.13	2.01	6.32	13.05	47.80	320.33
Max.	312.20	274.00	133.00	57.50	24.00	32.40	213.00	26.00	17.00	31.50	68.00	168.40	662.70
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00

Appendix A, 2.1 (3) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01020050-4 ISLA BLANCA													
1970	63.00	39.00	35.50	0.00	1.10	0.00	0.00	0.00	0.00	1.70	0.00	17.60	157.90
1971	54.60	122.30	29.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	19.00	55.70	283.80
1972	128.40	88.60	98.70	4.70	0.00	0.90	0.00	0.00	4.40	15.60	2.50	50.10	393.90
1973	167.90	72.60	36.20	4.60	0.00	0.00	0.00	2.50	1.20	0.00	0.00	0.00	285.00
1974	130.00	1.50	39.50	0.00	0.00	2.80	0.00	48.90	5.00	0.00	2.90	7.30	237.90
1975	77.50	148.10	89.50	2.50	2.20	0.80	0.40	0.00	0.00	0.00	0.00	52.10	373.10
1976	98.80	40.30	43.30	3.50	0.60	1.60	6.10	8.70	8.60	0.00	0.00	40.20	251.70
1977	38.30	186.30	113.80	0.90	0.10	0.00	0.00	0.30	4.70	2.40	11.80	30.70	389.30
1978	101.40	27.40	14.50	9.50	0.00	0.00	0.00	3.90	0.00	7.30	22.30	27.40	213.70
1979	68.20	2.90	66.40	0.00	0.00	0.00	0.00	0.00	0.00	3.80	0.30	92.00	233.60
1980	12.00	25.50	93.50	5.20	1.20	0.00	0.10	0.00	0.00	12.40	0.70	8.90	159.50
1981	68.10	106.30	49.80	13.90	0.00	0.00	0.00	10.40	4.60	0.00	2.80	26.60	282.50
1982	69.90	25.50	47.40	26.10	0.50	0.00	0.00	0.70	9.40	36.10	26.40	11.20	253.20
1983	6.10	8.10	11.90	0.10	0.70	0.60	0.00	0.90	1.50	3.80	0.60	15.20	49.50
1984	153.90	182.20	166.90	5.60	1.30	7.10	0.00	0.80	0.00	52.90	78.50	36.90	686.10
1985	84.20	229.10	140.80	59.60	4.20	0.90	0.00	0.00	7.90	0.00	106.20	146.60	779.50
1986	157.30	181.50	127.20	39.60	4.00	0.20	1.30	6.40	0.00	0.00	14.20	102.20	633.90
1987	205.80	63.90	10.70	4.20	2.10	7.70	36.70	0.00	0.00	21.70	0.00	17.40	370.20
1988	219.20	25.50	79.80	41.20	3.80	0.00	0.00	0.00	0.30	0.90	0.00	33.80	404.50
1989	152.70	110.60	72.50	45.40	0.00	6.50	0.00	0.00	0.00	0.00	0.00	0.00	387.70
Avg.	102.86	84.36	68.35	13.49	1.09	1.46	2.23	4.18	2.38	7.93	14.41	38.60	341.33
Max.	219.20	229.10	166.90	59.60	4.20	7.70	36.70	48.90	9.40	52.90	106.20	146.60	779.50
Min.	6.10	1.50	10.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.50

Appendix A, 2.1 (4) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01020051-2 COTACOTANI													
1960	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.80	17.80
1961	69.30	132.40	38.20	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	242.90
1962	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.50	73.50
1963	112.50	171.50	136.70	34.20	10.00	10.50	4.20	0.00	9.50	0.50	15.00	97.50	602.10
1964	30.00	100.00	69.00	23.50	2.00	0.00	0.00	9.90	4.00	0.00	18.50	86.60	343.50
1965	70.50	66.00	18.50	8.00	0.00	0.00	0.00	7.00	16.00	0.00	3.50	32.50	222.00
1966	0.50	62.00	16.50	0.00	5.50	0.00	0.00	0.00	0.00	11.50	17.50	34.50	148.00
1967	60.00	101.00	91.00	11.50	0.50	0.00	1.50	0.00	16.70	0.00	0.00	36.00	318.20
1968	100.50	157.00	86.50	5.10	11.20	0.50	0.00	0.00	0.00	25.50	42.20	44.20	472.70
1969	93.20	85.50	40.70	2.20	0.00	0.20	0.00	0.00	2.70	0.00	9.70	54.80	289.00
1970	97.00	58.30	0.50	2.10	4.30	0.00	0.00	0.00	0.00	9.70	0.00	25.90	197.80
1971	100.60	171.50	34.60	6.90	0.00	2.10	0.00	0.00	0.00	0.00	40.00	51.10	406.80
1972	191.00	98.60	124.70	8.50	0.00	1.30	0.00	0.00	6.70	17.20	5.00	72.00	525.00
1973	222.00	135.30	51.60	11.30	0.00	0.00	0.00	7.70	2.50	0.00	0.00	21.50	451.90
1974	158.70	103.40	58.00	14.70	0.00	3.60	0.00	51.30	5.50	0.00	4.80	12.40	412.40
1975	128.00	175.20	114.10	3.40	9.00	1.20	0.60	0.00	0.00	0.00	0.00	98.30	529.80
1976	149.70	54.40	68.00	5.10	1.00	1.30	6.90	9.80	9.80	0.00	0.00	70.80	376.80
1977	67.90	263.00	98.00	1.00	0.30	0.00	0.00	0.40	1.80	3.50	16.00	51.50	503.40
1978	156.90	39.90	28.00	18.00	0.60	0.00	0.00	5.30	0.00	10.80	42.20	36.50	338.20
1979	176.60	11.90	110.50	0.00	0.00	0.00	0.00	0.00	0.00	4.90	1.20	108.50	413.60
1980	23.20	33.90	126.90	0.80	1.00	0.00	0.30	0.00	0.00	19.40	0.10	13.30	218.90
1981	113.80	157.20	76.00	23.80	0.00	0.00	0.00	14.90	5.80	0.00	8.40	72.50	472.40
1982	114.30	41.50	68.10	31.10	0.80	0.00	0.00	1.00	17.50	59.90	43.70	21.50	399.40
1983	9.00	12.00	19.20	0.30	1.70	1.70	0.00	1.40	2.10	2.00	0.80	19.10	69.30
1984	153.70	201.90	161.50	5.20	1.80	8.10	0.00	1.90	0.00	45.60	66.90	22.20	668.80
1985	70.60	213.90	120.30	54.10	0.00	1.00	0.00	0.00	10.20	0.00	117.70	149.40	737.20
1986	147.00	185.80	122.00	36.70	5.80	0.10	1.40	0.00	0.00	0.00	17.10	107.30	623.20
1987	204.80	55.10	16.00	4.40	3.90	4.00	31.70	0.00	0.00	18.30	0.00	16.10	354.30
1988	212.70	24.20	80.00	53.10	1.70	0.00	0.00	0.00	1.20	0.90	0.00	31.10	404.90
1989	135.10	109.20	69.50	47.10	0.00	2.90	5.80	0.00	0.00	0.00	0.50	0.00	370.10
1990	110.50	33.80	39.40	13.40	11.00	26.20	0.00	0.00	0.00	13.30	31.60	71.40	350.60
1991	143.70	51.70	88.90	25.10	3.00	2.30	0.90	0.00	0.00	5.30	21.20	2.60	344.70
1992	116.20	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	138.20
Avg.	107.26	94.82	65.85	13.75	2.28	2.03	1.62	3.35	3.39	7.52	15.87	47.04	364.77
Max.	222.00	263.00	161.50	54.10	11.20	26.20	31.70	51.30	17.50	59.90	117.70	149.40	737.20
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.80

Appendix A, 2.1 (5) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01020053-9 CHUCUYO CARABINEROS													
1960	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.70	17.80	80.50
1961	70.30	132.40	44.20	0.00	0.00	0.00	0.00	0.00	0.80	6.00	10.70	0.00	264.40
1962	48.00	192.00	28.70	23.00	0.00	0.00	0.00	0.00	0.00	0.00	13.70	29.70	335.10
1963	109.70	171.50	138.00	0.00	3.40	0.00	0.00	0.00	13.40	1.10	20.00	57.50	514.60
1964	36.30	119.90	58.80	19.80	0.00	0.00	0.00	5.20	0.00	0.00	17.50	78.70	336.20
1965	54.20	50.00	13.50	0.50	0.00	0.00	0.00	11.50	13.50	0.00	1.50	16.00	160.70
1966	4.50	70.80	18.60	0.00	5.00	0.00	0.00	0.00	0.00	10.00	27.70	42.00	178.60
1967	34.70	117.50	105.70	4.80	2.50	0.00	0.00	0.00	1.60	0.00	0.00	45.20	312.00
1968	99.80	128.90	101.40	4.60	1.50	0.70	0.00	0.00	0.60	5.90	21.70	35.00	400.10
1969	84.50	84.70	43.50	2.80	0.00	0.30	0.00	0.30	9.30	0.00	4.60	27.70	257.70
1970	93.40	55.10	58.30	0.20	3.40	0.00	0.00	0.00	0.00	2.00	0.00	26.00	238.40
1971	106.90	144.10	9.40	3.40	0.00	1.20	0.00	0.00	0.00	0.40	40.10	69.50	375.00
1972	205.80	87.90	107.90	1.70	0.00	0.40	0.00	0.00	1.30	11.00	0.00	48.60	464.60
1973	177.90	116.30	53.30	8.30	0.00	0.00	0.00	5.60	3.70	0.00	0.00	7.60	372.70
1974	205.10	93.80	78.60	15.50	0.00	3.60	0.10	83.10	0.00	0.00	0.00	0.00	479.80
1975	206.60	192.30	62.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	461.40
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	3.00
1977	119.00	128.50	9.00	0.00	0.00	0.00	0.00	3.00	5.00	3.00	3.00	61.00	336.50
1978	104.50	11.00	19.00	0.00	2.00	0.00	0.00	9.00	0.00	13.00	27.60	30.20	216.30
1979	115.70	40.00	147.80	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	15.00	322.00
1980	38.50	34.00	88.50	0.00	1.00	0.00	0.00	0.00	0.00	12.00	0.00	11.00	185.00
1981	103.00	188.00	84.00	14.00	0.00	0.00	0.00	5.00	0.00	0.00	6.00	58.00	458.00
1982	104.00	49.00	37.00	7.00	0.00	0.00	0.00	0.10	7.00	10.00	6.00	9.00	229.10
1983	9.60	2.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	32.60
1984	169.00	146.00	154.00	0.00	0.00	18.00	0.00	0.00	0.00	64.00	80.00	13.00	644.00
1985	41.50	129.60	51.00	46.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	84.00	392.10
1986	158.00	146.00	63.00	5.00	0.00	0.00	0.00	17.00	0.00	0.00	6.00	93.00	488.00
1987	131.00	58.00	0.00	0.00	7.00	5.00	149.00	0.00	0.00	7.00	6.00	0.00	363.00
1988	0.00	0.00	56.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.00	97.00
1989	74.00	85.00	81.00	29.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	270.00
1990	79.30	17.00	61.50	0.00	22.00	21.00	0.00	0.00	0.00	9.00	12.00	135.00	356.80
1991	234.50	53.80	84.50	15.00	0.00	1.00	1.00	0.00	0.00	4.50	12.50	8.00	414.80
1992	98.00	14.00	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.80	17.20	52.00	184.50
1993	160.70	0.00	76.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	236.70
Avg.	96.41	84.09	57.29	5.90	1.41	1.51	4.44	4.19	1.65	4.80	12.99	33.01	307.68
Max.	234.50	192.30	154.00	46.00	22.00	21.00	149.00	83.10	13.50	64.00	80.00	135.00	644.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00

Appendix A, 2.1 (6) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01020054-7 PARINACOTA													
1983	6.80	25.90	35.50	0.00	0.00	0.90	0.00	1.00	8.00	0.00	5.00	35.70	118.80
1984	132.10	168.80	162.30	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.30	486.90
1985	66.30	169.90	76.90	34.30	0.00	0.00	0.00	0.00	0.00	0.00	92.20	119.00	558.60
1986	112.10	103.50	93.50	18.90	0.00	0.00	1.20	14.60	0.00	0.00	13.50	69.30	426.60
1987	0.00	56.00	36.10	0.70	3.10	3.10	21.90	0.00	0.00	0.00	1.80	0.80	123.50
1988	53.40	23.80	52.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	129.40
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	81.10	29.40	50.60	9.30	5.50	29.50	0.00	0.00	0.00	0.00	4.20	0.00	209.60
1991	104.20	49.30	97.00	8.30	0.00	0.50	0.00	0.00	0.00	10.90	10.70	9.50	290.40
1992	103.20	10.90	0.00	1.10	0.00	0.00	0.00	1.50	0.00	10.00	27.10	67.20	221.00
1993	178.20	27.00	97.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	302.80
Avg.	76.13	60.41	63.79	6.64	0.78	3.09	2.10	1.55	0.73	1.90	14.05	29.53	260.69
Max.	178.20	169.90	162.30	34.30	5.50	29.50	21.90	14.60	8.00	10.90	92.20	119.00	558.60
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 2.1 (7) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01020055-5 CHUCUYO													
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.90
1985	38.80	89.60	39.80	35.60	0.00	0.00	0.00	0.00	0.00	0.00	38.50	76.30	318.60
1986	112.70	49.50	54.30	11.40	0.00	0.00	0.80	5.40	0.00	0.00	13.10	78.50	325.70
1987	121.20	36.70	34.20	0.00	1.20	4.20	25.60	0.00	0.00	0.00	0.00	0.00	223.10
1988	148.90	0.00	78.90	20.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	248.30
1989	88.00	96.50	73.00	13.00	0.00	1.20	0.00	0.00	0.00	0.00	0.00	0.00	271.70
1990	76.00	24.00	23.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	123.40
Avg.	83.66	42.33	43.37	11.50	0.17	0.77	3.77	0.77	0.00	0.00	7.37	22.24	215.96
Max.	148.90	96.50	78.90	35.60	1.20	4.20	25.60	5.40	0.00	0.00	38.50	78.50	325.70
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90

Appendix A, 2.1 (8) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01110050-3 PUQUIOS													
1975	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	39.10	42.10
1976	66.70	0.00	0.00	0.00	0.00	0.00	0.50	1.00	0.00	0.00	0.00	4.00	72.20
1977	0.00	0.00	16.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	10.00	28.00
1978	23.00	0.00	10.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	18.00	2.00	56.00
1979	35.00	0.00	16.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	28.00	82.00
1980	6.00	5.00	13.50	0.00	0.00	0.00	1.00	0.00	0.00	4.00	0.00	1.00	30.50
1981	21.00	34.00	12.50	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.50
Avg.	21.67	5.57	9.71	0.71	0.00	0.00	1.07	0.57	0.29	0.57	2.57	12.01	54.76
Max.	66.70	34.00	16.00	5.00	0.00	0.00	3.00	3.00	2.00	4.00	18.00	39.10	82.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00

Appendix A, 2.1 (9) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01200050-2 VILLA INDUSTRIAL													
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	153.60	153.60
1976	352.80	199.00	71.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41.00	667.80
1977	107.00	194.00	138.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	65.50	516.50
1978	81.00	2.00	31.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	16.50	154.50
1979	103.30	16.50	130.60	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	67.00	320.40
1980	9.00	14.50	92.20	0.00	0.00	0.00	0.00	0.00	0.00	21.00	0.00	8.50	145.20
1981	111.00	163.50	50.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	102.00	438.50
1982	107.00	26.00	36.00	0.00	6.00	0.00	0.00	0.00	10.00	25.00	27.00	8.00	245.00
1983	9.50	7.00	18.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	10.00	47.50
1984	192.00	171.00	142.00	5.00	0.00	10.00	0.00	6.00	0.00	38.50	67.50	8.00	640.00
1985	35.00	222.00	49.50	11.00	0.00	0.00	0.00	0.00	1.00	0.00	58.00	83.50	460.00
1986	204.00	92.00	76.00	4.00	0.00	0.00	2.00	9.00	0.00	0.00	7.00	63.00	457.00
1987	115.00	64.00	8.00	0.00	6.00	7.00	108.00	0.00	0.00	6.00	5.00	0.00	319.00
1988	120.00	0.00	17.00	23.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	31.50	193.50
1989	104.80	141.20	17.40	12.80	0.00	6.00	0.20	0.00	0.00	0.00	0.00	0.00	282.40
1990	48.10	42.00	83.00	25.00	17.00	20.00	0.00	0.00	0.00	0.20	24.00	134.00	393.30
1991	168.00	57.00	108.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00	0.00	365.00
1992	0.00	1.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	17.30	190.00	208.50
1993	275.00	21.00	174.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	470.00
Avg.	112.76	75.46	65.35	6.04	1.53	2.26	5.81	0.79	1.00	4.77	13.46	51.69	340.93
Max.	352.80	222.00	174.00	25.00	17.00	20.00	108.00	9.00	10.00	38.50	67.50	190.00	667.80
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.50

Appendix A, 2.1 (10) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01200051-0 HUMAPALCA													
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.00	49.00
1972	173.00	58.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	0.00	48.00	297.00
1973	184.00	227.00	179.00	26.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	623.00
1974	275.00	87.00	0.00	17.00	0.00	3.50	1.00	98.30	0.00	0.00	0.00	6.50	488.30
1975	270.50	218.50	281.30	0.00	6.00	4.00	0.00	0.00	0.00	0.00	0.00	54.50	834.80
1976	171.00	136.00	72.50	1.00	0.00	0.00	10.00	3.50	7.50	0.00	0.00	0.10	401.60
1977	148.00	228.50	65.50	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	10.50	453.00
1978	89.50	1.00	59.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	17.80	18.00	185.50
1979	80.50	17.50	106.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	207.40
1980	22.50	0.00	87.00	0.00	0.00	0.00	0.00	0.00	0.00	14.00	0.00	8.50	132.00
1981	104.50	172.80	57.50	18.00	0.00	0.00	0.00	6.20	0.40	0.00	0.00	107.50	466.90
1982	117.00	33.00	32.00	0.00	0.00	0.00	0.00	0.00	1.00	12.50	11.00	37.00	243.50
1983	6.00	5.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50	20.20
1984	165.80	112.00	65.00	4.00	0.00	6.50	0.00	9.50	0.00	45.70	35.00	3.00	446.50
1985	11.00	151.50	46.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	40.00	54.50	309.00
1986	79.50	38.50	36.00	12.00	4.00	0.00	0.00	7.50	0.00	0.00	3.50	66.00	247.00
1987	109.00	12.40	0.00	0.00	2.00	3.50	11.00	0.00	0.00	7.50	0.50	0.00	145.90
1988	118.50	4.00	27.00	1.10	0.00	0.00	0.00	0.00	1.00	0.00	0.00	14.00	165.60
1989	82.00	99.00	17.50	12.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	212.50
1990	30.40	15.00	23.00	10.00	2.00	21.00	0.00	0.00	0.00	2.00	4.00	63.50	170.90
1991	77.00	36.00	55.90	9.00	1.00	0.50	0.00	0.00	0.00	2.00	6.00	8.00	195.40
1992	41.50	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50	12.50	28.00	84.80
1993	135.00	23.50	67.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	226.00
Avg.	108.31	72.89	55.60	5.05	0.65	1.74	1.00	5.43	0.45	4.54	5.67	25.87	287.21
Max.	275.00	228.50	281.30	26.00	6.00	21.00	11.00	98.30	7.50	45.70	40.00	107.50	834.80
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.20

Appendix A, 2.1 (11) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01201050-8 ALCERREGA													
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00	49.00	65.00
1972	105.50	74.50	97.70	0.00	18.00	0.00	0.00	0.00	0.00	0.00	0.00	47.00	342.70
1973	123.50	55.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	179.00
1974	98.00	35.50	10.50	5.00	0.00	1.00	0.00	22.50	0.00	0.00	0.00	0.00	172.50
1975	84.50	69.70	80.60	3.50	20.00	2.50	0.00	0.00	0.00	0.00	0.00	68.00	328.80
1976	106.50	41.00	53.00	14.50	0.00	1.50	5.00	2.50	6.50	0.00	0.00	2.00	232.50
1977	60.00	103.00	29.50	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	58.00	252.50
1978	71.50	17.00	31.50	4.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00	2.00	133.00
1979	47.00	1.00	47.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	36.50	133.50
1980	5.00	4.00	50.10	0.00	0.00	0.00	0.00	0.00	0.00	23.00	0.00	0.00	82.10
1981	66.50	74.00	27.00	15.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	41.00	226.50
1982	26.00	15.00	16.00	0.00	0.00	4.00	0.00	0.00	11.00	5.00	10.00	18.50	105.50
1983	16.50	0.00	2.00	0.00	0.00	0.00	0.00	1.50	10.00	0.00	0.00	5.00	35.00
1984	62.00	218.50	78.50	1.50	0.00	14.00	0.00	0.00	0.00	28.00	7.50	4.00	414.00
1985	30.50	196.00	54.00	8.00	0.00	0.00	0.00	0.00	2.00	0.00	18.50	40.00	349.00
1986	118.00	96.00	53.00	3.00	0.00	0.00	0.00	0.70	0.00	0.00	4.00	60.00	334.70
1987	153.80	121.00	5.00	0.00	1.00	0.00	61.00	0.00	0.00	0.00	3.00	0.00	344.80
1988	116.00	0.00	17.00	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	180.00
1989	118.00	158.00	26.00	24.00	0.00	6.00	2.00	0.00	0.00	0.00	0.00	0.00	334.00
1990	39.00	28.00	62.00	3.00	4.00	26.00	0.00	0.00	0.00	0.00	10.50	96.00	268.50
1991	156.00	23.00	123.20	0.00	0.00	0.30	0.00	0.00	0.00	5.00	4.00	0.00	311.50
1992	28.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	60.00	99.90
1993	114.00	1.50	44.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	159.50
Avg.	75.94	57.92	39.46	4.33	1.87	2.40	3.04	1.31	1.28	2.70	4.02	26.78	221.07
Max.	156.00	218.50	123.20	24.00	20.00	26.00	61.00	22.50	11.00	28.00	18.50	96.00	414.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.00

Appendix A, 2.1 (12) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01202050-3 PACOLLO													
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	1.50	12.50
1979	82.00	3.80	47.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.50	144.80
1980	9.00	36.80	64.20	0.00	0.00	0.00	0.00	0.00	0.00	13.50	0.00	0.00	123.50
1981	3.00	100.20	36.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139.70
1982	5.50	25.50	0.00	7.50	0.00	0.00	0.00	0.00	0.00	20.50	10.00	11.50	80.50
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00	0.00	0.00	9.50	13.00
1984	136.40	188.60	51.90	0.00	0.00	33.00	0.00	0.00	0.00	16.00	35.50	0.00	461.40
1985	35.40	144.00	45.50	3.00	0.00	0.00	0.00	1.50	2.50	0.00	25.80	56.20	313.90
1986	120.50	44.50	25.70	0.00	1.00	0.00	0.00	43.00	0.00	0.00	8.00	29.90	272.60
1987	125.80	31.50	3.00	0.00	3.00	10.00	26.50	0.00	0.00	5.00	0.00	0.00	204.80
1988	113.60	0.00	27.50	5.40	0.00	0.00	0.00	0.00	5.50	0.00	0.00	10.50	162.50
1989	89.00	80.80	48.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	225.80
1990	48.50	21.00	5.50	0.00	0.00	9.00	0.00	0.00	0.00	4.00	11.00	130.50	229.50
1991	123.50	26.50	43.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	199.30
1992	39.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	52.10	96.60
1993	157.20	18.00	35.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	210.90
Avg.	68.06	45.08	27.14	1.49	0.25	3.25	1.66	3.00	0.50	3.69	6.64	19.95	180.71
Max.	157.20	188.60	64.20	8.00	3.00	33.00	26.50	43.00	5.50	20.50	35.50	130.50	461.40
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50

Appendix A, 2.1 (13) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01202051-1 PUTRE													
1976	224.50	97.50	24.00	0.00	0.00	0.00	4.00	7.50	14.00	0.00	0.00	20.00	391.50
1977	51.50	154.00	31.50	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	15.10	254.10
1978	48.10	0.00	9.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	3.50	2.00	64.60
1979	67.00	3.50	49.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.00	183.00
1980	7.00	23.50	13.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.00	62.00
1981	79.20	73.10	20.50	6.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	15.00	194.30
1982	3.90	1.30	20.50	0.00	0.00	0.00	0.00	0.00	5.60	8.00	0.20	3.50	43.00
1983	1.80	0.00	10.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.00	26.60
1984	99.70	73.70	50.20	1.80	0.00	21.80	0.00	5.00	0.00	31.00	13.60	5.00	301.80
1985	24.00	106.00	24.00	0.00	0.00	0.00	0.00	0.00	1.40	0.00	26.00	42.30	223.70
1986	61.50	50.10	44.80	0.00	0.00	0.00	0.00	16.00	0.00	0.00	1.00	27.60	201.00
1987	81.60	16.20	0.00	0.00	0.00	0.00	0.20	0.00	5.90	5.90	0.00	0.00	109.80
1988	42.70	0.00	21.80	2.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	23.30	99.80
1989	55.70	104.70	25.10	1.40	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	187.30
1990	18.00	25.00	23.50	5.30	3.30	9.20	0.00	0.00	0.00	0.00	5.30	98.40	188.00
1991	81.20	6.50	24.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	12.00	125.70
1992	27.50	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	3.60	65.60	97.20
1993	128.90	11.50	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	144.40
Avg.	61.32	41.48	22.06	0.92	0.18	1.77	0.23	1.72	2.11	2.49	3.10	23.60	160.99
Max.	224.50	154.00	50.20	6.00	3.30	21.80	4.00	16.00	14.00	31.00	26.00	98.40	391.50
Min.	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.60

Appendix A, 2.1 (14) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01202052-K LAS CUEVAS CONAF													
1986	87.20	69.00	49.00	28.00	0.00	0.00	2.50	0.00	0.00	0.00	6.60	64.50	306.80
1987	8.00	45.00	2.00	0.00	3.00	9.50	30.50	0.00	0.00	0.00	0.00	0.00	98.00
1988	137.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	137.70
Avg.	77.63	38.00	17.00	9.33	1.00	3.17	11.00	0.00	0.00	0.00	2.20	21.50	180.83
Max.	137.70	69.00	49.00	28.00	3.00	9.50	30.50	0.00	0.00	0.00	6.60	64.50	306.80
Min.	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.00

Appendix A, 2.1 (15) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01211050-2 LLUTA													
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1969	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
1970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29
Max.	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 2.1 (16) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01310050-0 ARICA OFICINA													
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
1976	0.20	0.00	0.00	0.00	0.00	0.20	0.40	0.50	0.40	0.00	0.00	0.00	1.70
1977	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	1.60
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
1987	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00	1.80
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.20
1989	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	0.90
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.12	0.23	0.00	0.00	0.00	0.06	0.11	0.03	0.03	0.03	0.05	0.00	0.64
Max.	1.80	3.10	0.00	0.00	0.00	1.00	1.80	0.50	0.40	0.50	0.90	0.00	3.10
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 2.1 (17) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01310053-5 U. DEL NORTE													
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Avg.	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Max.	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 2.1 (18) Average Monthly Precipitation observed by DGA in Lluta River Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Rio Lluta >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01400050-K AERODROMO EL BUITRE													
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46
Max.	0.00	4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.10
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 2.2 (1) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Caracani River in Humapalca													
1973								0.423	0.349	0.234	0.090	0.117	0.243
1974	1.150	0.681	0.503	0.265	0.295	0.267	0.242	0.476	0.182	0.157	0.135	0.134	0.374
1975	0.483	0.066	.	0.277	0.339	0.224	0.255	0.207		0.710	0.692	0.445	0.370
1976	2.950	0.536	0.442	0.324	0.301	0.362	0.379	0.243	0.291	0.375	0.151	0.194	0.546
1977			0.462	0.395	0.373	0.358	0.361	0.347	0.360	0.377	0.376		0.379
1978							0.453	0.399	0.328	0.224	0.225	0.238	0.311
1979	0.389	0.267	0.609	0.255	0.256	0.243	0.239	0.220	0.239	0.181	0.200	0.228	0.277
1980	0.344	0.044		0.261	0.232	0.244	0.267	0.205	0.215	0.277	0.190	0.240	0.229
1981	1.000	2.870	0.807	0.365	0.304	0.243	0.240	0.254	0.242	0.316	0.203	0.900	0.645
1982	0.739	0.576	0.438	0.334	0.270	0.259	0.320	0.317	0.285	0.218	0.214	0.317	0.357
1983	0.164	0.133	0.197	0.231	0.321	0.339	0.269	0.301	0.249	0.201	0.218	0.198	0.235
1984	0.549	0.956	0.750	0.366	0.322	0.305	0.393	0.348	0.259	0.273	0.324	0.259	0.425
1985	0.258	0.944	0.533	0.448	0.375	0.327	1.900	0.284	0.244	0.206	0.305	0.352	0.515
1986	0.689	0.812	0.732	0.384	0.327		0.474	0.384	0.297	0.240	0.195	0.361	0.445
1987	0.630	0.201	0.263	0.258	0.262	0.280	0.377	0.376	0.250	0.221	0.220	0.176	0.293
1988	0.449	0.305	0.287	0.316	0.289	0.333	0.336	0.302	0.233	0.184	0.184	0.252	0.289
1989	0.394	0.761	0.330	0.337	0.301	0.348	0.383	0.393	0.309	0.228	0.231	0.200	0.351
1990	0.286	0.223	0.293	0.256	0.286	0.416	0.348	0.291	0.230	0.201	0.206	0.403	0.287
AVG	0.698	0.625	0.475	0.317	0.303	0.303	0.426	0.321	0.268	0.268	0.242	0.295	0.378

Appendix A, 2.2 (2) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

ST: Colpitas River in Alcerreca

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1961												0.696	0.696
1962	0.638	0.971	0.569	0.583	0.496	0.497	0.484	0.449	0.459	0.447	0.483	0.562	0.553
1963	1.220			0.747	0.782	0.335	0.302	0.501	0.535	0.475	0.475	0.473	0.585
1964	0.416	0.486						0.151	0.150	0.174	0.410	0.597	0.341
1965	0.618	0.752	0.520	0.475	0.441			0.440	0.465	0.379	0.331	0.369	0.479
1966	0.356	0.354	0.414	0.372	0.351	0.378	0.430	0.397	0.419	0.432	0.495	0.601	0.417
1967	0.547			0.561	0.623	0.570	0.557	0.504	0.471				0.548
1968										0.488	0.501	0.472	0.487
1969	0.513	0.850		0.511	0.518	0.519	0.498	0.455	0.394	0.393	0.394	0.440	0.499
1970	0.448	0.419	0.489	0.450	0.493	0.511	0.533	0.502	0.450	0.446	0.426	0.408	0.465
1971	1.300	1.940	0.437	0.281	0.288	0.292	0.303	0.285	0.287	0.281	0.285	0.323	0.525
1972	1.060	0.742	0.940	1.020	0.287	0.282	0.271	0.264	0.253	0.218	0.235	0.226	0.483
1973	0.402				0.257	0.252	0.255			0.265	0.281	0.274	0.284
1974	0.713	0.714	0.707		0.374	0.410	0.402	0.490	0.352	0.484	0.401	0.357	0.491
1975	0.458	0.879	1.010	0.744		0.412	0.267	0.217	0.309	0.390	0.476	0.410	0.507
1976				0.392	0.400	0.379	0.365	0.362	0.369	0.507	0.510	0.462	0.416
1977	0.387					0.412	0.450	0.450	0.432	0.409	0.389	0.423	0.419
1978	0.603	0.433	0.364	0.364	0.374	0.388	0.403	0.395	0.371	0.368	0.338	0.354	0.396
1979	0.591	0.396	0.691	0.442	0.463	0.475	0.463		0.428	0.427	0.433	0.495	0.482
1980			0.475	0.436	0.493	0.483	0.467	0.430	0.441	0.466	0.499	0.526	0.472
1981	0.577	0.962	0.471	0.433	0.369	0.329	0.304	0.349	0.382	0.351	0.339	0.349	0.435
1982	0.459	0.472	0.450	0.433	0.462	0.502	0.478	0.384	0.391	0.381	0.389	0.546	0.446
1983	0.661	0.702	0.649	0.648	0.618	0.594	0.529	0.507	0.455	0.455	0.450	0.555	0.569
1984	0.646	1.440	1.220	0.744	0.596	0.541				0.579	0.627	0.549	0.771
1985	0.617	1.620	1.170	1.540	0.562	0.532	0.516	0.481	0.439	0.415	0.568	0.691	0.763
1986	1.420	1.060	1.540	0.754	0.401	0.453	0.465	0.417	0.325	0.289	0.299	0.478	0.658
1987	1.690	1.180	0.553	0.552	0.587	0.627	0.715	0.642	0.604	0.544	0.548	0.535	0.731
1988	0.707	0.455	0.511	0.458	0.451	0.463	0.494	0.470	0.419	0.438	0.442	0.468	0.481
1989		0.606	0.346	0.453	0.440	0.440	0.489	0.488	0.452	0.461	0.472	0.483	0.466
1990	0.586	0.437	0.504	0.532	0.599	0.668	0.613	0.551	0.530	0.546	0.228	0.349	0.512
AVG	0.705	0.812	0.668	0.580	0.469	0.452	0.442	0.423	0.407	0.411	0.419	0.465	0.521

Appendix A, 2.2 (3) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Caracarani River in Alcerreca													
1961												1.150	1.150
1962	0.924	1.100	0.753	1.010	0.684	0.791	0.776	0.732	0.664	0.569	0.552	0.696	0.771
1963				1.060	1.020	0.977	1.010	0.937	0.903	1.020	0.971	0.869	0.974
1964	0.819	0.850								0.827	0.797	0.939	0.846
1965	0.860	1.230	0.796	0.723	0.741	0.913	0.961	0.946	0.895	0.925	0.888	0.935	0.901
1966	0.853	0.918	0.582	0.640	0.702	0.421				0.506	0.352		0.622
1969				0.598	0.714	0.796	0.814	0.832	0.747	0.657	0.607	0.639	0.712
1970	0.788	0.926	0.930	0.636	0.700	0.696	0.715	0.669	0.634	0.560			0.725
1971					0.710	0.772	0.816	0.770	0.632	0.525		0.953	0.740
1972	2.130	0.350											1.240
1973										0.667	0.611	0.563	0.614
1974	0.692	0.608		0.852	0.865	0.962	0.937		0.895	0.643	0.552	0.607	0.761
1975	0.718	5.020	3.590	1.830									2.790
1981										0.654	0.472	0.688	0.605
1982	0.745		0.699	0.752	0.825	0.863	0.917	0.851	0.868	0.718	0.666	0.399	0.755
1983	0.410	0.522	0:530	0.535	0.634	0.771	0.804	0.883	0.610	0.528	0.543	0.581	0.613
1984	1.680	1.910	0.298										1.296
AVG	0.965	1.343	1.022	0.864	0.760	0.796	0.861	0.828	0.761	0.677	0.637	0.752	0.855

Appendix A, 2.2 (4) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Lluta River in Tocontasi & Chapisca													
1946							1.470	1.470	1.250	1.270	1.230	1.380	1.345
1947	2.110	1.450	1.220	1.380	1.450	1.390	1.570	1.280	1.210	1.190	1.090	2.220	1.463
1948	1.880	3.920	5.630	1.940	1.940	1.890	1.940	1.770	1.490	1.370	1.330	1.820	2.243
1949	9.160	8.780	8.350	3.640	3.640	2.570	2.680	2.400		1.370	1.330	1.820	4.158
1950	1.600	1.710	2.340	1.730	1.820	1.830		1.730	1.570	1.380	1.170	1.430	1.665
1951	2.210	2.850	2.700	1.580	1.610	1.630	1.730	1.690	1.600	1.280	1.250	1.230	1.780
1952	6.360	6.590	3.680	2.420	2.140	2.390	3.410	2.390	2.260	1.760	1.600	1.790	3.066
1953	4.050	11.900	12.800						1.600	1.540	1.790	2.120	5.114
1954	2.930	12.100											7.515
1955										1.380	1.320	2.010	1.570
1956	2.050	3.920	1.920	1.570			1.790	1.690	1.570	1.390	1.320	1.110	1.833
1957	1.190	2.790				1.860	1.650	1.680	1.420	1.190	1.200	2.710	1.743
1958	3.270				2.400	2.550	2.520	2.100	2.020	1.820	1.350	1.250	2.142
1959	1.290												1.290
1961								1.760	1.390	1.100			1.417
1962	3.700	3.560			1.820	2.060	1.980	1.980	1.650	1.200	1.450	1.530	2.093
1963	2.020	7.470	4.790	2.030	2.650	2.370	2.350	2.200	2.020	1.690	1.640		2.839
1964		1.750	1.850	1.290	1.660	1.850		2.150	2.080	1.700	1.390	1.970	1.769
1965	3.340	4.220	4.110	2.250	1.110	1.030	3.610	2.330	2.310	2.520	2.490	2.260	2.632
1966	2.380	2.450	1.810	1.510	1.930	2.280	1.750	1.320	1.240	1.150	1.160	1.060	1.670
1967	1.150	3.400	4.150								1.060	1.160	2.184
1968	2.000		5.500	1.950	0.970	0.352							2.154
1969									1.530	1.240	1.080	1.390	1.310
1970	2.420	1.820	2.160	1.230	1.350	1.300	1.550	1.410	1.200	1.040	1.903	1.020	1.534
1971	2.510	5.090	2.090	1.420	1.430	1.570	1.580	1.470	1.260	1.080	1.120	1.100	1.810
1972	9.790	6.880	7.760		2.790	2.730	2.340	2.000	1.850	1.240			4.153
1973											1.110	1.010	1.060
1974	4.920	3.000	4.760		1.730	1.810	1.960	2.930	1.360	1.260	1.120	0.988	2.349
1975	2.300				1.710	1.970	2.150	1.740	1.470	1.320		2.520	1.898
1976	2.550	7.140	11.800		2.010	1.990	1.900	1.800	2.000	1.340	1.030	1.050	3.146
1977			4.820	2.360	2.420	2.580		2.000	1.670		1.180	1.330	2.295
1978	3.660	2.600	1.340	1.500	1.540	1.520	1.800	1.620	1.330	1.120	1.320	1.210	1.713
1979	2.580	1.110	3.400	1.460	1.590	1.790	1.830		1.740	1.720	1.380	1.180	1.798
1980						1.530	1.690	1.620	1.320	1.170	1.040	1.939	1.473
1981	1.660	9.410	8.590	1.560	1.630	1.840	1.920		1.580	1.250		1.000	3.044
1982	1.620	2.090	1.320	1.440	1.570	1.600	1.590	0.558	0.551	0.524	0.931	1.650	1.287
1983	0.989	0.950	1.210	1.100	1.200	1.330	1.420	1.340	1.320	1.170	1.030	1.090	1.179
1984	2.230				1.560	1.670	1.640	1.610	1.350	1.260	1.620	1.240	1.576
1985	1.470	5.110					1.790	1.660			1.480	2.150	2.277
1986													-
1987									1.570	1.340	1.210	1.060	1.295
1988	3.350	13.200	2.610	1.920	1.500	1.590	1.660	1.520	1.480	1.380	1.310	1.510	2.753

Appendix A, 2.2 (5) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1990	1.190	1.320	1.280	1.420	1.480	1.850	1.700	1.560	1.670	1.220	1.030	1.470	1.433
AVG	2.887	4.741	4.222	1.759	1.809	1.802	1.937	1.746	1.542	1.332	1.307	1.508	2.216

Appendix A, 2.2 (6) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

Unit : m3/s

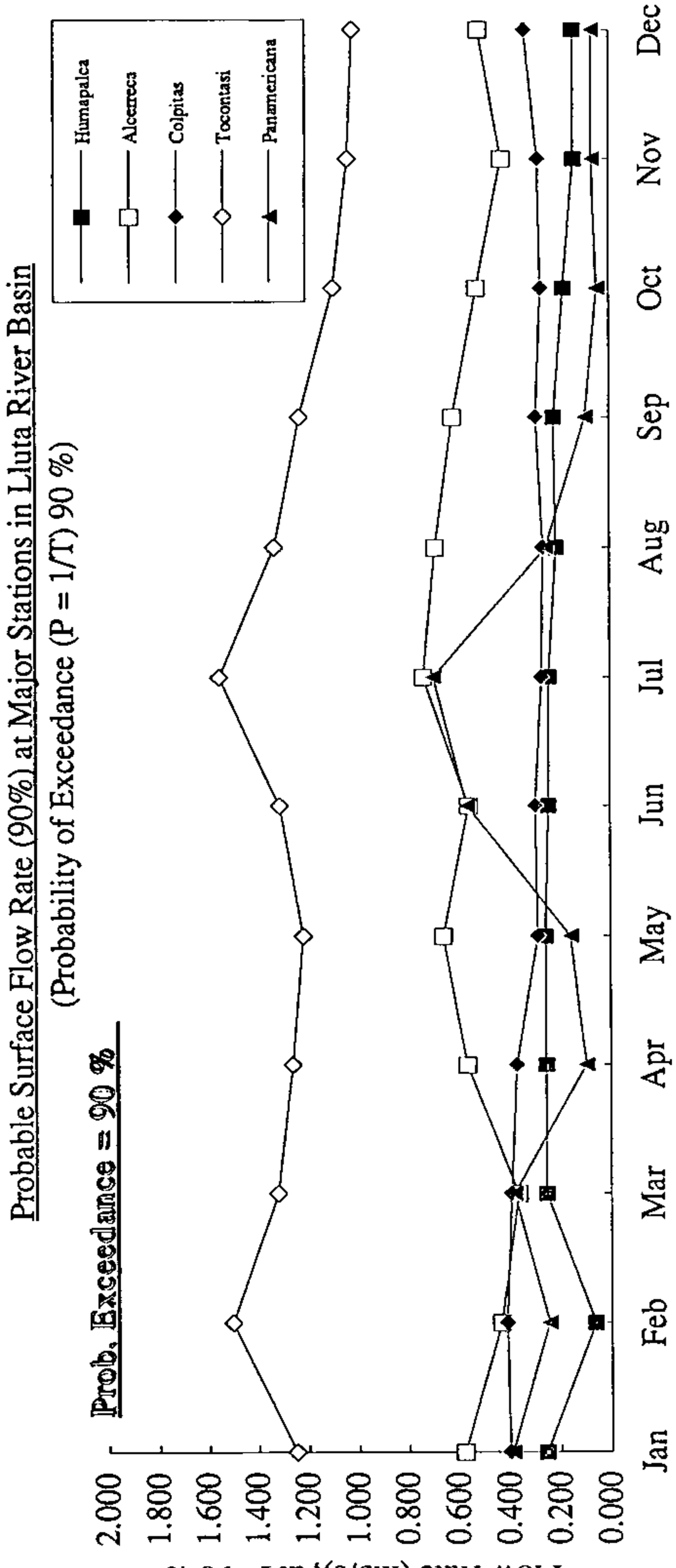
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Lluta River in Panamericana													
1969	0.577	1.630	1.230	0.413	0.274	0.542	0.673		0.367		0.076	0.114	0.590
1970	1.210	0.459	0.762			0.587	0.712	0.483	0.163	0.091	0.080	0.079	0.463
1971	0.915	2.900	1.630	0.165	0.320	0.833	0.894	0.423	0.224	0.132	0.089	0.083	0.717
1972	6.490	6.190	5.090	1.070	1.070	1.100	1.530	0.537	0.535	0.296	0.103	0.971	2.082
1973	4.560												4.560
1974	4.190	4.950			1.060	1.210	1.270	1.540	1.100	0.638	0.642	0.528	1.713
1975	1.390		4.930	0.033									2.118
1985	1.480	16.700	4.650	1.490	1.230	1.010	0.891	0.590	0.320		0.168	0.629	2.651
1986	8.640	22.800	5.350	2.510	0.759	0.902	0.873	0.868	0.378			0.230	4.331
1987	5.040	0.371	0.629	0.403	0.373	1.630	1.600	0.196	0.081	0.064	0.153	0.195	0.895
1988	1.360	4.240	0.541	0.598	1.220	1.930	0.817	0.389	0.327	0.240	0.108	0.099	0.989
1989	0.444	6.840	0.264	1.540	1.160	1.540	0.880	0.324	0.133	0.043	0.062	0.062	1.108
1990	0.190	0.059	0.460	0.163	0.043		1.110	0.310	0.106	0.157	0.160	1.090	0.350
AVG	2.807	6.104	2.321	0.839	0.751	1.128	1.023	0.566	0.339	0.208	0.164	0.371	1.385

Appendix A, 2.2 (7) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Lluta River Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

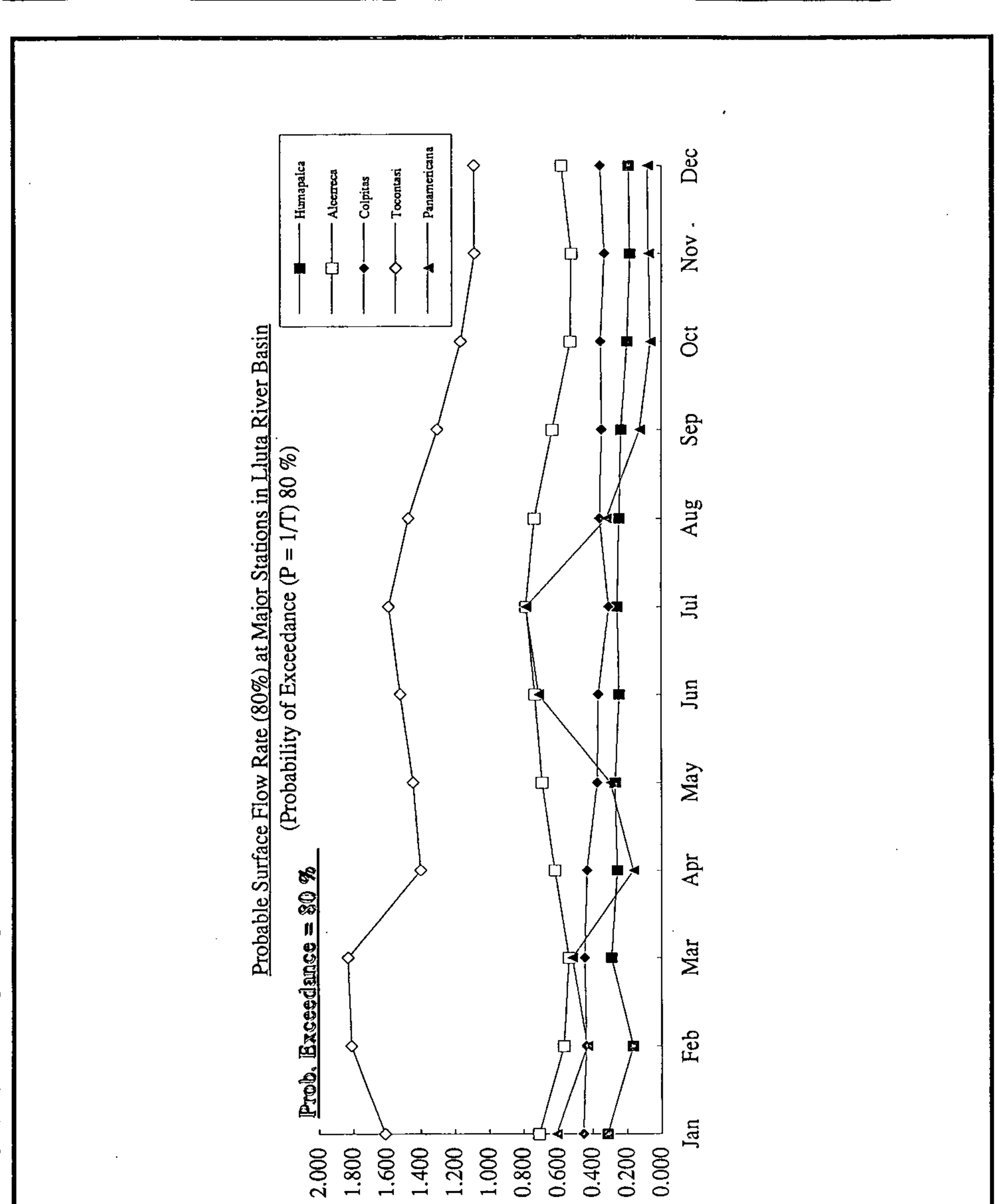
Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Lluta River in Alcerreca													
1961											1.300	1.720	1.510
1962	1.930	2.070	1.170	1.270	0.933	0.987	1.110	1.830	1.130	2.390	2.220	2.680	1.643
1963	6.680				2.120	2.260	2.390	0.976	4.910	1.380	1.080	1.360	2.573
1964	1.360	1.890		1.400									1.550
1965			1.460		1.220	1.430	1.230	1.100	1.430	1.140	1.070	1.000	1.231
1966	1.100	1.360	1.900	1.180	1.190	1.050	1.140			1.290	1.430	1.470	1.311
1967	1.340	3.300	3.100	2.070	2.130	2.440	2.060						2.349
1968	2.540	2.310	2.520	1.690	1.510	1.170	1.330	1.290	1.350	1.320	1.440		1.679
1969	2.300	1.990	1.690	1.080	2.740								1.960
1970													-
1971							1.610	1.430	1.180	1.010	1.140	1.360	1.288
1972	5.310	3.470	4.480	2.040	1.350	1.340	1.360	1.200	1.070	1.010	1.010	1.390	2.086
1973	3.930	6.910	2.470	1.530	1.280	1.370	1.430	1.280	1.100	1.010			2.231
1974		3.620	3.560	2.010	1.410	1.710	1.720	2.230	1.490	1.070	1.000	1.100	1.902
1975	2.390	6.360	5.690	2.860	2.640	2.540	1.810	1.540	1.420	1.280	1.180	1.230	2.578
1976	5.730	5.510	3.740	2.070	1.600	1.580	1.590	1.590	1.600	1.090	0.976	1.160	2.353
1977	2.230	6.740	7.350	3.330	1.430	1.490	1.530	1.530	1.150	1.130	1.190	1.170	2.523
1978	2.380		2.860	1.210			1.530	1.470		1.210	1.160	1.270	1.636
1979	2.000	0.871	2.800	1.290	1.310	1.410	1.400	1.310					1.549
1980			7.370										7.370
1981										0.965	0.902	1.280	1.049
1982	1.900	4.590	0.961	1.200	1.250	1.320	1.200	1.130	1.360	1.070	0.860	1.160	1.500
1983	0.870	0.888	1.260	1.040	1.140	1.320	1.300	1.290	1.050	0.940	0.949	1.080	1.094
1984	2.580	8.160	4.180	1.940	1.400	1.540	1.550	1.430	1.240	1.150			2.517
1985	0.932	6.360	4.050	3.740	1.400	1.350	1.220	1.220	1.030	0.916	1.240	1.160	2.052
1986	4.270	5.280	5.410	2.140	1.490	1.570	1.560	1.570	1.240	1.030	0.981	1.770	2.359
1987	9.670	5.160	1.450	1.300	1.190	1.240	1.600	1.240	1.120	0.987	0.980	1.030	2.247
1988	3.070	1.860	1.810	1.790	1.430	1.580	1.560	1.330	1.150	1.060	0.971	1.270	1.573
1989	1.710	4.490	1.510	1.930	1.340	1.390	1.370	1.300	1.060	0.963	0.932	0.933	1.577
1990	1.370	1.110	1.330	1.170	1.280	1.590	1.340	1.200	1.040	0.955	1.000	1.770	1.263
AVG	2.939	3.832	3.088	1.795	1.512	1.531	1.498	1.386	1.406	1.146	1.137	1.351	1.885



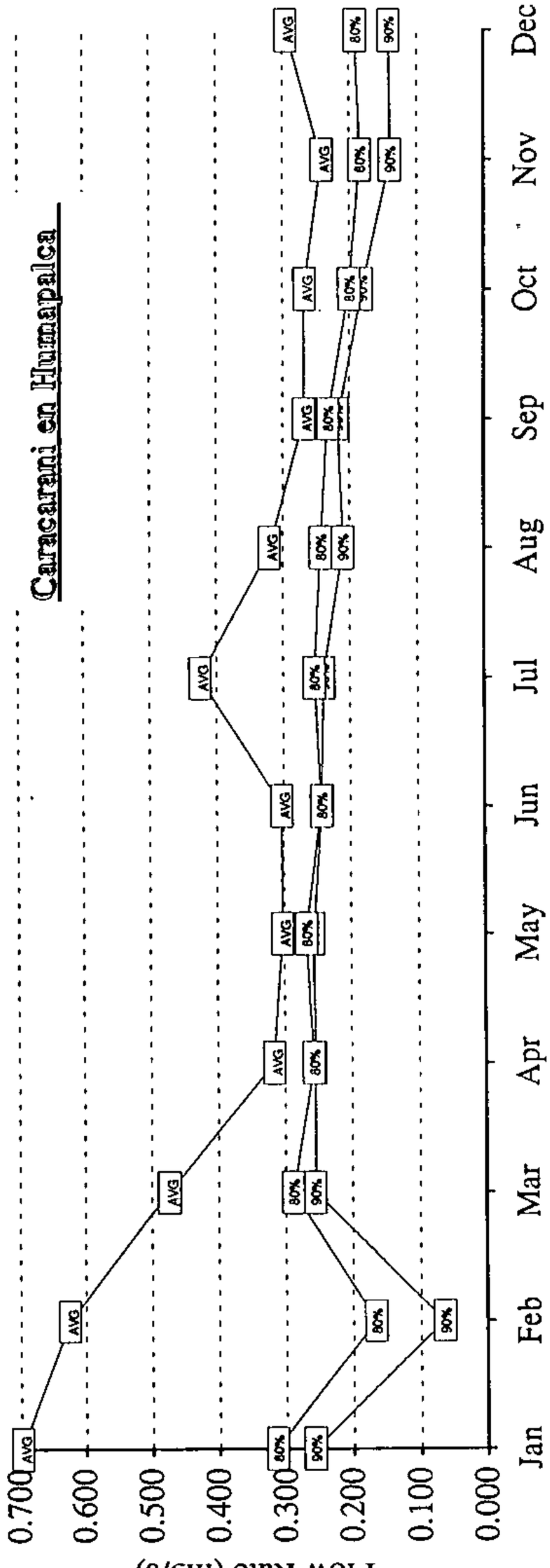
Appendix A, 2.3(1) Probable Surface Flow Rate (90%) at Major Stations in Lluta River Basin

<Nivel Probable de Flujo de Superficie (90%) en la Cuenca del Rio Lluta>



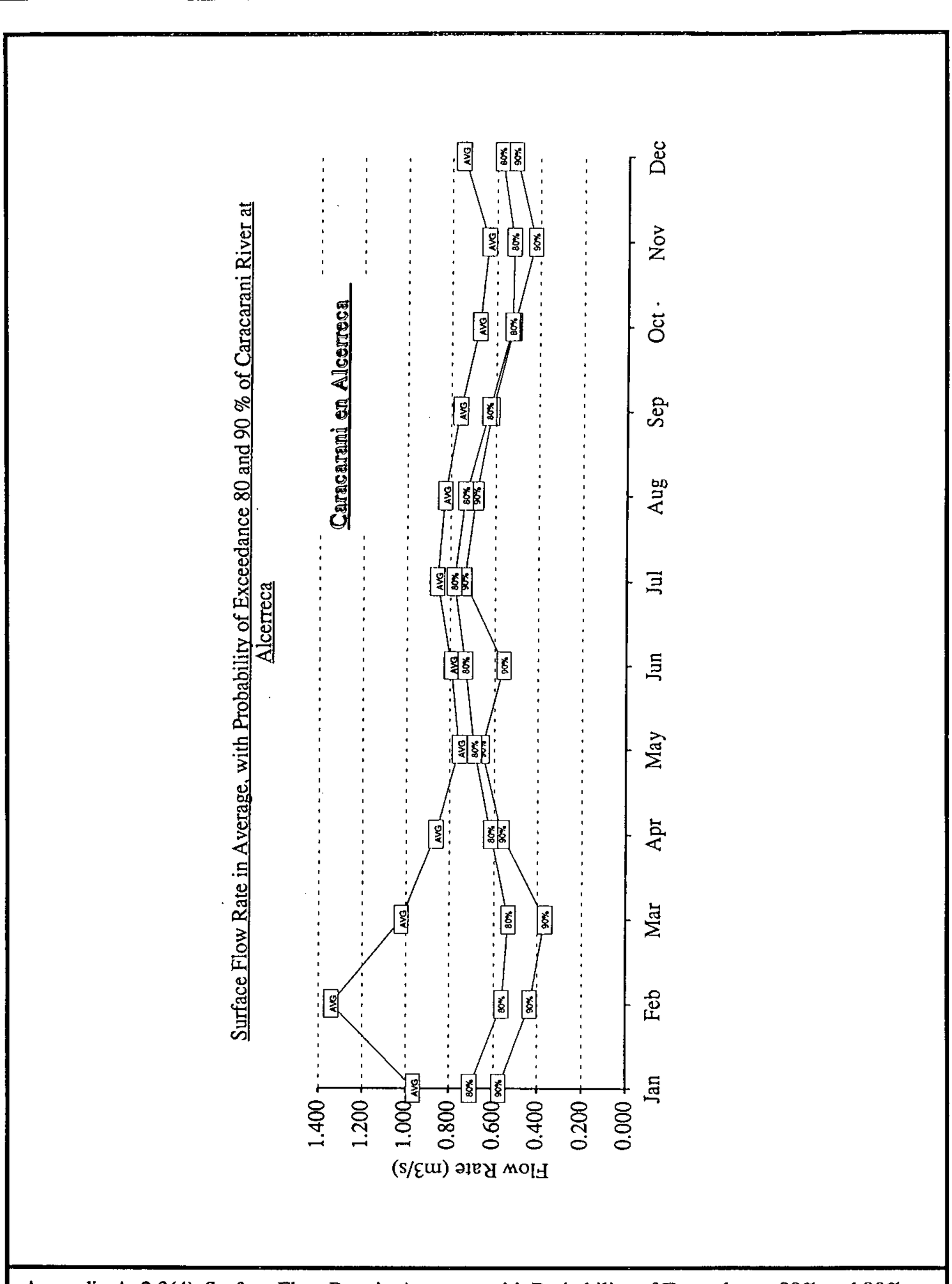
Appendix A, 2.3(2) Probable Surface Flow Rate (80%) at Major Stations in Lluta River Basin

<Nivel Probable de Flujo de Superficie (80%) en la Cuenca del Rio Lluta>



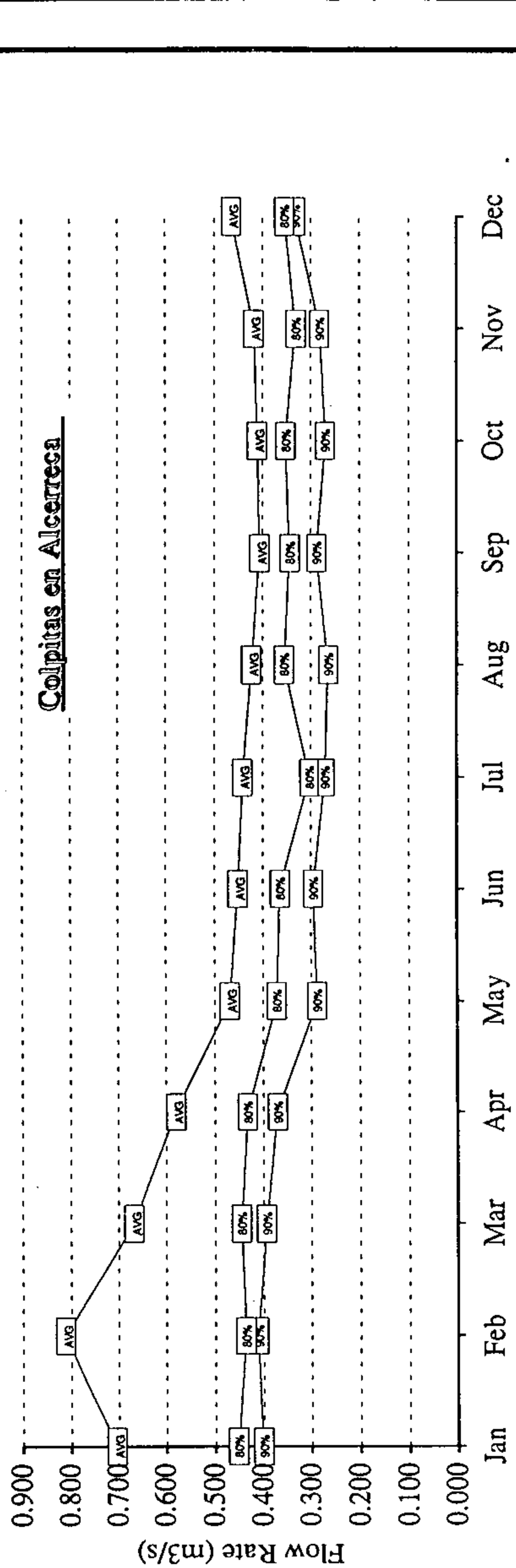
Appendix A, 2.3(3) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%

<Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>



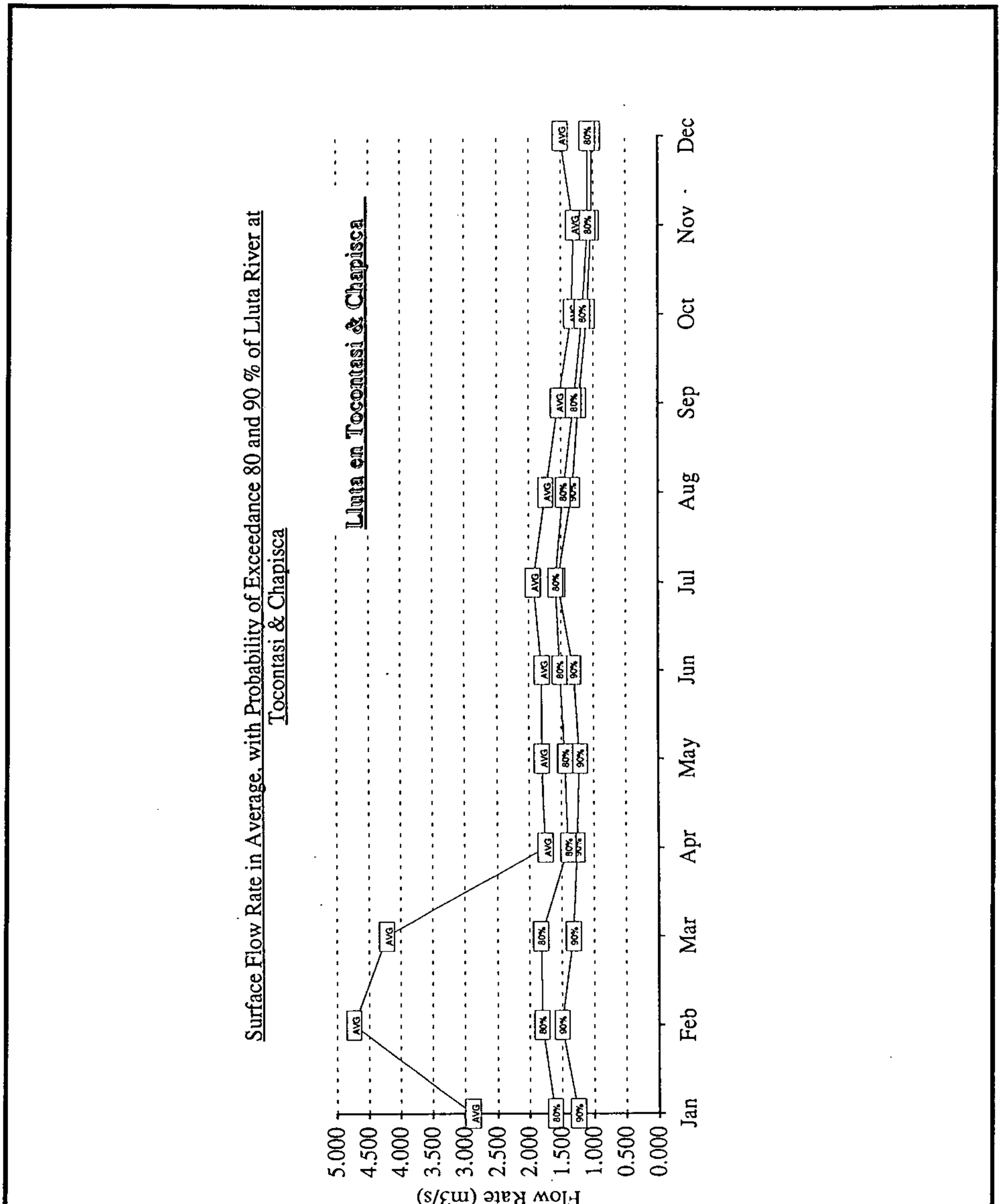
Appendix A, 2.3(4) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%

<Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>



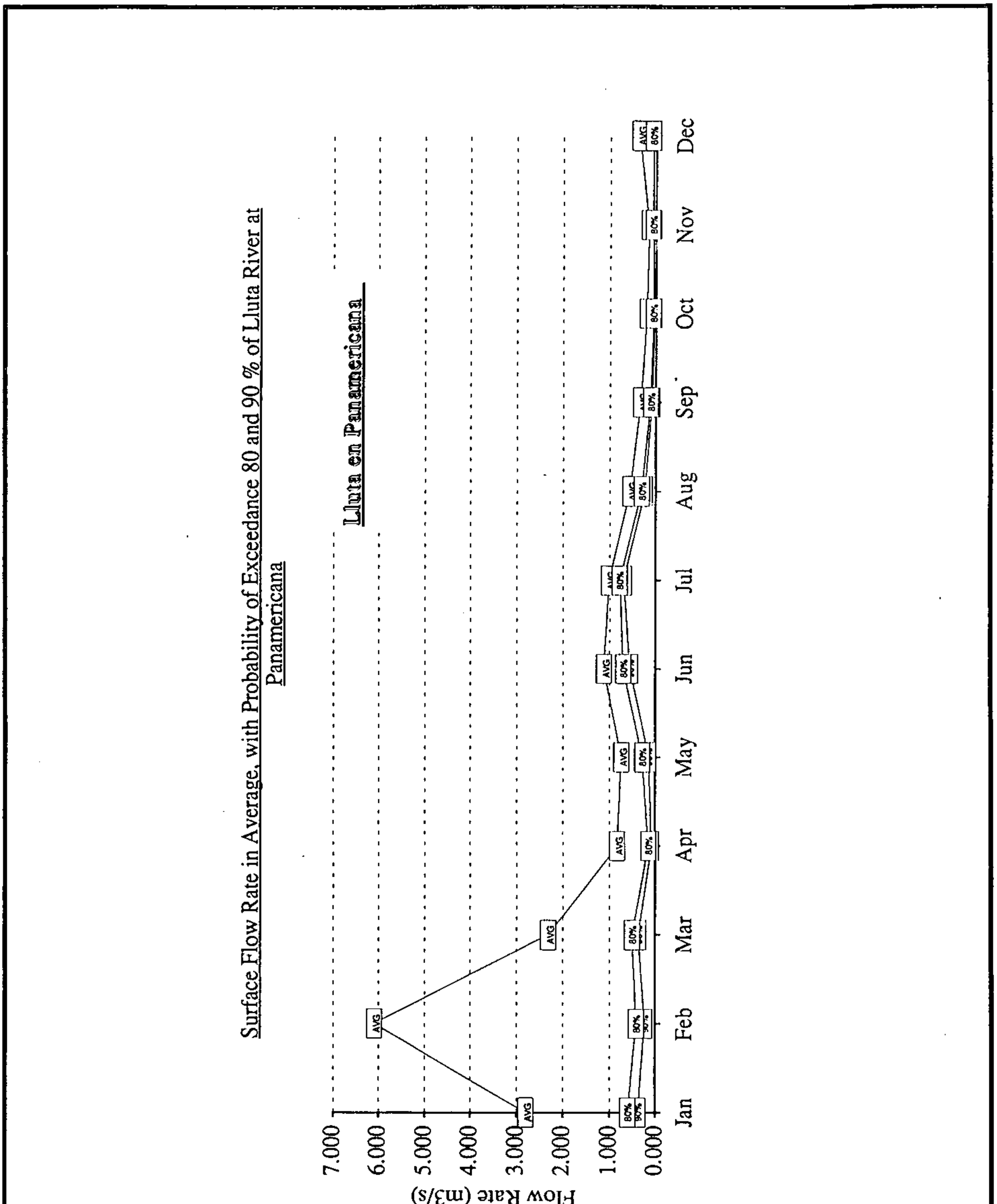
Appendix A, 2.3(5) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%

<Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>



Appendix A, 2.3(6) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%

<Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>



Appendix A, 2.3(7) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%

<Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>

Appendix A, 2.4 (1) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: Caracarani River at Humapalca																		
1967	8.10	1,500	13.200	212.0	162	288	74.1	44.4	17.2	140.0	3.30							
1968	7.70	1,496	0.000	207.0	142	212	72.1	54.8	14.9	136.0	1.85	0.010						
1969	7.30	1,438	3.000	223.0	169	252	80.2	46.7	23.3	148.0	4.00							
1970	7.60	1,523	2.420	188.0	179	339	73.2	45.2	16.2	168.0	2.00							
1971	8.00	1,598	13.200	157.0	191	383	87.8	47.0	18.7	174.0	3.00		0.040					
1972	8.10	1,384	5.750	195.0	172	256	80.7	34.8	17.9	155.0	2.65							
1974	7.49	1,375	0.000	230.0	159	251	72.4	51.7	20.4	137.0	2.50	0.051	0.015					
1975	7.80	1,780	3.450	220.0	159	365	86.1	56.2	21.6	165.0	1.97	0.081	0.000	0.780	0.050			
1976	7.93	1,376	0.000	193.0	158	293	53.7	51.3	20.3	170.0	3.25	0.114	0.080	0.710	0.384	0.000	0.130	
1979	7.79	1,291	0.000	222.0	160	264	67.7	38.2	18.0	144.0	3.53	0.105	0.015	1.060	0.015	0.005		0.033
1980	7.70	1,750	0.000	236.0	169	317	25.5	74.4	30.9	178.0	4.45	0.210	0.000	1.060				
1983	7.73	1,493	10.000	244.0		269	84.4	41.0	20.6	168.0	3.24	0.151	0.080	2.960				
1984	7.94	1,355	0.000	234.0		259	75.8	39.5	21.6	146.0	4.24	0.174						
1985	7.95	1,295	0.000	226.0		248	68.7	33.7	23.5	149.0	5.26	0.181	0.000	0.440				
Average	7.80	1,475	3.644	213.4	165	285	71.6	47.1	20.4	155.6	3.23	0.120	0.029	1.168	0.150	0.003	0.130	0.033

Appendix A, 2.4 (2) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: Azufre River at Humapalca																		
1967	2.10	2,290							89.9	285.0								
1968	2.50	5,200	0.000	0.0	2,340	1,008	331.0	128.0	199.0	192.0	12.00	0.463						
1969	2.10	10,200	0.000	0.0	1,042	1,639	208.0	72.0	146.0	227.0	24.00	0.367	0.450					
1970	2.00	9,610	0.000	0.0	1,135	2,042	216.0	150.0	77.1	338.0	16.00	0.324						
1971	2.60	6,879	0.000	0.0	911	1,678	227.0	61.4	66.9	284.0	11.80							
1972	2.20	9,352	0.000	0.0	1,128	2,066	384.0	80.4	163.0	275.0								
1974	1.80	13,549	0.000	0.0	1,453	2,978	47.5	198.0	116.0	301.0	12.00	0.005	0.000	50.000				
1975	1.58	10,133	0.000	0.0	1,211	2,483	87.1	204.0	113.0	290.0	16.10	1.880	0.150	9.760	0.994			
1976	1.83	16,134	0.000	0.0	1,574	3,252	30.5	140.0	122.0	375.0	41.60	2.890	0.475	114.000	2.280			
1977	1.86	12,996	0.000	0.0	1,360	2,805	26.3	151.0	101.0	323.0	34.70	1.730	0.000	59.800	7.610	0.069		0.230
1980	1.81	13,000	0.000	0.0	1,619	2,651	48.1	783.0	450.0	498.0	23.20	3.710		103.000				
1983	2.61	5,500	0.000	0.0		1,251	244.0	193.0	81.6	414.0	6.68	0.552		35.100				
1984	2.48	5,310	0.000	0.0		1,484	240.0	125.0	91.3	282.0	11.50	0.539						
Average	2.11	9,243	0.000	0.0	1,377	2,111	174.1	190.5	139.8	314.2	19.05	1.246	0.215	61.943	3.628	0.069		0.230

Appendix A, 2.4 (3) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: Caracarani River at Alcerreca																		
1967	4.50	1,440	0.000	11.6	246	370	66.4	22.6	19.9	119.0	3.80							
1968	7.10	1,119	0.000	73.1	179	193	62.8	34.1	14.9	120.0	1.90	0.042						
1969	6.40	1,234	0.000	47.1	201	250	64.4	33.9	30.4	111.0	3.10							
1970	6.10	1,440	0.000	43.0	263	259	79.4	28.2	26.9	158.0	5.87							
1971	6.24	1,455	0.000	56.5	208	430	79.7	42.5	21.7	165.0	2.20							
1972	5.45	1,371	0.000	25.6	191	329	91.2	38.0	11.9	104.0	1.36							
1974	4.13	1,442	0.000	7.0	208	319	61.1	38.0	28.4	97.4	2.98	0.070	0.000	5.000				
1975	3.82	2,008	0.000	3.4	228	478	85.3	46.8	24.5	116.0	2.84	0.153	0.335	3.560	0.106			
1976	3.83	1,684	0.000	0.0	369	442	45.0	36.1	21.6	121.0	5.43	0.113	0.053	9.000	0.256	0.000	0.000	
1977	4.11	1,260	0.000	0.0	192	315	52.1	42.0	16.5	111.0	5.96	0.206	0.093	6.910	0.065			0.118
1978	4.27	1,204	0.000	0.0	183	330	20.4	61.0	32.5	106.0	4.56	0.068	0.020					
1980	5.13	1,425	0.000	24.4	174	309	32.3	40.8	25.0	133.0	4.02	0.221	0.000	4.740				
1983	6.98	1,083	0.000	72.9	161	233	47.8	35.7	17.2	113.0	3.19	0.215	0.053	3.120				
1984	7.43	1,095	0.000	84.8	164	223	61.4	30.1	21.1	112.0	3.68	0.125	0.010					
1985	6.85	990	0.000	62.0	149	262	60.3	31.0	25.8	104.0	2.14	0.080	0.010	2.290				
1986	5.60	1,150	0.000	35.7	167	319	63.5	32.7	22.3	98.4	2.56	0.122		3.680				
1987	7.80	1,950	0.000	128.0	503	211	73.3	22.0	54.0	326.0	19.90	0.329	0.020		0.005		0.215	
1989	7.17	1,077	0.000	87.9	151	210	55.5	28.2	12.7	116.0	29.10	0.080	0.010		0.020		0.027	
Average	5.72	1,357	0.000	42.4	219	305	61.2	35.8	23.7	129.5	5.81	0.140	0.055	4.788	0.090	0.000	0.081	0.118

Appendix A, 2.4 (4) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: Colpitas River at Alcerreca																		
1967	7.70	2,628	4.560	104.0	588	188	75.7	27.7	54.3	359.0	27.60							
1968	7.40	2,365	0.000	144.0	488	200	90.5	36.7	47.8	356.0	15.30	0.363						
1969	7.60	2,595	0.000	138.0	631	191	79.5	27.5	74.8	375.0	22.60	0.170						
1970	7.50	2,433	4.480	100.0	595	271	76.3	30.2	53.4	386.0	17.70							
1971	7.70	2,482	1.580	139.0	533	268	77.1	19.9	42.6	374.0	13.90							
1972	7.90	1,997	3.150	154.0	459	178	72.4	25.3	23.1	290.0	8.87							
1974	7.30	2,156	0.000	130.0	462	186	69.1	23.1	51.5	294.0	17.20	0.172	0.000					
1975	7.39	2,158	0.000	133.0	421	185	66.3	23.8	44.2	261.0	10.20	0.350	0.000	0.890	0.034			
1976	7.26	2,356	0.000	150.0	531	168	55.8	35.7	49.5	362.0	30.80	0.332	0.017	0.463	0.557	0.000	0.000	
1977	7.26	2,138	0.000	137.0	538	210	64.4	33.5	47.3	338.0	24.60	0.282	0.003	1.010	0.023	0.002		0.037
1978	6.41	2,153	0.000	119.0	465	295	21.0	54.0	110.0	246.0	13.80	0.318	0.050					
1980	7.56	2,600	0.000	127.0	475	225	24.0	46.7	75.1	345.0	19.50	0.730	0.000	1.040				
1983	7.81	3,914	0.000	157.0	1,017	285	105.0	39.6	91.6	651.0	8.33	1.480	0.030	4.380				
1984	8.08	2,473	0.000	135.0	586	295	86.5	26.5	81.1	360.0	12.60	0.320						
1985	7.54	2,289	0.000	144.0	555	233	78.2	19.3	81.5	356.0	13.10	0.440	0.015	0.335				
1986	7.42	1,825	0.000	132.0	445	201	69.4	20.9	57.9	280.0	9.80	0.379	0.005	0.475				
1987	7.20	1,543	0.000	88.5	352	189	59.7	20.6	39.6	220.0	11.10	0.634	0.017	2.720	0.105		0.165	
1988	7.65	2,200	0.000	144.0	574	226	77.6	20.7	64.0	373.0	92.40	0.636	0.020		0.002		0.256	
1989	8.31	2,822	0.000	143.0	638	240	96.4	25.7	57.5	428.0	40.10	0.366	0.010		0.020		0.233	
Average	7.53	2,375	0.725	132.6	545	223	70.8	29.3	60.4	350.2	21.55	0.465	0.014	1.414	0.124	0.001	0.164	0.037

Appendix A, 2.4 (5) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: Lluta River at Alcerreca																		
1967	4.90	1,800	0.000	13.4	392	272	71.0	25.9	33.1	203.0	16.70							
1968	7.30	1,596	0.000	119.0	305	193	73.1	28.1	33.3	198.0	9.00							
1969	6.70	1,827	0.000	68.2	365	232	76.2	28.7	46.4	226.0	12.40	0.163						
1970	6.30	1,873	0.000	74.5	308	364	90.9	44.1	39.2	188.0	5.44							
1971	7.70	1,597	5.670	100.0	251	370	76.1	41.8	25.0	187.0	3.50							
1972	7.03	1,557	0.000	65.5	282	243	80.4	30.2	14.9	172.0	4.12							
1974	5.17	1,659	0.000	29.9	295	276	67.5	33.7	31.5	164.0	6.23	0.097	0.005					
1975	3.12	2,422	0.000	0.0	377	442	83.8	47.4	39.5	184.0	4.53	0.342	0.000	9.760	0.045			
1976	4.49	1,773	0.000	7.1	332	356	49.0	44.6	33.2	186.0	12.50	0.176	0.087	6.870	0.444	0.000	0.000	
1977	5.65	1,915	0.000	17.3	325	271	64.6	34.2	28.4	203.0	27.60	0.244	0.063	5.300	0.074			
1978	6.80	1,453	0.000	9.2	277	280	24.0	55.1	53.6	168.0	11.00	0.195	0.030					
1980	6.31	1,475	0.000	53.1	200	235	23.7	52.7	30.7	136.0	8.36	0.130	0.000	2.980				
1983	7.43	1,991	0.000	125.0		279	73.3	38.9	41.1	286.0	6.94	0.263	0.060	3.110				
1984	7.70	1,592	0.000	93.7		236	67.3	28.6	40.1	198.0	9.18	0.235						
1985	7.60	1,474	0.000	107.0		215	61.9	15.8	44.6	206.0	10.20	0.244	0.000	0.930				
Average	6.28	1,734	0.378	58.9	309	284	65.5	36.7	35.6	193.7	9.85	0.209	0.031	4.825	0.188	0.000	0.000	

Appendix A, 2.4 (6) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: LLuta River at Tocontasi																		
1967	7.40	1,960	0.000	64.1	363	380	92.2	35.3	28.9	202.0	12.00							
1968	7.90	1,870	0.000	95.2	301	117	84.2	49.6	26.2	248.0	9.50	0.168						
1969	6.60	2,050	0.000	63.8	384	288	113.0	41.2	36.5	195.0	11.00							
1970	7.30	1,840	0.000	72.4	360	310	77.2	36.5	27.3	244.0	12.30							
1971	7.50	1,980	9.600	84.4	434	466	120.0	47.9	43.7	325.0	22.00							
1972	6.70	1,400	0.000	47.5	237	282	83.0	28.8	22.0	151.0	5.60							
1974	6.50	1,900	0.000	45.4	343	312	97.0	39.7	28.7	214.0	12.00	0.156	0.082					
1975	5.80	2,310	0.000	17.9	373	446	105.0	52.0	30.5	204.0	9.03	0.378	0.027	5.070	0.237			
1976	6.45	1,660	0.000	27.3	268	295	84.9	35.4	25.4	160.0	5.83	0.236	0.240	2.740	0.155	0.003	0.000	
1977	6.82	1,070	0.000	42.0	222	247	71.7	31.0	19.5	135.0	9.98	0.267	0.035	3.310	0.015	0.003		0.090
1978	5.11	1,540	0.000	4.4	266	352	90.5	29.6	21.3	163.0	13.80	0.434	0.148	6.080	0.243	0.004	0.033	0.093
1985	7.81	1,950	0.000	111.0		314	107.0	26.4	35.4	242.0	10.80	0.328		1.940				
1986	6.79	1,370	0.000	61.7		252	76.2	24.2	30.2	168.0	9.43	0.312		1.950				
1987	7.80	1,290	0.000	54.9		276			22.7	134.0	6.38	0.463		5.630	0.397		0.133	
Average	6.89	1,728	0.686	56.6	323	310	92.5	36.7	28.5	198.9	10.69	0.305	0.106	3.817	0.209	0.003	0.055	0.092

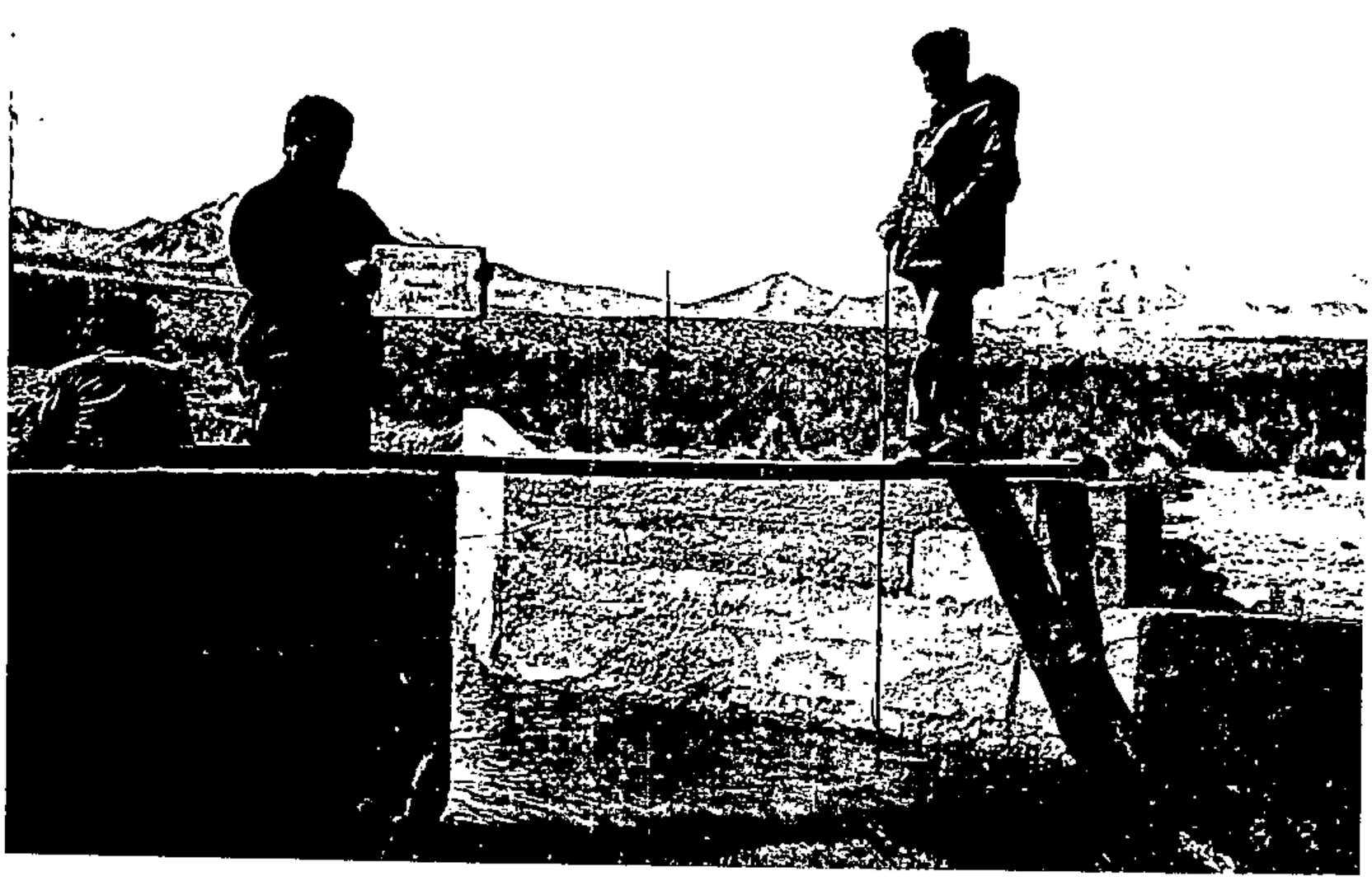
Appendix A, 2.4 (7) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: LLuta River at Poconchile																		
1968	7.40	2,485	0.000	58.6	564	493	154.0	62.5	33.3	285.0	10.50	0.040						
1969	7.00	2,374	0.000	63.2	446	355	136.0	43.5	38.1	235.0	16.30							
1973	6.50	1,859																
1976	6.47	1,148	0.000	90.1	157	224	68.2	27.8	16.3	107.0	6.69	0.336						
1985	7.89	2,380	0.000	11.3	476	419	144.0	30.8	47.7	300.0	11.20	0.142	0.000					
Average	7.05	2,049	0.000	55.8	411	373	125.6	41.2	33.9	231.8	11.17	0.173	0.000					

Appendix A, 2.4 (8) Average Water Quality observed by DGA at Major Stations in Lluta River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Lluta>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-Na2 mg/l	P mg/l	N-NH3 mg/l
ST: LLuta River at Panamericana																		
1967	7.30	3,745	0.000	61.0	620	644	241.0	85.1	49.7	428.0	29.00							
1968	7.60	7,473	0.000	80.0	881	872	321.0	122.0	56.7	555.0	19.30	0.013						
1969	7.60	5,202	0.000	76.7	855	713	274.0	103.0	57.6	519.0	21.80							
1970	7.50	5,335	0.000	94.9	1,071	1,285	386.0	128.0	70.4	669.0	24.00							
1971	7.30	4,909	0.000	105.0	902	980	325.0	105.0	71.9	524.0	30.60							
1972	7.40	2,298	0.000	82.5	404	496	157.0	49.5	33.0	235.0	7.60							
1973	8.00	2,612																
1974	6.90	2,088	0.000	43.4	366	451	128.0	45.7	33.7	230.0	8.06	0.006	0.033					
1975	6.71	2,574	0.000	44.5	441	539	507.0	62.7	31.4	266.0	9.20	0.167	0.147	1.880	0.337			
1976	7.17	2,575	0.000	60.8	337	413	124.0	50.3	27.0	213.0	25.20	0.398	0.290	4.280	0.152	0.020	0.033	
1978	6.94	1,345	0.000	78.7	191	307	107.0	34.0	10.2	133.0	9.24	0.060	0.060		0.486	0.010		0.211
1983	7.26	4,645	0.000	139.0	873	781	291.0	107.0	74.3	548.0	6.45	0.035	0.010	0.765				
1985	7.63	4,684	0.000	164.0	993	1,023	352.0	76.8	101.0	567.0	12.80	0.088	0.040	0.640				
1986	7.81	3,112	0.000	89.3	613	656	206.0	63.5	54.2	357.0	14.70	0.150	0.013	0.953	1.950			
1987	7.83	3,200	0.000	114.0	691	713	232.0	69.8	50.8	415.0	17.80	0.272	0.067	5.710	0.073		0.102	
1988	7.30	3,412	0.000	81.2	640	740	217.0	63.0	53.6	389.0		0.158	0.020		0.001		0.044	
1989	8.02	7,000	0.000	111.0	1,390	1,400	443.0	145.0	73.0	810.0		0.021	0.070		0.020		0.005	
Average	7.43	3,895	0.000	89.1	704	751	269.4	81.9	53.0	428.6	16.84	0.124	0.075	2.371	0.431	0.015	0.046	0.211

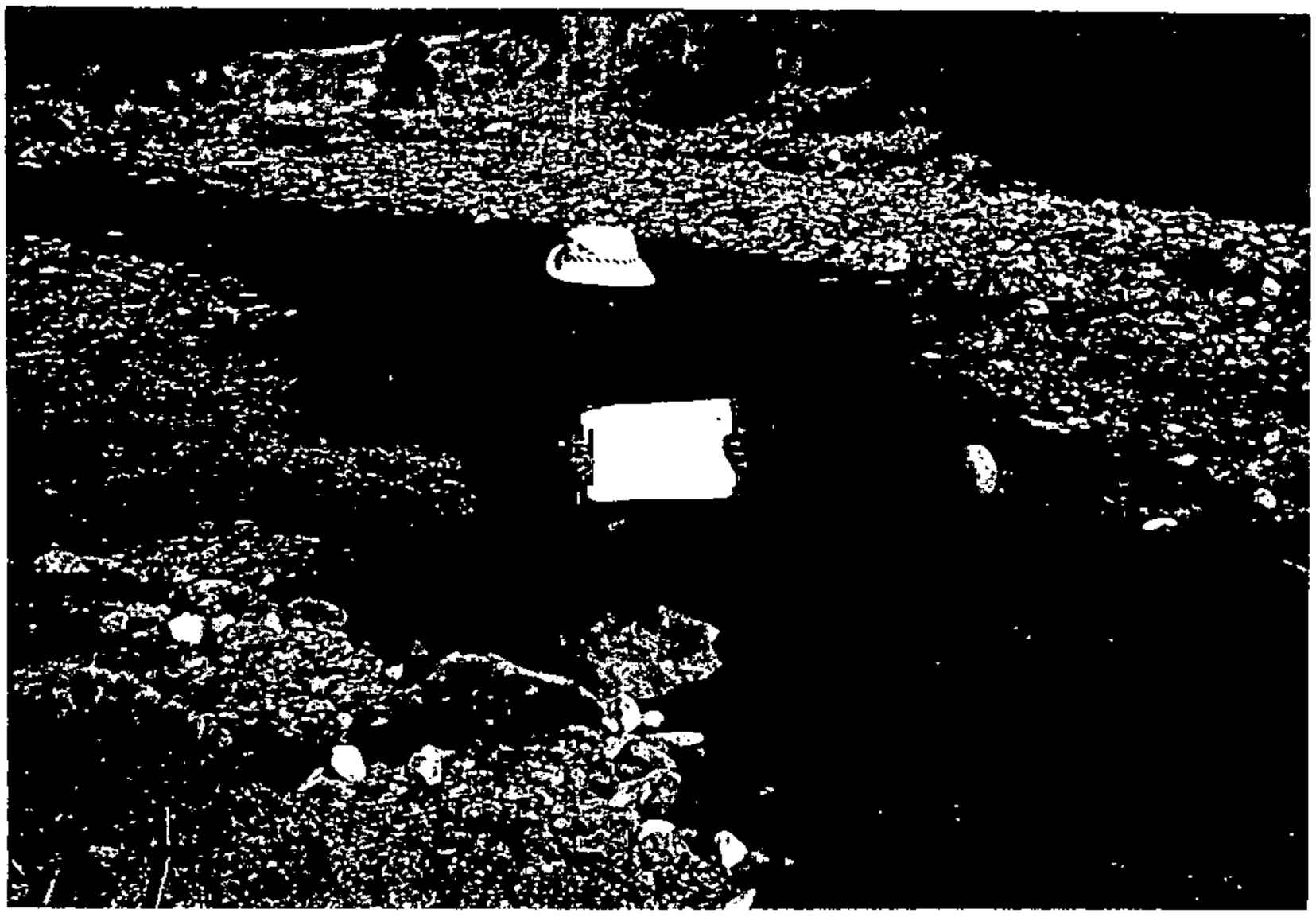
Azufre River



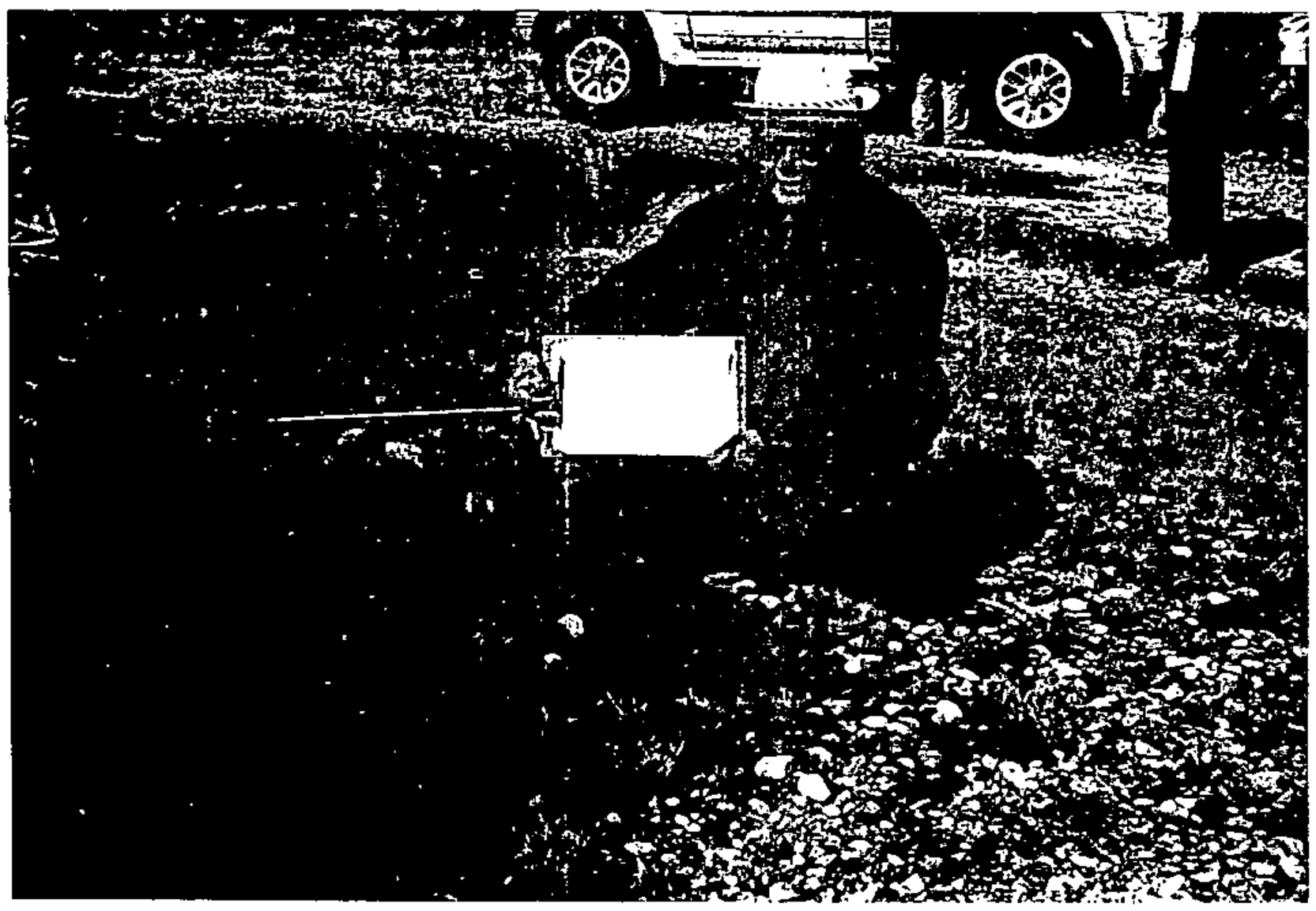
Caracarani River

Appendix A, 2.5(1) Field Observation in Lluta River Basin on 1st - 3rd June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 1 - 3 Junio 1993>



Cascavillane River

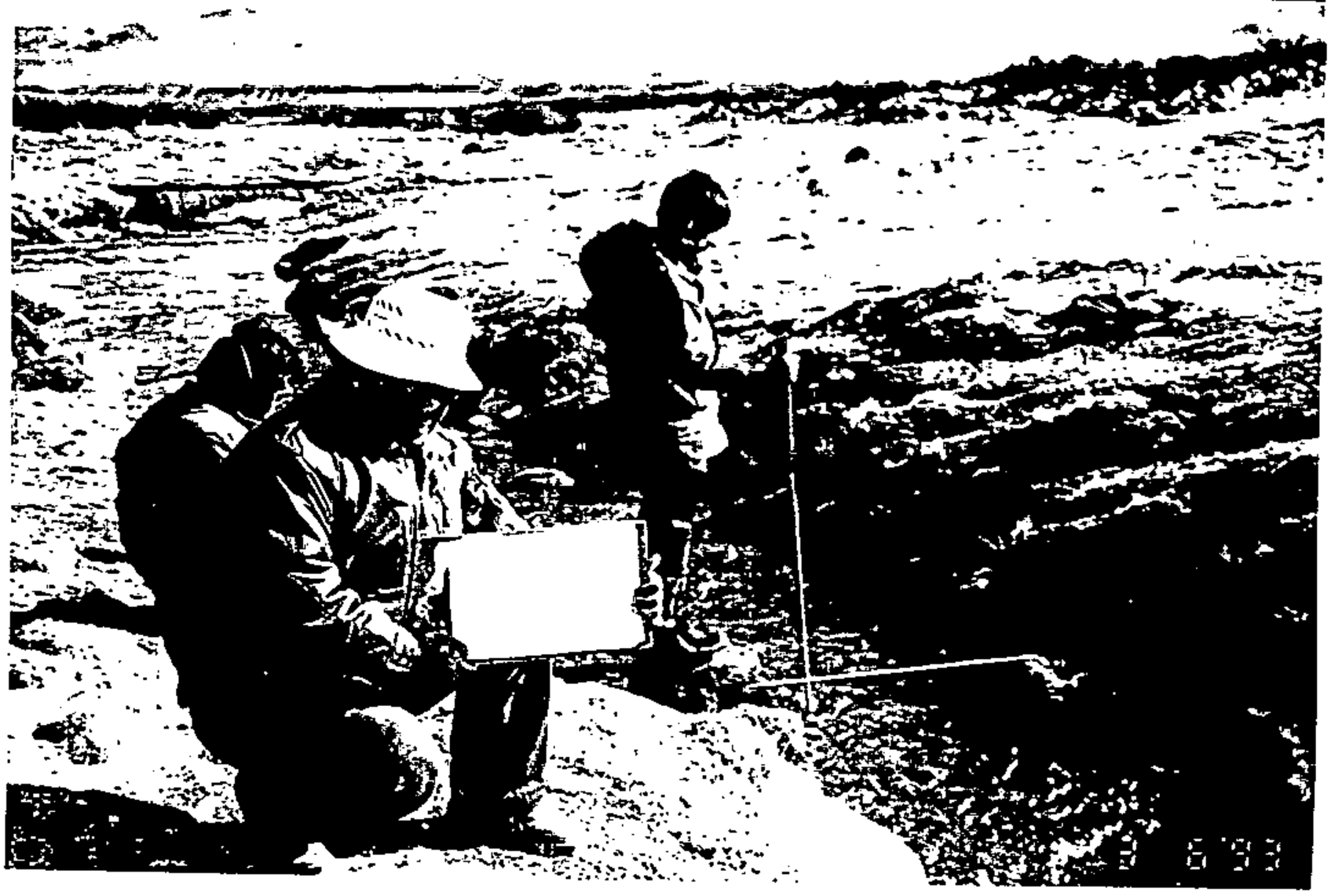


Teleschuno River

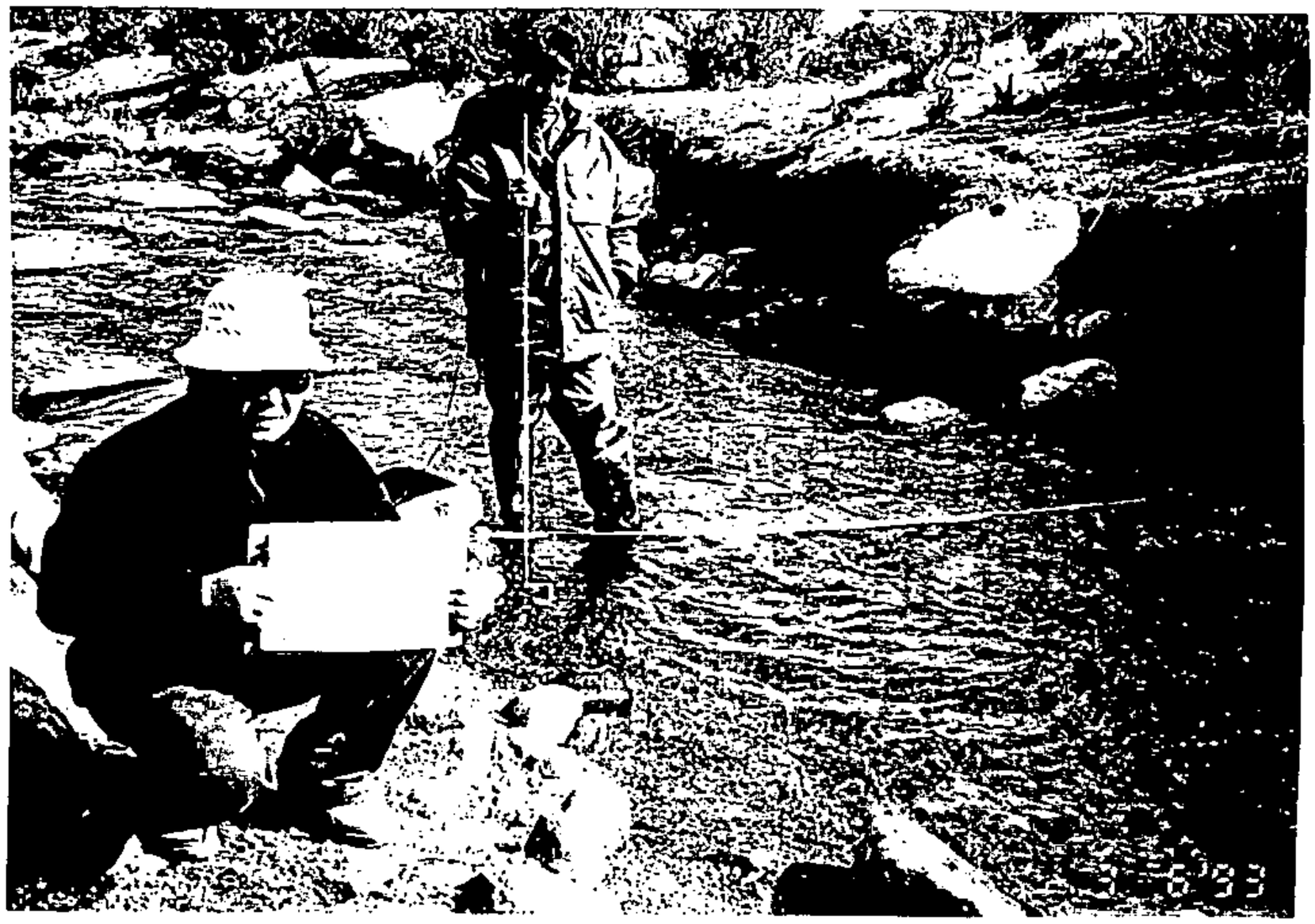
Appendix A, 2.5(2) Field Observation in Lluta River Basin on 1st - 3rd June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 1 - 3 Junio 1993>

Guancarane River



Chuquiananta River



Colpitas River

Putre River

Appendix A, 2.5(4) Field Observation in Lluta River Basin on 1st - 3rd June 1993

<Observacion en Terreno en la Cuenca del Rio San Jose el 1 - 3 Junio 1993>

Quebrada Taipicahua

Quebrada Jurase

Aroma River

Socoroma River

Lluta River at Chapisca

Sampling of Water from the River

Appendix A, 2.6 (1) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1946	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,346,278
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-489,888
	Jul	1.470	0.470	1,258,848	-0.030	-80,352	-0.530	-1,419,552
	Aug	1.470	0.470	1,258,848	-0.030	-80,352	-0.530	-1,419,552
	Sep	1.250	0.250	648,000	-0.250	-648,000	-0.750	-1,944,000
	Oct	1.270	0.270	723,168	-0.230	-616,032	-0.730	-1,955,232
	Nov	1.230	0.230	596,160	-0.270	-699,840	-0.770	-1,995,840
	Dec	1.380	0.380	1,017,792	-0.120	-321,408	-0.620	-1,660,608
	AVG	2.099	1.099	2,848,284	0.599	1,534,284	0.099	220,284
1947	Jan	2.110	1.110	2,973,024	0.610	1,633,824	0.110	294,624
	Feb	1.450	0.450	1,088,640	-0.050	-120,960	-0.550	-1,330,560
	Mar	1.220	0.220	589,248	-0.280	-749,952	-0.780	-2,089,152
	Apr	1.380	0.380	984,960	-0.120	-311,040	-0.620	-1,607,040
	May	1.450	0.450	1,205,280	-0.050	-133,920	-0.550	-1,473,120
	Jun	1.390	0.390	1,010,880	-0.110	-285,120	-0.610	-1,581,120
	Jul	1.570	0.570	1,526,688	0.070	187,488	-0.430	-1,151,712
	Aug	1.280	0.280	749,952	-0.220	-589,248	-0.720	-1,928,448
	Sep	1.210	0.210	544,320	-0.290	-751,680	-0.790	-2,047,680
	Oct	1.190	0.190	508,896	-0.310	-830,304	-0.810	-2,169,504
	Nov	1.090	0.090	233,280	-0.410	-1,062,720	-0.910	-2,358,720
	Dec	2.220	1.220	3,267,648	0.720	1,928,448	0.220	589,248
	AVG	1.463	0.463	1,223,568	-0.037	-90,432	-0.537	-1,404,432
1948	Jan	1.880	0.880	2,356,992	0.380	1,017,792	-0.120	-321,408
	Feb	3.920	2.920	7,064,064	2.420	5,854,464	1.920	4,644,864
	Mar	5.630	4.630	12,400,992	4.130	11,061,792	3.630	9,722,592
	Apr	1.940	0.940	2,436,480	0.440	1,140,480	-0.060	-155,520
	May	1.940	0.940	2,517,696	0.440	1,178,496	-0.060	-160,704
	Jun	1.890	0.890	2,306,880	0.390	1,010,880	-0.110	-285,120
	Jul	1.940	0.940	2,517,696	0.440	1,178,496	-0.060	-160,704
	Aug	1.770	0.770	2,062,368	0.270	723,168	-0.230	-616,032
	Sep	1.490	0.490	1,270,080	-0.010	-25,920	-0.510	-1,321,920
	Oct	1.370	0.370	991,008	-0.130	-348,192	-0.630	-1,687,392
	Nov	1.330	0.330	855,360	-0.170	-440,640	-0.670	-1,736,640
	Dec	1.820	0.820	2,196,288	0.320	857,088	-0.180	-482,112
	AVG	2.243	1.243	3,247,992	0.743	1,933,992	0.243	619,992

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1949	Jan	9.160	8.160	21,855,744	7.660	20,516,544	7.160	19,17
	Feb	8.780	7.780	18,821,376	7.280	17,611,776	6.780	16,40
	Mar	8.350	7.350	19,686,240	6.850	18,347,040	6.350	17,00
	Apr	3.640	2.640	6,842,880	2.140	5,546,880	1.640	4,25
	May	2.570	1.570	4,205,088	1.070	2,865,888	0.570	1,52
	Jun	2.680	1.680	4,354,560	1.180	3,058,560	0.680	1,76
	Jul	2.400	1.400	3,749,760	0.900	2,410,560	0.400	1,07
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.370	0.370	991,008	-0.130	-348,192	-0.630	-1,68
	Nov	1.190	0.190	492,480	-0.310	-803,520	-0.810	-2,09
	Dec	1.350	0.350	937,440	-0.150	-401,760	-0.650	-1,74
	AVG	3.730	2.730	7,108,675	2.230	5,794,675	1.730	4,48
1950	Jan	1.600	0.600	1,607,040	0.100	267,840	-0.400	-1,07
	Feb	1.710	0.710	1,717,632	0.210	508,032	-0.290	-70
	Mar	2.340	1.340	3,589,056	0.840	2,249,856	0.340	91
	Apr	1.730	0.730	1,892,160	0.230	596,160	-0.270	-69
	May	1.820	0.820	2,196,288	0.320	857,088	-0.180	-48
	Jun	1.830	0.830	2,151,360	0.330	855,360	-0.170	-44
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.730	0.730	1,955,232	0.230	616,032	-0.270	-72
	Sep	1.570	0.570	1,477,440	0.070	181,440	-0.430	-1,11
	Oct	1.380	0.380	1,017,792	-0.120	-321,408	-0.620	-1,66
	Nov	1.170	0.170	440,640	-0.330	-855,360	-0.830	-2,15
	Dec	1.430	0.430	1,151,712	-0.070	-187,488	-0.570	-1,52
	AVG	1.687	0.687	1,808,388	0.187	494,388	-0.313	-81
1951	Jan	2.210	1.210	3,240,864	0.710	1,901,664	0.210	56
	Feb	2.850	1.850	4,475,520	1.350	3,265,920	0.850	2,05
	Mar	2.700	1.700	4,553,280	1.200	3,214,080	0.700	1,87
	Apr	1.580	0.580	1,503,360	0.080	207,360	-0.420	-1,08
	May	1.610	0.610	1,633,824	0.110	294,624	-0.390	-1,04
	Jun	1.630	0.630	1,632,960	0.130	336,960	-0.370	-95
	Jul	1.730	0.730	1,955,232	0.230	616,032	-0.270	-72
	Aug	1.690	0.690	1,848,096	0.190	508,896	-0.310	-83
	Sep	1.600	0.600	1,555,200	0.100	259,200	-0.400	-1,03
	Oct	1.280	0.280	749,952	-0.220	-589,248	-0.720	-1,92
	Nov	1.250	0.250	648,000	-0.250	-648,000	-0.750	-1,94
	Dec	1.230	0.230	616,032	-0.270	-723,168	-0.770	-2,06
	AVG	1.780	0.780	2,034,360	0.280	720,360	-0.220	-59

Appendix A, 2.6 (2) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1952	Jan	6.360	5.360	14,356,224	4.860	13,017,024	4.360	11,677,824
	Feb	6.590	5.590	13,523,328	5.090	12,313,728	4.590	11,104,128
	Mar	3.680	2.680	7,178,112	2.180	5,838,912	1.680	4,499,712
	Apr	2.420	1.420	3,680,640	0.920	2,384,640	0.420	1,088,640
	May	2.140	1.140	3,053,376	0.640	1,714,176	0.140	374,976
	Jun	2.390	1.390	3,602,880	0.890	2,306,880	0.390	1,010,880
	Jul	3.410	2.410	6,454,944	1.910	5,115,744	1.410	3,776,544
	Aug	2.390	1.390	3,722,976	0.890	2,383,776	0.390	1,044,576
	Sep	2.260	1.260	3,265,920	0.760	1,969,920	0.260	673,920
	Oct	1.760	0.760	2,035,584	0.260	696,384	-0.240	-642,816
	Nov	1.600	0.600	1,555,200	0.100	259,200	-0.400	-1,036,800
	Dec	1.790	0.790	2,115,936	0.290	776,736	-0.210	-562,464
	AVG	3.066	2.066	5,378,760	1.566	4,064,760	1.066	2,750,760
1953	Jan	4.050	3.050	8,169,120	2.550	6,829,920	2.050	5,490,720
	Feb	11.900	10.900	26,369,280	10.400	25,159,680	9.900	23,950,080
	Mar	12.800	11.800	31,605,120	11.300	30,265,920	10.800	28,926,720
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-489,888
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-733,882
	Sep	1.600	0.600	1,555,200	0.100	259,200	-0.400	-1,036,800
	Oct	1.540	0.540	1,446,336	0.040	107,136	-0.460	-1,232,064
	Nov	1.790	0.790	2,047,680	0.290	751,680	-0.210	-544,320
	Dec	2.120	1.120	2,999,808	0.620	1,660,608	0.120	321,408
	AVG	3.733	2.733	7,063,078	2.233	5,749,078	1.733	4,435,078
1954	Jan	2.930	1.930	5,169,312	1.430	3,830,112	0.930	2,490,912
	Feb	12.100	11.100	26,853,120	10.600	25,643,520	10.100	24,433,920
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-489,888
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-733,882
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,168,992
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,794,528
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,879,200
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,422,230
	AVG	2.819	1.819	4,615,222	1.319	3,301,222	0.819	1,987,222

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1955	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.380	0.380	1,017,792	-0.120	-321,408	-0.620	-1,66
	Nov	1.320	0.320	829,440	-0.180	-466,560	-0.680	-1,76
	Dec	2.010	1.010	2,705,184	0.510	1,365,984	0.010	2
	AVG	2.253	1.253	3,258,403	0.753	1,944,403	0.253	63
1956	Jan	2.050	1.050	2,812,320	0.550	1,473,120	0.050	13
	Feb	3.920	2.920	7,064,064	2.420	5,854,464	1.920	4,64
	Mar	1.920	0.920	2,464,128	0.420	1,124,928	-0.080	-21
	Apr	1.570	0.570	1,477,440	0.070	181,440	-0.430	-1,11
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.790	0.790	2,115,936	0.290	776,736	-0.210	-56
	Aug	1.690	0.690	1,848,096	0.190	508,896	-0.310	-83
	Sep	1.570	0.570	1,477,440	0.070	181,440	-0.430	-1,11
	Oct	1.390	0.390	1,044,576	-0.110	-294,624	-0.610	-1,63
	Nov	1.320	0.320	829,440	-0.180	-466,560	-0.680	-1,76
	Dec	1.110	0.110	294,624	-0.390	-1,044,576	-0.890	-2,38
	AVG	1.825	0.825	2,130,926	0.325	816,926	-0.175	-49
1957	Jan	1.190	0.190	508,896	-0.310	-830,304	-0.810	-2,16
	Feb	2.790	1.790	4,330,368	1.290	3,120,768	0.790	1,91
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.860	0.860	2,229,120	0.360	933,120	-0.140	-36
	Jul	1.650	0.650	1,740,960	0.150	401,760	-0.350	-93
	Aug	1.680	0.680	1,821,312	0.180	482,112	-0.320	-85
	Sep	1.420	0.420	1,088,640	-0.080	-207,360	-0.580	-1,50
	Oct	1.190	0.190	508,896	-0.310	-830,304	-0.810	-2,16
	Nov	1.200	0.200	518,400	-0.300	-777,600	-0.800	-2,07
	Dec	2.710	1.710	4,580,064	1.210	3,240,864	0.710	1,90
	AVG	1.950	0.950	2,488,342	0.450	1,174,342	-0.051	-13

Appendix A, 2.6 (3) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1958	Jan	3.270	2.270	6,079,968	1.770	4,740,768	1.270	3,401,568
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	2.400	1.400	3,749,760	0.900	2,410,560	0.400	1,071,360
	Jun	2.550	1.550	4,017,600	1.050	2,721,600	0.550	1,425,600
	Jul	2.520	1.520	4,071,168	1.020	2,731,968	0.520	1,392,768
	Aug	2.100	1.100	2,946,240	0.600	1,607,040	0.100	267,840
	Sep	2.020	1.020	2,643,840	0.520	1,347,840	0.020	51,840
	Oct	1.820	0.820	2,196,288	0.320	857,088	-0.180	-482,112
	Nov	1.350	0.350	907,200	-0.150	-388,800	-0.650	-1,684,800
	Dec	1.250	0.250	669,600	-0.250	-669,600	-0.750	-2,008,800
	AVG	2.496	1.496	3,899,210	0.996	2,585,210	0.496	1,271,210
1959	Jan	1.290	0.290	776,736	-0.210	-562,464	-0.710	-1,901,664
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-489,888
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-733,882
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,168,992
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,794,528
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,879,200
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,422,230
	AVG	2.068	1.068	2,762,777	0.568	1,448,777	0.068	134,777
1960	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,346,278
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-489,888
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-733,882
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,168,992
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,794,528
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,879,200
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,422,230
	AVG	2.200	1.200	3,116,772	0.700	1,802,772	0.200	488,772

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1961	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.760	0.760	2,035,584	0.260	696,384	-0.240	-64
	Sep	1.390	0.390	1,010,880	-0.110	-285,120	-0.610	-1,58
	Oct	1.100	0.100	267,840	-0.400	-1,071,360	-0.900	-2,41
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,87
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,42
	AVG	2.171	1.171	3,038,681	0.671	1,724,681	0.171	41
1962	Jan	3.700	2.700	7,231,680	2.200	5,892,480	1.700	4,55
	Feb	3.560	2.560	6,193,152	2.060	4,983,552	1.560	3,77
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.820	0.820	2,196,288	0.320	857,088	-0.180	-48
	Jun	2.060	1.060	2,747,520	0.560	1,451,520	0.060	15
	Jul	1.980	0.980	2,624,832	0.480	1,285,632	-0.020	-5
	Aug	1.980	0.980	2,624,832	0.480	1,285,632	-0.020	-5
	Sep	1.650	0.650	1,684,800	0.150	388,800	-0.350	-90
	Oct	1.200	0.200	535,680	-0.300	-803,520	-0.800	-2,14
	Nov	1.450	0.450	1,166,400	-0.050	-129,600	-0.550	-1,42
	Dec	1.530	0.530	1,419,552	0.030	80,352	-0.470	-1,25
	AVG	2.239	1.239	3,243,103	0.739	1,929,103	0.239	61
1963	Jan	2.020	1.020	2,731,968	0.520	1,392,768	0.020	5
	Feb	7.470	6.470	15,652,224	5.970	14,442,624	5.470	13,23
	Mar	4.790	3.790	10,151,136	3.290	8,811,936	2.790	7,47
	Apr	2.030	1.030	2,669,760	0.530	1,373,760	0.030	7
	May	2.650	1.650	4,419,360	1.150	3,080,160	0.650	1,74
	Jun	2.370	1.370	3,551,040	0.870	2,255,040	0.370	95
	Jul	2.350	1.350	3,615,840	0.850	2,276,640	0.350	93
	Aug	2.200	1.200	3,214,080	0.700	1,874,880	0.200	53
	Sep	2.020	1.020	2,643,840	0.520	1,347,840	0.020	5
	Oct	1.690	0.690	1,848,096	0.190	508,896	-0.310	-83
	Nov	1.640	0.640	1,658,880	0.140	362,880	-0.360	-93
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,42
	AVG	2.725	1.725	4,451,033	1.225	3,137,033	0.725	1,82

Appendix A, 2.6 (4) Water Development Potential at Tocontasi & Chapisca
<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1964	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,346,278
	Feb	1.750	0.750	1,814,400	0.250	604,800	-0.250	-604,800
	Mar	1.850	0.850	2,276,640	0.350	937,440	-0.150	-401,760
	Apr	1.290	0.290	751,680	-0.210	-544,320	-0.710	-1,840,320
	May	1.660	0.660	1,767,744	0.160	428,544	-0.340	-910,656
	Jun	1.850	0.850	2,203,200	0.350	907,200	-0.150	-388,800
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	2.150	1.150	3,080,160	0.650	1,740,960	0.150	401,760
	Sep	2.080	1.080	2,799,360	0.580	1,503,360	0.080	207,360
	Oct	1.700	0.700	1,874,880	0.200	535,680	-0.300	-803,520
	Nov	1.390	0.390	1,010,880	-0.110	-285,120	-0.610	-1,581,120
	Dec	1.970	0.970	2,598,048	0.470	1,258,848	-0.030	-80,352
	AVG	1.875	0.875	2,308,831	0.375	994,831	-0.125	-319,169
1965	Jan	3.340	2.340	6,267,456	1.840	4,928,256	1.340	3,589,056
	Feb	4.220	3.220	7,789,824	2.720	6,580,224	2.220	5,370,624
	Mar	4.110	3.110	8,329,824	2.610	6,990,624	2.110	5,651,424
	Apr	2.250	1.250	3,240,000	0.750	1,944,000	0.250	648,000
	May	1.110	0.110	294,624	-0.390	-1,044,576	-0.890	-2,383,776
	Jun	1.030	0.030	77,760	-0.470	-1,218,240	-0.970	-2,514,240
	Jul	3.610	2.610	6,990,624	2.110	5,651,424	1.610	4,312,224
	Aug	2.330	1.330	3,562,272	0.830	2,223,072	0.330	883,872
	Sep	2.310	1.310	3,395,520	0.810	2,099,520	0.310	803,520
	Oct	2.520	1.520	4,071,168	1.020	2,731,968	0.520	1,392,768
	Nov	2.490	1.490	3,862,080	0.990	2,566,080	0.490	1,270,080
	Dec	2.260	1.260	3,374,784	0.760	2,035,584	0.260	696,384
	AVG	2.632	1.632	4,271,328	1.132	2,957,328	0.632	1,643,328
1966	Jan	2.380	1.380	3,696,192	0.880	2,356,992	0.380	1,017,792
	Feb	2.450	1.450	3,507,840	0.950	2,298,240	0.450	1,088,640
	Mar	1.810	0.810	2,169,504	0.310	830,304	-0.190	-508,896
	Apr	1.510	0.510	1,321,920	0.010	25,920	-0.490	-1,270,080
	May	1.930	0.930	2,490,912	0.430	1,151,712	-0.070	-187,488
	Jun	2.280	1.280	3,317,760	0.780	2,021,760	0.280	725,760
	Jul	1.750	0.750	2,008,800	0.250	669,600	-0.250	-669,600
	Aug	1.320	0.320	857,088	-0.180	-482,112	-0.680	-1,821,312
	Sep	1.240	0.240	622,080	-0.260	-673,920	-0.760	-1,969,920
	Oct	1.150	0.150	401,760	-0.350	-937,440	-0.850	-2,276,640
	Nov	1.160	0.160	414,720	-0.340	-881,280	-0.840	-2,177,280
	Dec	1.060	0.060	160,704	-0.440	-1,178,496	-0.940	-2,517,696
	AVG	1.670	0.670	1,747,440	0.170	433,440	-0.330	-880,560

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1967	Jan	1.150	0.150	401,760	-0.350	-937,440	-0.850	-2,27
	Feb	3.400	2.400	5,806,080	1.900	4,596,480	1.400	3,38
	Mar	4.150	3.150	8,436,960	2.650	7,097,760	2.150	5,75
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,79
	Nov	1.060	0.060	155,520	-0.440	-1,140,480	-0.940	-2,43
	Dec	1.160	0.160	428,544	-0.340	-910,656	-0.840	-2,24
	AVG	1.900	0.900	2,341,678	0.400	1,027,678	-0.101	-28
1968	Jan	2.000	1.000	2,678,400	0.500	1,339,200	0.000	
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	5.500	4.500	12,052,800	4.000	10,713,600	3.500	9,37
	Apr	1.950	0.950	2,462,400	0.450	1,166,400	-0.050	-12
	May	0.970	-0.030	-80,352	-0.530	-1,419,552	-1.030	-2,75
	Jun	0.352	-0.648	-1,679,616	-1.148	-2,975,616	-1.648	-4,27
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,79
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,87
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,42
	AVG	2.065	1.065	2,764,555	0.565	1,450,555	0.065	13
1969	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.530	0.530	1,373,760	0.030	77,760	-0.470	-1,21
	Oct	1.240	0.240	642,816	-0.260	-696,384	-0.760	-2,03
	Nov	1.080	0.080	207,360	-0.420	-1,088,640	-0.920	-2,38
	Dec	1.390	0.390	1,044,576	-0.110	-294,624	-0.610	-1,63
	AVG	2.168	1.168	3,032,827	0.668	1,718,827	0.168	40

Appendix A, 2.6 (5) Water Development Potential at Tocontasi & Chapisca
<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s		Outflow = 1.50 m3/s		Outflow = 2.00 m3/s	
			Balance (m3/s)	Excess Q (m3/s*mon)	Balance (m3/s)	Excess Q (m3/s*mon)	Balance (m3/s)	Excess Q (m3/s*mon)
1970	Jan	2.420	1.420	3,803,328	0.920	2,464,128	0.420	1,124,928
	Feb	1.820	0.820	1,983,744	0.320	774,144	-0.180	-435,456
	Mar	2.160	1.160	3,106,944	0.660	1,767,744	0.160	428,544
	Apr	1.230	0.230	596,160	-0.270	-699,840	-0.770	-1,995,840
	May	1.350	0.350	937,440	-0.150	-401,760	-0.650	-1,740,960
	Jun	1.300	0.300	777,600	-0.200	-518,400	-0.700	-1,814,400
	Jul	1.550	0.550	1,473,120	0.050	133,920	-0.450	-1,205,280
	Aug	1.410	0.410	1,098,144	-0.090	-241,056	-0.590	-1,580,256
	Sep	1.200	0.200	518,400	-0.300	-777,600	-0.800	-2,073,600
	Oct	1.040	0.040	107,136	-0.460	-1,232,064	-0.960	-2,571,264
	Nov	0.903	-0.097	-251,424	-0.597	-1,547,424	-1.097	-2,843,424
	Dec	1.020	0.020	53,568	-0.480	-1,285,632	-0.980	-2,624,832
	AVG	1.450	0.450	1,183,680	-0.050	-130,320	-0.550	-1,444,320
1971	Jan	2.510	1.510	4,044,384	1.010	2,705,184	0.510	1,365,984
	Feb	5.090	4.090	9,894,528	3.590	8,684,928	3.090	7,475,328
	Mar	2.090	1.090	2,919,456	0.590	1,580,256	0.090	241,056
	Apr	1.420	0.420	1,088,640	-0.080	-207,360	-0.580	-1,503,360
	May	1.430	0.430	1,151,712	-0.070	-187,488	-0.570	-1,526,688
	Jun	1.570	0.570	1,477,440	0.070	181,440	-0.430	-1,114,560
	Jul	1.580	0.580	1,553,472	0.080	214,272	-0.420	-1,124,928
	Aug	1.470	0.470	1,258,848	-0.030	-80,352	-0.530	-1,419,552
	Sep	1.260	0.260	673,920	-0.240	-622,080	-0.740	-1,918,080
	Oct	1.080	0.080	214,272	-0.420	-1,124,928	-0.920	-2,464,128
	Nov	1.120	0.120	311,040	-0.380	-984,960	-0.880	-2,280,960
	Dec	1.100	0.100	267,840	-0.400	-1,071,360	-0.900	-2,410,560
	AVG	1.810	0.810	2,071,296	0.310	757,296	-0.190	-556,704
1972	Jan	9.790	8.790	23,543,136	8.290	22,203,936	7.790	20,864,736
	Feb	6.820	5.820	14,079,744	5.320	12,870,144	4.820	11,660,544
	Mar	7.760	6.760	18,105,984	6.260	16,766,784	5.760	15,427,584
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	2.790	1.790	4,794,336	1.290	3,455,136	0.790	2,115,936
	Jun	2.730	1.730	4,484,160	1.230	3,188,160	0.730	1,892,160
	Jul	2.340	1.340	3,589,056	0.840	2,249,856	0.340	910,656
	Aug	2.000	1.000	2,678,400	0.500	1,339,200	0.000	0
	Sep	1.850	0.850	2,203,200	0.350	907,200	-0.150	-388,800
	Oct	1.240	0.240	642,816	-0.260	-696,384	-0.760	-2,035,584
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,879,200
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,422,230
	AVG	3.485	2.485	6,505,193	1.985	5,191,193	1.485	3,877,193

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s		Outflow = 1.50 m3/s		Outflow = 2.00 m	
			Balance (m3/s)	Excess Q (m3/s*mon)	Balance (m3/s)	Excess Q (m3/s*mon)	Balance (m3/s)	Excess
1973	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,79
	Nov	1.110	0.110	285,120	-0.390	-1,010,880	-0.890	-2,30
	Dec	1.010	0.010	26,784	-0.490	-1,312,416	-0.990	-2,65
	AVG	2.148	1.148	2,978,683	0.648	1,664,683	0.148	35
1974	Jan	4.920	3.920	10,499,328	3.420	9,160,128	2.920	7,82
	Feb	3.000	2.000	4,838,400	1.500	3,628,800	1.000	2,41
	Mar	4.760	3.760	10,070,784	3.260	8,731,584	2.760	7,39
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.730	0.730	1,955,232	0.230	616,032	-0.270	-72
	Jun	1.810	0.810	2,099,520	0.310	803,520	-0.190	-49
	Jul	1.960	0.960	2,571,264	0.460	1,232,064	-0.040	-10
	Aug	2.930	1.930	5,169,312	1.430	3,830,112	0.930	2,49
	Sep	1.360	0.360	933,120	-0.140	-362,880	-0.640	-1,65
	Oct	1.260	0.260	696,384	-0.240	-642,816	-0.740	-1,98
	Nov	1.120	0.120	311,040	-0.380	-984,960	-0.880	-2,28
	Dec	0.988	-0.012	-32,141	-0.512	-1,371,341	-1.012	-2,71
	AVG	2.300	1.300	3,423,730	0.800	2,109,730	0.300	79
1975	Jan	2.300	1.300	3,481,920	0.800	2,142,720	0.300	80
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.710	0.710	1,901,664	0.210	562,464	-0.290	-77
	Jun	1.970	0.970	2,514,240	0.470	1,218,240	-0.030	-7
	Jul	2.150	1.150	3,080,160	0.650	1,740,960	0.150	40
	Aug	1.740	0.740	1,982,016	0.240	642,816	-0.260	-69
	Sep	1.470	0.470	1,218,240	-0.030	-77,760	-0.530	-1,37
	Oct	1.320	0.320	857,088	-0.180	-482,112	-0.680	-1,82
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,87
	Dec	2.520	1.520	4,071,168	1.020	2,731,968	0.520	1,39
	AVG	2.260	1.260	3,277,346	0.760	1,963,346	0.260	64

Appendix A, 2.6 (6) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1976	Jan	2.550	1.550	4,151,520	1.050	2,812,320	0.550	1,473,120
	Feb	7.140	6.140	14,853,888	5.640	13,644,288	5.140	12,434,688
	Mar	11.800	10.800	28,926,720	10.300	27,587,520	9.800	26,248,320
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	2.010	1.010	2,705,184	0.510	1,365,984	0.010	26,784
	Jun	1.990	0.990	2,566,080	0.490	1,270,080	-0.010	-25,920
	Jul	1.900	0.900	2,410,560	0.400	1,071,360	-0.100	-267,840
	Aug	1.800	0.800	2,142,720	0.300	803,520	-0.200	-535,680
	Sep	2.000	1.000	2,592,000	0.500	1,296,000	0.000	0
	Oct	1.340	0.340	910,656	-0.160	-428,544	-0.660	-1,767,744
	Nov	1.030	0.030	77,760	-0.470	-1,218,240	-0.970	-2,514,240
	Dec	1.050	0.050	133,920	-0.450	-1,205,280	-0.950	-2,544,480
	AVG	3.031	2.031	5,286,960	1.531	3,972,960	1.031	2,658,960
1977	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,346,278
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.820	3.820	10,231,488	3.320	8,892,288	2.820	7,553,088
	Apr	2.360	1.360	3,525,120	0.860	2,229,120	0.360	933,120
	May	2.420	1.420	3,803,328	0.920	2,464,128	0.420	1,124,928
	Jun	2.580	1.580	4,095,360	1.080	2,799,360	0.580	1,503,360
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-174,096
	Aug	2.000	1.000	2,678,400	0.500	1,339,200	0.000	0
	Sep	1.670	0.670	1,736,640	0.170	440,640	-0.330	-855,360
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,794,528
	Nov	1.180	0.180	466,560	-0.320	-829,440	-0.820	-2,125,440
	Dec	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,794,528
	AVG	2.436	1.436	3,737,498	0.936	2,423,498	0.436	1,109,498
1978	Jan	3.660	2.660	7,124,544	2.160	5,785,344	1.660	4,446,144
	Feb	2.600	1.600	3,870,720	1.100	2,661,120	0.600	1,451,520
	Mar	1.340	0.340	910,656	-0.160	-428,544	-0.660	-1,767,744
	Apr	1.500	0.500	1,296,000	0.000	0	-0.500	-1,296,000
	May	1.540	0.540	1,446,336	0.040	107,136	-0.460	-1,232,064
	Jun	1.520	0.520	1,347,840	0.020	51,840	-0.480	-1,244,160
	Jul	1.800	0.800	2,142,720	0.300	803,520	-0.200	-535,680
	Aug	1.620	0.620	1,660,608	0.120	321,408	-0.380	-1,017,792
	Sep	1.330	0.330	855,360	-0.170	-440,640	-0.670	-1,736,640
	Oct	1.120	0.120	321,408	-0.380	-1,017,792	-0.880	-2,356,992
	Nov	1.320	0.320	829,440	-0.180	-466,560	-0.680	-1,762,560
	Dec	1.210	0.210	562,464	-0.290	-776,736	-0.790	-2,115,936
	AVG	1.713	0.713	1,864,008	0.213	550,008	-0.287	-763,992

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1979	Jan	2.560	1.560	4,178,304	1.060	2,839,104	0.560	1,49
	Feb	1.110	0.110	266,112	-0.390	-943,488	-0.890	-2,15
	Mar	3.400	2.400	6,428,160	1.900	5,088,960	1.400	3,74
	Apr	1.460	0.460	1,192,320	-0.040	-103,680	-0.540	-1,39
	May	1.590	0.590	1,580,256	0.090	241,056	-0.410	-1,09
	Jun	1.790	0.790	2,047,680	0.290	751,680	-0.210	-54
	Jul	1.830	0.830	2,223,072	0.330	883,872	-0.170	-45
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.740	0.740	1,918,080	0.240	622,080	-0.260	-67
	Oct	1.720	0.720	1,928,448	0.220	589,248	-0.280	-74
	Nov	1.360	0.360	933,120	-0.140	-362,880	-0.640	-1,65
	Dec	1.180	0.180	482,112	-0.320	-857,088	-0.820	-2,19
	AVG	1.789	0.789	2,093,515	0.289	779,515	-0.211	-53
1980	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.530	0.530	1,373,760	0.030	77,760	-0.470	-1,21
	Jul	1.690	0.690	1,848,096	0.190	508,896	-0.310	-83
	Aug	1.680	0.680	1,821,312	0.180	482,112	-0.320	-85
	Sep	1.380	0.380	984,960	-0.120	-311,040	-0.620	-1,60
	Oct	1.170	0.170	455,328	-0.330	-883,872	-0.830	-2,22
	Nov	1.040	0.040	103,680	-0.460	-1,192,320	-0.960	-2,48
	Dec	0.939	-0.061	-163,382	-0.561	-1,502,582	-1.061	-2,84
	AVG	2.061	1.061	2,749,853	0.561	1,435,853	0.061	12
1981	Jan	1.660	0.660	1,767,744	0.160	428,544	-0.340	-91
	Feb	9.410	8.410	20,345,472	7.910	19,135,872	7.410	17,92
	Mar	8.590	7.590	20,329,056	7.090	18,989,856	6.590	17,65
	Apr	1.560	0.560	1,451,520	0.060	155,520	-0.440	-1,14
	May	1.630	0.630	1,687,392	0.130	348,192	-0.370	-99
	Jun	1.840	0.840	2,177,280	0.340	881,280	-0.160	-41
	Jul	1.920	0.920	2,464,128	0.420	1,124,928	-0.080	-21
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.580	0.580	1,503,360	0.080	207,360	-0.420	-1,08
	Oct	1.250	0.250	669,600	-0.250	-669,600	-0.750	-2,00
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,87
	Dec	1.000	0.000	0	-0.500	-1,339,200	-1.000	-2,67
	AVG	2.787	1.787	4,587,739	1.287	3,273,739	0.787	1,95

Appendix A, 2.6 (7) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1982	Jan	1.620	0.620	1,660,608	0.120	321,408	-0.380	-1,017,792
	Feb	2.090	1.090	2,636,928	0.590	1,427,328	0.090	217,728
	Mar	1.320	0.320	857,088	-0.180	-482,112	-0.680	-1,821,312
	Apr	1.440	0.440	1,140,480	-0.060	-155,520	-0.560	-1,451,520
	May	1.570	0.570	1,526,688	0.070	187,488	-0.430	-1,151,712
	Jun	1.600	0.600	1,555,200	0.100	259,200	-0.400	-1,036,800
	Jul	1.590	0.590	1,580,256	0.090	241,056	-0.410	-1,098,144
	Aug	0.558	-0.442	-1,183,853	-0.942	-2,523,053	-1.442	-3,862,253
	Sep	0.551	-0.449	-1,163,808	-0.949	-2,459,808	-1.449	-3,755,808
	Oct	0.524	-0.476	-1,274,918	-0.976	-2,614,118	-1.476	-3,953,318
	Nov	0.931	-0.069	-178,848	-0.569	-1,474,848	-1.069	-2,770,848
	Dec	1.650	0.650	1,740,960	0.150	401,760	-0.350	-937,440
	AVG	1.287	0.287	741,398	-0.213	-572,602	-0.713	-1,886,602
1983	Jan	0.980	-0.020	-53,568	-0.520	-1,392,768	-1.020	-2,731,968
	Feb	0.950	-0.050	-120,960	-0.550	-1,330,560	-1.050	-2,540,160
	Mar	1.210	0.210	562,464	-0.290	-776,736	-0.790	-2,115,936
	Apr	1.100	0.100	259,200	-0.400	-1,036,800	-0.900	-2,332,800
	May	1.200	0.200	535,680	-0.300	-803,520	-0.800	-2,142,720
	Jun	1.330	0.330	855,360	-0.170	-440,640	-0.670	-1,736,640
	Jul	1.420	0.420	1,124,928	-0.080	-214,272	-0.580	-1,553,472
	Aug	1.340	0.340	910,656	-0.160	-428,544	-0.660	-1,767,744
	Sep	1.320	0.320	829,440	-0.180	-466,560	-0.680	-1,762,560
	Oct	1.170	0.170	455,328	-0.330	-883,872	-0.830	-2,223,072
	Nov	1.030	0.030	77,760	-0.470	-1,218,240	-0.970	-2,514,240
	Dec	1.090	0.090	241,056	-0.410	-1,098,144	-0.910	-2,437,344
	AVG	1.178	0.178	473,112	-0.322	-840,888	-0.822	-2,154,888
1984	Jan	2.230	1.230	3,294,432	0.730	1,955,232	0.230	616,032
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,597,158
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.560	0.560	1,499,904	0.060	160,704	-0.440	-1,178,496
	Jun	1.670	0.670	1,736,640	0.170	440,640	-0.330	-855,360
	Jul	1.640	0.640	1,714,176	0.140	374,976	-0.360	-964,224
	Aug	1.610	0.610	1,633,824	0.110	294,624	-0.390	-1,044,576
	Sep	1.350	0.350	907,200	-0.150	-388,800	-0.650	-1,684,800
	Oct	1.260	0.260	696,384	-0.240	-642,816	-0.740	-1,982,016
	Nov	1.620	0.620	1,607,040	0.120	311,040	-0.380	-984,960
	Dec	1.240	0.240	642,816	-0.260	-696,384	-0.760	-2,035,584
	AVG	2.071	1.071	2,770,106	0.571	1,456,106	0.071	142,106

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*m
1985	Jan	1.470	0.470	1,258,848	-0.030	-80,352	-0.530	-1,41
	Feb	5.110	4.110	9,942,912	3.610	8,733,312	3.110	7,52
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.790	0.790	2,115,936	0.290	776,736	-0.210	-56
	Aug	1.660	0.660	1,767,744	0.160	428,544	-0.340	-91
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,79
	Nov	1.480	0.480	1,244,160	-0.020	-51,840	-0.520	-1,34
	Dec	2.150	1.150	3,080,160	0.650	1,740,960	0.150	40
	AVG	2.171	1.171	3,029,350	0.671	1,715,350	0.171	40
1986	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.549	0.549	1,423,008	0.049	127,008	-0.451	-1,16
	Oct	1.330	0.330	883,872	-0.170	-455,328	-0.670	-1,79
	Nov	1.275	0.275	712,800	-0.225	-583,200	-0.725	-1,87
	Dec	1.469	0.469	1,256,170	-0.031	-83,030	-0.531	-1,42
	AVG	2.200	1.200	3,116,772	0.700	1,802,772	0.200	48
1987	Jan	2.876	1.876	5,024,678	1.376	3,685,478	0.876	2,34
	Feb	4.727	3.727	9,016,358	3.227	7,806,758	2.727	6,59
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,84
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-61
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-63
	Jun	1.811	0.811	2,102,112	0.311	806,112	-0.189	-48
	Jul	1.935	0.935	2,504,304	0.435	1,165,104	-0.065	-17
	Aug	1.726	0.726	1,944,518	0.226	605,318	-0.274	-73
	Sep	1.570	0.570	1,477,440	0.070	181,440	-0.430	-1,11
	Oct	1.340	0.340	910,656	-0.160	-428,544	-0.660	-1,76
	Nov	1.210	0.210	544,320	-0.290	-751,680	-0.790	-2,04
	Dec	1.060	0.060	160,704	-0.440	-1,178,496	-0.940	-2,51
	AVG	2.163	1.163	3,018,211	0.663	1,704,211	0.163	39

Appendix A, 2.6 (8) Water Development Potential at Tocontasi & Chapisca

<Desarrollo Potencial de Agua en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m3/s Balance (m3/s)	Outflow = 2.00 m3/s Excess Q (m3/s*mon)
1988	Jan	3.350	2.350	6,294,240	1.850	4,955,040	1.350	3,615,840
	Feb	13.200	12.200	29,514,240	11.700	28,304,640	11.200	27,095,040
	Mar	2.610	1.610	4,312,224	1.110	2,973,024	0.610	1,633,824
	Apr	1.920	0.920	2,384,640	0.420	1,088,640	-0.080	-207,360
	May	1.500	0.500	1,339,200	0.000	0	-0.500	-1,339,200
	Jun	1.590	0.590	1,529,280	0.090	233,280	-0.410	-1,062,720
	Jul	1.660	0.660	1,767,744	0.160	428,544	-0.340	-910,656
	Aug	1.520	0.520	1,392,768	0.020	53,568	-0.480	-1,285,632
	Sep	1.480	0.480	1,244,160	-0.020	-51,840	-0.520	-1,347,840
	Oct	1.380	0.380	1,017,792	-0.120	-321,408	-0.620	-1,660,608
	Nov	1.310	0.310	803,520	-0.190	-492,480	-0.690	-1,788,480
	Dec	1.510	0.510	1,365,984	0.010	26,784	-0.490	-1,312,416
	AVG	2.753	1.753	4,413,816	1.253	3,099,816	0.753	1,785,816
1989	Jan	2.230	1.230	3,294,432	0.730	1,955,232	0.230	616,032
	Feb	3.660	2.660	6,435,072	2.160	5,225,472	1.660	4,015,872
	Mar	4.181	3.181	8,519,990	2.681	7,180,790	2.181	5,841,590
	Apr	1.761	0.761	1,972,512	0.261	676,512	-0.239	-619,488
	May	1.762	0.762	2,040,941	0.262	701,741	-0.238	-637,459
	Jun	1.150	0.150	388,800	-0.350	-907,200	-0.850	-2,203,200
	Jul	1.150	0.150	401,760	-0.350	-937,440	-0.850	-2,276,640
	Aug	1.100	0.100	267,840	-0.400	-1,071,360	-0.900	-2,410,560
	Sep	1.040	0.040	103,680	-0.460	-1,192,320	-0.960	-2,488,320
	Oct	0.967	-0.033	-88,387	-0.533	-1,427,587	-1.033	-2,766,787
	Nov	0.975	-0.025	-64,800	-0.525	-1,360,800	-1.025	-2,656,800
	Dec	1.010	0.010	26,784	-0.490	-1,312,416	-0.990	-2,651,616
	AVG	1.749	0.749	1,941,552	0.249	627,552	-0.251	-686,448

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.00 m3/s Balance (m3/s)	Outflow = 1.00 m3/s Excess Q (m3/s*mon)	Outflow = 1.50 m3/s Balance (m3/s)	Outflow = 1.50 m3/s Excess Q (m3/s*mon)	Outflow = 2.00 m Balance (m3/s)	Outflow = 2.00 m Excess (m3/s*mo
1990	Jan	1.190	0.190	508,896	-0.310	-830,304	-0.810	-2,16
	Feb	1.320	0.320	774,144	-0.180	-435,456	-0.680	-1,64
	Mar	1.280	0.280	749,952	-0.220	-589,248	-0.720	-1,92
	Apr	1.420	0.420	1,088,640	-0.080	-207,360	-0.580	-1,50
	May	1.480	0.480	1,285,632	-0.020	-53,568	-0.520	-1,39
	Jun	1.850	0.850	2,203,200	0.350	907,200	-0.150	-38
	Jul	1.700	0.700	1,874,880	0.200	535,680	-0.300	-80
	Aug	1.560	0.560	1,499,904	0.060	160,704	-0.440	-1,17
	Sep	1.670	0.670	1,736,640	0.170	440,640	-0.330	-85
	Oct	1.220	0.220	589,248	-0.280	-749,952	-0.780	-2,08
	Nov	1.030	0.030	77,760	-0.470	-1,218,240	-0.970	-2,51
	Dec	1.470	0.470	1,258,848	-0.030	-80,352	-0.530	-1,41
	AVG	1.433	0.433	1,137,312	-0.068	-176,688	-0.568	-1,49

Appendix 2.7 (1) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1946	Jan	2.876	0.876	2,346,278	2,346,278
	Feb	4.727	2.727	6,597,158	8,943,437
	Mar	4.181	2.181	5,841,590	14,785,027
	Apr	1.761	-0.239	-619,488	14,165,539
	May	1.762	-0.238	-637,459	13,528,080
	Jun	1.811	-0.189	-489,888	13,038,192
	Jul	1.470	-0.530	-1,419,552	11,618,640
	Aug	1.470	-0.530	-1,419,552	10,199,088
	Sep	1.250	-0.750	-1,944,000	8,255,088
	Oct	1.270	-0.730	-1,955,232	6,299,856
	Nov	1.230	-0.770	-1,995,840	4,304,016
	Dec	1.380	-0.620	-1,660,608	2,643,408
1947	Jan	2.110	0.110	294,624	2,938,032
	Feb	1.450	-0.550	-1,330,560	1,607,472
	Mar	1.220	-0.780	-2,089,152	-481,680
	Apr	1.380	-0.620	-1,607,040	-2,088,720
	May	1.450	-0.550	-1,473,120	-3,561,840
	Jun	1.390	-0.610	-1,581,120	-5,142,960
	Jul	1.570	-0.430	-1,151,712	-6,294,672
	Aug	1.280	-0.720	-1,928,448	-8,223,120
	Sep	1.210	-0.790	-2,047,680	-10,270,800
	Oct	1.190	-0.810	-2,169,504	-12,440,304
	Nov	1.090	-0.910	-2,358,720	-14,799,024
	Dec	2.220	0.220	589,248	-14,209,776
1948	Jan	1.880	-0.120	-321,408	-14,531,184
	Feb	3.920	1.920	4,644,864	-9,886,320
	Mar	5.630	3.630	9,722,592	-163,728
	Apr	1.940	-0.060	-155,520	-319,248
	May	1.940	-0.060	-160,704	-479,952
	Jun	1.890	-0.110	-285,120	-765,072
	Jul	1.940	-0.060	-160,704	-925,776
	Aug	1.770	-0.230	-616,032	-1,541,808
	Sep	1.490	-0.510	-1,321,920	-2,863,728
	Oct	1.370	-0.630	-1,687,392	-4,551,120
	Nov	1.330	-0.670	-1,736,640	-6,287,760
	Dec	1.820	-0.180	-482,112	-6,769,872

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1949	Jan	9.160	7.160	19,177,344	12,407,472
	Feb	8.780	6.780	16,402,176	28,809,648
	Mar	8.350	6.350	17,007,840	45,817,488
	Apr	3.640	1.640	4,250,880	50,068,368
	May	2.570	0.570	1,526,688	51,595,056
	Jun	2.680	0.680	1,762,560	53,357,616
	Jul	2.400	0.400	1,071,360	54,428,976
	Aug	1.726	-0.274	-733,882	53,695,094
	Sep	1.549	-0.451	-1,168,992	52,526,102
	Oct	1.370	-0.630	-1,687,392	50,838,710
	Nov	1.190	-0.810	-2,099,520	48,739,190
	Dec	1.350	-0.650	-1,740,960	46,998,230
1950	Jan	1.600	-0.400	-1,071,360	45,926,870
	Feb	1.710	-0.290	-701,568	45,225,302
	Mar	2.340	0.340	910,656	46,135,958
	Apr	1.730	-0.270	-699,840	45,436,118
	May	1.820	-0.180	-482,112	44,954,006
	Jun	1.830	-0.170	-440,640	44,513,366
	Jul	1.935	-0.065	-174,096	44,339,270
	Aug	1.730	-0.270	-723,168	43,616,102
	Sep	1.570	-0.430	-1,114,560	42,501,542
	Oct	1.380	-0.620	-1,660,608	40,840,934
	Nov	1.170	-0.830	-2,151,360	38,689,574
	Dec	1.430	-0.570	-1,526,688	37,162,886
1951	Jan	2.210	0.210	562,464	37,725,350
	Feb	2.850	0.850	2,056,320	39,781,670
	Mar	2.700	0.700	1,874,880	41,656,550
	Apr	1.580	-0.420	-1,088,640	40,567,910
	May	1.610	-0.390	-1,044,576	39,523,334
	Jun	1.630	-0.370	-959,040	38,564,294
	Jul	1.730	-0.270	-723,168	37,841,126
	Aug	1.690	-0.310	-830,304	37,010,822
	Sep	1.600	-0.400	-1,036,800	35,974,022
	Oct	1.280	-0.720	-1,928,448	34,045,574
	Nov	1.250	-0.750	-1,944,000	32,101,574
	Dec	1.230	-0.770	-2,062,368	30,039,206

Appendix 2.7 (2) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1952	Jan	6.360	4.360	11,677,824	41,717,030
	Feb	6.590	4.590	11,104,128	52,821,158
	Mar	3.680	1.680	4,499,712	57,320,870
	Apr	2.420	0.420	1,088,640	58,409,510
	May	2.140	0.140	374,976	58,784,486
	Jun	2.390	0.390	1,010,880	59,795,366
	Jul	3.410	1.410	3,776,544	63,571,910
	Aug	2.390	0.390	1,044,576	64,616,486
	Sep	2.260	0.260	673,920	65,290,406
	Oct	1.760	-0.240	-642,816	64,647,590
	Nov	1.600	-0.400	-1,036,800	63,610,790
	Dec	1.790	-0.210	-562,464	63,048,326
1953	Jan	4.050	2.050	5,490,720	68,539,046
	Feb	11.900	9.900	23,950,080	92,489,126
	Mar	12.800	10.800	28,926,720	121,415,846
	Apr	1.761	-0.239	-619,488	120,796,358
	May	1.762	-0.238	-637,459	120,158,899
	Jun	1.811	-0.189	-489,888	119,669,011
	Jul	1.935	-0.065	-174,096	119,494,915
	Aug	1.726	-0.274	-733,882	118,761,034
	Sep	1.600	-0.400	-1,036,800	117,724,234
	Oct	1.540	-0.460	-1,232,064	116,492,170
	Nov	1.790	-0.210	-544,320	115,947,850
	Dec	2.120	0.120	321,408	116,269,258
1954	Jan	2.930	0.930	2,490,912	118,760,170
	Feb	12.100	10.100	24,433,920	143,194,090
	Mar	4.181	2.181	5,841,590	149,035,680
	Apr	1.761	-0.239	-619,488	148,416,192
	May	1.762	-0.238	-637,459	147,778,733
	Jun	1.811	-0.189	-489,888	147,288,845
	Jul	1.935	-0.065	-174,096	147,114,749
	Aug	1.726	-0.274	-733,882	146,380,867
	Sep	1.549	-0.451	-1,168,992	145,211,875
	Oct	1.330	-0.670	-1,794,528	143,417,347
	Nov	1.275	-0.725	-1,879,200	141,538,147
	Dec	1.469	-0.531	-1,422,230	140,115,917

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1955	Jan	2.876	0.876	2,346,278	142,462,195
	Feb	4.727	2.727	6,597,158	149,059,354
	Mar	4.181	2.181	5,841,590	154,900,944
	Apr	1.761	-0.239	-619,488	154,281,456
	May	1.762	-0.238	-637,459	153,643,997
	Jun	1.811	-0.189	-489,888	153,154,109
	Jul	1.935	-0.065	-174,096	152,980,013
	Aug	1.726	-0.274	-733,882	152,246,131
	Sep	1.549	-0.451	-1,168,992	151,077,139
	Oct	1.380	-0.620	-1,660,608	149,416,531
	Nov	1.320	-0.680	-1,762,560	147,653,971
	Dec	2.010	0.010	26,784	147,680,755
1956	Jan	2.050	0.050	133,920	147,814,675
	Feb	3.920	1.920	4,644,864	152,459,539
	Mar	1.920	-0.080	-214,272	152,245,267
	Apr	1.570	-0.430	-1,114,560	151,130,707
	May	1.762	-0.238	-637,459	150,493,248
	Jun	1.811	-0.189	-489,888	150,003,360
	Jul	1.790	-0.210	-562,464	149,440,896
	Aug	1.690	-0.310	-830,304	148,610,592
	Sep	1.570	-0.430	-1,114,560	147,496,032
	Oct	1.390	-0.610	-1,633,824	145,862,208
	Nov	1.320	-0.680	-1,762,560	144,099,648
	Dec	1.110	-0.890	-2,383,776	141,715,872
1957	Jan	1.190	-0.810	-2,169,504	139,546,368
	Feb	2.790	0.790	1,911,168	141,457,536
	Mar	4.181	2.181	5,841,590	147,299,126
	Apr	1.761	-0.239	-619,488	146,679,638
	May	1.762	-0.238	-637,459	146,042,179
	Jun	1.860	-0.140	-362,880	145,679,299
	Jul	1.650	-0.350	-937,440	144,741,859
	Aug	1.680	-0.320	-857,088	143,884,771
	Sep	1.420	-0.580	-1,503,360	142,381,411
	Oct	1.190	-0.810	-2,169,504	140,211,907
	Nov	1.200	-0.800	-2,073,600	138,138,307
	Dec	2.710	0.710	1,901,664	140,039,971

Appendix 2.7 (3) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1958	Jan	3.270	1.270	3,401,568	143,441,539
	Feb	4.727	2.727	6,597,158	150,038,698
	Mar	4.181	2.181	5,841,590	155,880,288
	Apr	1.761	-0.239	-619,488	155,260,800
	May	2.400	0.400	1,071,360	156,332,160
	Jun	2.550	0.550	1,425,600	157,757,760
	Jul	2.520	0.520	1,392,768	159,150,528
	Aug	2.100	0.100	267,840	159,418,368
	Sep	2.020	0.020	51,840	159,470,208
	Oct	1.820	-0.180	-482,112	158,988,096
	Nov	1.350	-0.650	-1,684,800	157,303,296
	Dec	1.250	-0.750	-2,008,800	155,294,496
1959	Jan	1.290	-0.710	-1,901,664	153,392,832
	Feb	4.727	2.727	6,597,158	159,989,990
	Mar	4.181	2.181	5,841,590	165,831,581
	Apr	1.761	-0.239	-619,488	165,212,093
	May	1.762	-0.238	-637,459	164,574,634
	Jun	1.811	-0.189	-489,888	164,084,746
	Jul	1.935	-0.065	-174,096	163,910,650
	Aug	1.726	-0.274	-733,882	163,176,768
	Sep	1.549	-0.451	-1,168,992	162,007,776
	Oct	1.330	-0.670	-1,794,528	160,213,248
	Nov	1.275	-0.725	-1,879,200	158,334,048
	Dec	1.469	-0.531	-1,422,230	156,911,818
1960	Jan	2.876	0.876	2,346,278	159,258,096
	Feb	4.727	2.727	6,597,158	165,855,254
	Mar	4.181	2.181	5,841,590	171,696,845
	Apr	1.761	-0.239	-619,488	171,077,357
	May	1.762	-0.238	-637,459	170,439,898
	Jun	1.811	-0.189	-489,888	169,950,010
	Jul	1.935	-0.065	-174,096	169,775,914
	Aug	1.726	-0.274	-733,882	169,042,032
	Sep	1.549	-0.451	-1,168,992	167,873,040
	Oct	1.330	-0.670	-1,794,528	166,078,512
	Nov	1.275	-0.725	-1,879,200	164,199,312
	Dec	1.469	-0.531	-1,422,230	162,777,082
1961	Jan	2.876	0.876	2,346,278	165,123,360
	Feb	4.727	2.727	6,597,158	171,720,518
	Mar	4.181	2.181	5,841,590	177,562,109
	Apr	1.761	-0.239	-619,488	176,942,621
	May	1.762	-0.238	-637,459	176,305,162
	Jun	1.811	-0.189	-489,888	175,815,274
	Jul	1.935	-0.065	-174,096	175,641,178
	Aug	1.760	-0.240	-642,816	174,998,362
	Sep	1.390	-0.610	-1,581,120	173,417,242
	Oct	1.100	-0.900	-2,410,560	171,006,682
	Nov	1.275	-0.725	-1,879,200	169,127,482
	Dec	1.469	-0.531	-1,422,230	167,705,251
1962	Jan	3.700	1.700	4,553,280	172,258,531
	Feb	3.560	1.560	3,773,952	176,032,483
	Mar	4.181	2.181	5,841,590	181,874,074
	Apr	1.761	-0.239	-619,488	181,254,586
	May	1.820	-0.180	-482,112	180,772,474
	Jun	2.060	0.060	155,520	180,927,994
	Jul	1.980	-0.020	-53,568	180,874,426
	Aug	1.980	-0.020	-53,568	180,820,858
	Sep	1.650	-0.350	-907,200	179,913,658
	Oct	1.200	-0.800	-2,142,720	177,770,938
	Nov	1.450	-0.550	-1,425,600	176,345,338
	Dec	1.530	-0.470	-1,258,848	175,086,490
1963	Jan	2.020	0.020	53,568	175,140,058
	Feb	7.470	5.470	13,233,024	188,373,082
	Mar	4.790	2.790	7,472,736	195,845,818
	Apr	2.030	0.030	77,760	195,923,578
	May	2.650	0.650	1,740,960	197,664,538
	Jun	2.370	0.370	959,040	198,623,578
	Jul	2.350	0.350	937,440	199,561,018
	Aug	2.200	0.200	535,680	200,096,698
	Sep	2.020	0.020	51,840	200,148,538
	Oct	1.690	-0.310	-830,304	199,318,234
	Nov	1.640	-0.360	-933,120	198,385,114
	Dec	1.469	-0.531	-1,422,230	196,962,883

Appendix 2.7 (4) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1964	Jan	2.876	0.876	2,346,278	199,309,162
	Feb	1.750	-0.250	-604,800	198,704,362
	Mar	1.850	-0.150	-401,760	198,302,602
	Apr	1.290	-0.710	-1,840,320	196,462,282
	May	1.660	-0.340	-910,656	195,551,626
	Jun	1.850	-0.150	-388,800	195,162,826
	Jul	1.935	-0.065	-174,096	194,988,730
	Aug	2.150	0.150	401,760	195,390,490
	Sep	2.080	0.080	207,360	195,597,850
	Oct	1.700	-0.300	-803,520	194,794,330
	Nov	1.390	-0.610	-1,581,120	193,213,210
	Dec	1.970	-0.030	-80,352	193,132,858
1965	Jan	3.340	1.340	3,589,056	196,721,914
	Feb	4.220	2.220	5,370,624	202,092,538
	Mar	4.110	2.110	5,651,424	207,743,962
	Apr	2.250	0.250	648,000	208,391,962
	May	1.110	-0.890	-2,383,776	206,008,186
	Jun	1.030	-0.970	-2,514,240	203,493,946
	Jul	3.610	1.610	4,312,224	207,806,170
	Aug	2.330	0.330	883,872	208,690,042
	Sep	2.310	0.310	803,520	209,493,562
	Oct	2.520	0.520	1,392,768	210,886,330
	Nov	2.490	0.490	1,270,080	212,156,410
	Dec	2.260	0.260	696,384	212,852,794
1966	Jan	2.380	0.380	1,017,792	213,870,586
	Feb	2.450	0.450	1,088,640	214,959,226
	Mar	1.810	-0.190	-508,896	214,450,330
	Apr	1.510	-0.490	-1,270,080	213,180,250
	May	1.930	-0.070	-187,488	212,992,762
	Jun	2.280	0.280	725,760	213,718,522
	Jul	1.750	-0.250	-669,600	213,048,922
	Aug	1.320	-0.680	-1,821,312	211,227,610
	Sep	1.240	-0.760	-1,969,920	209,257,690
	Oct	1.150	-0.850	-2,276,640	206,981,050
	Nov	1.160	-0.840	-2,177,280	204,803,770
	Dec	1.060	-0.940	-2,517,696	202,286,074

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1967	Jan	1.150	-0.850	-2,276,640	200,009,434
	Feb	3.400	1.400	3,386,880	203,396,314
	Mar	4.150	2.150	5,758,560	209,154,874
	Apr	1.761	-0.239	-619,488	208,535,386
	May	1.762	-0.238	-637,459	207,897,926
	Jun	1.811	-0.189	-489,888	207,408,038
	Jul	1.935	-0.065	-174,096	207,233,942
	Aug	1.726	-0.274	-733,882	206,500,061
	Sep	1.549	-0.451	-1,168,992	205,331,069
	Oct	1.330	-0.670	-1,794,528	203,536,541
	Nov	1.060	-0.940	-2,436,480	201,100,061
	Dec	1.160	-0.840	-2,249,856	198,850,205
1968	Jan	2.000	0.000	0	198,850,205
	Feb	4.727	2.727	6,597,158	205,447,363
	Mar	5.500	3.500	9,374,400	214,821,763
	Apr	1.950	-0.050	-129,600	214,692,163
	May	0.970	-1.030	-2,758,752	211,933,411
	Jun	0.352	-1.648	-4,271,616	207,661,795
	Jul	1.935	-0.065	-174,096	207,487,699
	Aug	1.726	-0.274	-733,882	206,753,818
	Sep	1.549	-0.451	-1,168,992	205,584,826
	Oct	1.330	-0.670	-1,794,528	203,790,298
	Nov	1.275	-0.725	-1,879,200	201,911,098
	Dec	1.469	-0.531	-1,422,230	200,488,867
1969	Jan	2.876	0.876	2,346,278	202,835,146
	Feb	4.727	2.727	6,597,158	209,432,304
	Mar	4.181	2.181	5,841,590	215,273,894
	Apr	1.761	-0.239	-619,488	214,654,406
	May	1.762	-0.238	-637,459	214,016,947
	Jun	1.811	-0.189	-489,888	213,527,059
	Jul	1.935	-0.065	-174,096	213,352,963
	Aug	1.726	-0.274	-733,882	212,619,082
	Sep	1.530	-0.470	-1,218,240	211,400,842
	Oct	1.240	-0.760	-2,035,584	209,365,258
	Nov	1.080	-0.920	-2,384,640	206,980,618
	Dec	1.390	-0.610	-1,633,824	205,346,794

Appendix 2.7 (5) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1970	Jan	2.420	0.420	1,124,928	206,471,722
	Feb	1.820	-0.180	-435,456	206,036,266
	Mar	2.160	0.160	428,544	206,464,810
	Apr	1.230	-0.770	-1,995,840	204,468,970
	May	1.350	-0.650	-1,740,960	202,728,010
	Jun	1.300	-0.700	-1,814,400	200,913,610
	Jul	1.550	-0.450	-1,205,280	199,708,330
	Aug	1.410	-0.590	-1,580,256	198,128,074
	Sep	1.200	-0.800	-2,073,600	196,054,474
	Oct	1.040	-0.960	-2,571,264	193,483,210
	Nov	0.903	-1.097	-2,843,424	190,639,786
	Dec	1.020	-0.980	-2,624,832	188,014,954
1971	Jan	2.510	0.510	1,365,984	189,380,938
	Feb	5.090	3.090	7,475,328	196,856,266
	Mar	2.090	0.090	241,056	197,097,322
	Apr	1.420	-0.580	-1,503,360	195,593,962
	May	1.430	-0.570	-1,526,688	194,067,274
	Jun	1.570	-0.430	-1,114,560	192,952,714
	Jul	1.580	-0.420	-1,124,928	191,827,786
	Aug	1.470	-0.530	-1,419,552	190,408,234
	Sep	1.260	-0.740	-1,918,080	188,490,154
	Oct	1.080	-0.920	-2,464,128	186,026,026
	Nov	1.120	-0.880	-2,280,960	183,745,066
	Dec	1.100	-0.900	-2,410,560	181,334,506
1972	Jan	9.790	7.790	20,864,736	202,199,242
	Feb	6.820	4.820	11,660,544	213,859,786
	Mar	7.760	5.760	15,427,584	229,287,370
	Apr	1.761	-0.239	-619,488	228,667,882
	May	2.790	0.790	2,115,936	230,783,818
	Jun	2.730	0.730	1,892,160	232,675,978
	Jul	2.340	0.340	910,656	233,586,634
	Aug	2.000	0.000	0	233,586,634
	Sep	1.850	-0.150	-388,800	233,197,834
	Oct	1.240	-0.760	-2,035,584	231,162,250
	Nov	1.275	-0.725	-1,879,200	229,283,050
	Dec	1.469	-0.531	-1,422,230	227,860,819

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1973	Jan	2.876	0.876	2,346,278	230,207,098
	Feb	4.727	2.727	6,597,158	236,804,256
	Mar	4.181	2.181	5,841,590	242,645,846
	Apr	1.761	-0.239	-619,488	242,026,358
	May	1.762	-0.238	-637,459	241,388,899
	Jun	1.811	-0.189	-489,888	240,899,011
	Jul	1.935	-0.065	-174,096	240,724,915
	Aug	1.726	-0.274	-733,882	239,991,034
	Sep	1.549	-0.451	-1,168,992	238,822,042
	Oct	1.330	-0.670	-1,794,528	237,027,514
	Nov	1.110	-0.890	-2,306,880	234,720,634
	Dec	1.010	-0.990	-2,651,616	232,069,018
1974	Jan	4.920	2.920	7,820,928	239,889,946
	Feb	3.000	1.000	2,419,200	242,309,146
	Mar	4.760	2.760	7,392,384	249,701,530
	Apr	1.761	-0.239	-619,488	249,082,042
	May	1.730	-0.270	-723,168	248,358,874
	Jun	1.810	-0.190	-492,480	247,866,394
	Jul	1.960	-0.040	-107,136	247,759,258
	Aug	2.930	0.930	2,490,912	250,250,170
	Sep	1.360	-0.640	-1,658,880	248,591,290
	Oct	1.260	-0.740	-1,982,016	246,609,274
	Nov	1.120	-0.880	-2,280,960	244,328,314
	Dec	0.988	-1.012	-2,710,541	241,617,773
1975	Jan	2.300	0.300	803,520	242,421,293
	Feb	4.727	2.727	6,597,158	249,018,451
	Mar	4.181	2.181	5,841,590	254,860,042
	Apr	1.761	-0.239	-619,488	254,240,554
	May	1.710	-0.290	-776,736	253,463,818
	Jun	1.970	-0.030	-77,760	253,386,058
	Jul	2.150	0.150	401,760	253,787,818
	Aug	1.740	-0.260	-696,384	253,091,434
	Sep	1.470	-0.530	-1,373,760	251,717,674
	Oct	1.320	-0.680	-1,821,312	249,896,362
	Nov	1.275	-0.725	-1,879,200	248,017,162
	Dec	2.520	0.520	1,392,768	249,409,930

Appendix 2.7 (6) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1976	Jan	2.550	0.550	1,473,120	250,883,050
	Feb	7.140	5.140	12,434,688	263,317,738
	Mar	11.800	9.800	26,248,320	289,566,058
	Apr	1.761	-0.239	-619,488	288,946,570
	May	2.010	0.010	26,784	288,973,354
	Jun	1.990	-0.010	-25,920	288,947,434
	Jul	1.900	-0.100	-267,840	288,679,594
	Aug	1.800	-0.200	-535,680	288,143,914
	Sep	2.000	0.000	0	288,143,914
	Oct	1.340	-0.660	-1,767,744	286,376,170
	Nov	1.030	-0.970	-2,514,240	283,861,930
	Dec	1.050	-0.950	-2,544,480	281,317,450
1977	Jan	2.876	0.876	2,346,278	283,663,728
	Feb	4.727	2.727	6,597,158	290,260,886
	Mar	4.820	2.820	7,553,088	297,813,974
	Apr	2.360	0.360	933,120	298,747,094
	May	2.420	0.420	1,124,928	299,872,022
	Jun	2.580	0.580	1,503,360	301,375,382
	Jul	1.935	-0.065	-174,096	301,201,286
	Aug	2.000	0.000	0	301,201,286
	Sep	1.670	-0.330	-855,360	300,345,926
	Oct	1.330	-0.670	-1,794,528	298,551,398
	Nov	1.180	-0.820	-2,125,440	296,425,958
	Dec	1.330	-0.670	-1,794,528	294,631,430
1978	Jan	3.660	1.660	4,446,144	299,077,574
	Feb	2.600	0.600	1,451,520	300,529,094
	Mar	1.340	-0.660	-1,767,744	298,761,350
	Apr	1.500	-0.500	-1,296,000	297,465,350
	May	1.540	-0.460	-1,232,064	296,233,286
	Jun	1.520	-0.480	-1,244,160	294,989,126
	Jul	1.800	-0.200	-535,680	294,453,446
	Aug	1.620	-0.380	-1,017,792	293,435,654
	Sep	1.330	-0.670	-1,736,640	291,699,014
	Oct	1.120	-0.880	-2,356,992	289,342,022
	Nov	1.320	-0.680	-1,762,560	287,579,462
	Dec	1.210	-0.790	-2,115,936	285,463,526

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1979	Jan	2.560	0.560	1,499,904	286,963,430
	Feb	1.110	-0.890	-2,153,088	284,810,342
	Mar	3.400	1.400	3,749,760	288,560,102
	Apr	1.460	-0.540	-1,399,680	287,160,422
	May	1.590	-0.410	-1,098,144	286,062,278
	Jun	1.790	-0.210	-544,320	285,517,958
	Jul	1.830	-0.170	-455,328	285,062,630
	Aug	1.726	-0.274	-733,882	284,328,749
	Sep	1.740	-0.260	-673,920	283,654,829
	Oct	1.720	-0.280	-749,952	282,904,877
	Nov	1.360	-0.640	-1,658,880	281,245,997
	Dec	1.180	-0.820	-2,196,288	279,049,709
1980	Jan	2.876	0.876	2,346,278	281,395,987
	Feb	4.727	2.727	6,597,158	287,993,146
	Mar	4.181	2.181	5,841,590	293,834,736
	Apr	1.761	-0.239	-619,488	293,215,248
	May	1.762	-0.238	-637,459	292,577,789
	Jun	1.530	-0.470	-1,218,240	291,359,549
	Jul	1.690	-0.310	-830,304	290,529,245
	Aug	1.680	-0.320	-857,088	289,672,157
	Sep	1.380	-0.620	-1,607,040	288,065,117
	Oct	1.170	-0.830	-2,223,072	285,842,045
	Nov	1.040	-0.960	-2,488,320	283,353,725
	Dec	0.939	-1.061	-2,841,782	280,511,942
1981	Jan	1.660	-0.340	-910,656	279,601,286
	Feb	9.410	7.410	17,926,272	297,527,558
	Mar	8.590	6.590	17,650,656	315,178,214
	Apr	1.560	-0.440	-1,140,480	314,037,734
	May	1.630	-0.370	-991,008	313,046,726
	Jun	1.840	-0.160	-414,720	312,632,006
	Jul	1.920	-0.080	-214,272	312,417,734
	Aug	1.726	-0.274	-733,882	311,683,853
	Sep	1.580	-0.420	-1,088,640	310,595,213
	Oct	1.250	-0.750	-2,008,800	308,586,413
	Nov	1.275	-0.725	-1,879,200	306,707,213
	Dec	1.000	-1.000	-2,678,400	304,028,813

Appendix 2.7 (7) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1982	Jan	1.620	-0.380	-1,017,792	303,011,021
	Feb	2.090	0.090	217,728	303,228,749
	Mar	1.320	-0.680	-1,821,312	301,407,437
	Apr	1.440	-0.560	-1,451,520	299,955,917
	May	1.570	-0.430	-1,151,712	298,804,205
	Jun	1.600	-0.400	-1,036,800	297,767,405
	Jul	1.590	-0.410	-1,098,144	296,669,261
	Aug	0.558	-1.442	-3,862,253	292,807,008
	Sep	0.551	-1.449	-3,755,808	289,051,200
	Oct	0.524	-1.476	-3,953,318	285,097,882
	Nov	0.931	-1.069	-2,770,848	282,327,034
	Dec	1.650	-0.350	-937,440	281,389,594
1983	Jan	0.980	-1.020	-2,731,968	278,657,626
	Feb	0.950	-1.050	-2,540,160	276,117,466
	Mar	1.210	-0.790	-2,115,936	274,001,530
	Apr	1.100	-0.900	-2,332,800	271,668,730
	May	1.200	-0.800	-2,142,720	269,526,010
	Jun	1.330	-0.670	-1,736,640	267,789,370
	Jul	1.420	-0.580	-1,553,472	266,235,898
	Aug	1.340	-0.660	-1,767,744	264,468,154
	Sep	1.320	-0.680	-1,762,560	262,705 594
	Oct	1.170	-0.830	-2,223,072	260,482,522
	Nov	1.030	-0.970	-2,514,240	257,968,282
	Dec	1.090	-0.910	-2,437,344	255,530,938
1984	Jan	2.230	0.230	616,032	256,146,970
	Feb	4.727	2.727	6,597,158	262,744,128
	Mar	4.181	2.181	5,841,590	268,585,718
	Apr	1.761	-0.239	-619,488	267,966,230
	May	1.560	-0.440	-1,178,496	266,787,734
	Jun	1.670	-0.330	-855,360	265,932,374
	Jul	1.640	-0.360	-964,224	264,968,150
	Aug	1.610	-0.390	-1,044,576	263,923,574
	Sep	1.350	-0.650	-1,684,800	262,238,774
	Oct	1.260	-0.740	-1,982,016	260,256,758
	Nov	1.620	-0.380	-984,960	259,271,798
	Dec	1.240	-0.760	-2,035,584	257,236,214

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1985	Jan	1.470	-0.530	-1,419,552	255,816,662
	Feb	5.110	3.110	7,523,712	263,340,374
	Mar	4.181	2.181	5,841,590	269,181,965
	Apr	1.761	-0.239	-619,488	268,562,477
	May	1.762	-0.238	-637,459	267,925,018
	Jun	1.811	-0.189	-489,888	267,435,130
	Jul	1.790	-0.210	-562,464	266,872,666
	Aug	1.660	-0.340	-910,656	265,962,010
	Sep	1.549	-0.451	-1,168,992	264,793,018
	Oct	1.330	-0.670	-1,794,528	262,998,490
	Nov	1.480	-0.520	-1,347,840	261,650,650
	Dec	2.150	0.150	401,760	262,052,410
1986	Jan	2.876	0.876	2,346,278	264,398,688
	Feb	4.727	2.727	6,597,158	270,995,846
	Mar	4.181	2.181	5,841,590	276,837,437
	Apr	1.761	-0.239	-619,488	276,217,949
	May	1.762	-0.238	-637,459	275,580,490
	Jun	1.811	-0.189	-489,888	275,090,602
	Jul	1.935	-0.065	-174,096	274,916,506
	Aug	1.726	-0.274	-733,882	274,182,624
	Sep	1.549	-0.451	-1,168,992	273,013,632
	Oct	1.330	-0.670	-1,794,528	271,219,104
	Nov	1.275	-0.725	-1,879,200	269,339,904
	Dec	1.469	-0.531	- -1,422,230	267,917,674
1987	Jan	2.876	0.876	2,346,278	270,263,952
	Feb	4.727	2.727	6,597,158	276,861,110
	Mar	4.181	2.181	5,841,590	282,702,701
	Apr	1.761	-0.239	-619,488	282,083,213
	May	1.762	-0.238	-637,459	281,445,754
	Jun	1.811	-0.189	-489,888	280,955,866
	Jul	1.935	-0.065	-174,096	280,781,770
	Aug	1.726	-0.274	-733,882	280,047,888
	Sep	1.570	-0.430	-1,114,560	278,933,328
	Oct	1.340	-0.660	-1,767,744	277,165,584
	Nov	1.210	-0.790	-2,047,680	275,117,904
	Dec	1.060	-0.940	-2,517,696	272,600,208

Appendix 2.7 (8) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1988	Jan	3.350	1.350	3,615,840	276,216,048
	Feb	13.200	11.200	27,095,040	303,311,088
	Mar	2.610	0.610	1,633,824	304,944,912
	Apr	1.920	-0.080	-207,360	304,737,552
	May	1.500	-0.500	-1,339,200	303,398,352
	Jun	1.590	-0.410	-1,062,720	302,335,632
	Jul	1.660	-0.340	-910,656	301,424,976
	Aug	1.520	-0.480	-1,285,632	300,139,344
	Sep	1.480	-0.520	-1,347,840	298,791,504
	Oct	1.380	-0.620	-1,660,608	297,130,896
	Nov	1.310	-0.690	-1,788,480	295,342,416
	Dec	1.510	-0.490	-1,312,416	294,030,000
1989	Jan	2.230	0.230	616,032	294,646,032
	Feb	3.660	1.660	4,015,872	298,661,904
	Mar	4.181	2.181	5,841,590	304,503,494
	Apr	1.761	-0.239	-619,488	303,884,006
	May	1.762	-0.238	-637,459	303,246,547
	Jun	1.150	-0.850	-2,203,200	301,043,347
	Jul	1.150	-0.850	-2,276,640	298,766,707
	Aug	1.100	-0.900	-2,410,560	296,356,147
	Sep	1.040	-0.960	-2,488,320	293,867,827
	Oct	0.967	-1.033	-2,766,787	291,101,040
	Nov	0.975	-1.025	-2,656,800	288,444,240
	Dec	1.010	-0.990	-2,651,616	285,792,624

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 2.00 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1990	Jan	1.190	-0.810	-2,169,504	283,623,120
	Feb	1.320	-0.680	-1,645,056	281,978,064
	Mar	1.280	-0.720	-1,928,448	280,049,616
	Apr	1.420	-0.580	-1,503,360	278,546,256
	May	1.480	-0.520	-1,392,768	277,153,488
	Jun	1.850	-0.150	-388,800	276,764,688
	Jul	1.700	-0.300	-803,520	275,961,168
	Aug	1.560	-0.440	-1,178,496	274,782,672
	Sep	1.670	-0.330	-855,360	273,927,312
	Oct	1.220	-0.780	-2,089,152	271,838,160
	Nov	1.030	-0.970	-2,514,240	269,323,920
	Dec	1.470	-0.530	-1,419,552	267,904,368

Appendix 2.7 (9) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1946	Jan	2.876	1.376	3,685,478	3,685,478
	Feb	4.727	3.227	7,806,758	11,492,237
	Mar	4.181	2.681	7,180,790	18,673,027
	Apr	1.761	0.261	676,512	19,349,539
	May	1.762	0.262	701,741	20,051,280
	Jun	1.811	0.311	806,112	20,857,392
	Jul	1.470	-0.030	-80,352	20,777,040
	Aug	1.470	-0.030	-80,352	20,696,688
	Sep	1.250	-0.250	-648,000	20,048,688
	Oct	1.270	-0.230	-616,032	19,432,656
	Nov	1.230	-0.270	-699,840	18,732,816
	Dec	1.380	-0.120	-321,408	18,411,408
1947	Jan	2.110	0.610	1,633,824	20,045,232
	Feb	1.450	-0.050	-120,960	19,924,272
	Mar	1.220	-0.280	-749,952	19,174,320
	Apr	1.380	-0.120	-311,040	18,863,280
	May	1.450	-0.050	-133,920	18,729,360
	Jun	1.390	-0.110	-285,120	18,444,240
	Jul	1.570	0.070	187,488	18,631,728
	Aug	1.280	-0.220	-589,248	18,042,480
	Sep	1.210	-0.290	-751,680	17,290,800
	Oct	1.190	-0.310	-830,304	16,460,496
	Nov	1.090	-0.410	-1,062,720	15,397,776
	Dec	2.220	0.720	1,928,448	17,326,224
1948	Jan	1.880	0.380	1,017,792	18,344,016
	Feb	3.920	2.420	5,854,464	24,198,480
	Mar	5.630	4.130	11,061,792	35,260,272
	Apr	1.940	0.440	1,140,480	36,400,752
	May	1.940	0.440	1,178,496	37,579,248
	Jun	1.890	0.390	1,010,880	38,590,128
	Jul	1.940	0.440	1,178,496	39,768,624
	Aug	1.770	0.270	723,168	40,491,792
	Sep	1.490	-0.010	-25,920	40,465,872
	Oct	1.370	-0.130	-348,192	40,117,680
	Nov	1.330	-0.170	-440,640	39,677,040
	Dec	1.820	0.320	857,088	40,534,128

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1949	Jan	9.160	7.660	20,516,544	61,050,672
	Feb	8.780	7.280	17,611,776	78,662,448
	Mar	8.350	6.850	18,347,040	97,009,488
	Apr	3.640	2.140	5,546,880	102,556,368
	May	2.570	1.070	2,865,888	105,422,256
	Jun	2.680	1.180	3,058,560	108,480,816
	Jul	2.400	0.900	2,410,560	110,891,376
	Aug	1.726	0.226	605,318	111,496,694
	Sep	1.549	0.049	127,008	111,623,702
	Oct	1.370	-0.130	-348,192	111,275,510
	Nov	1.190	-0.310	-803,520	110,471,990
	Dec	1.350	-0.150	-401,760	110,070,230
1950	Jan	1.600	0.100	267,840	110,338,070
	Feb	1.710	0.210	508,032	110,846,102
	Mar	2.340	0.840	2,249,856	113,095,958
	Apr	1.730	0.230	596,160	113,692,118
	May	1.820	0.320	857,088	114,549,206
	Jun	1.830	0.330	855,360	115,404,566
	Jul	1.935	0.435	1,165,104	116,569,670
	Aug	1.730	0.230	616,032	117,185,702
	Sep	1.570	0.070	181,440	117,367,142
	Oct	1.380	-0.120	-321,408	117,045,734
	Nov	1.170	-0.330	-855,360	116,190,374
	Dec	1.430	-0.070	-187,488	116,002,886
1951	Jan	2.210	0.710	1,901,664	117,904,550
	Feb	2.850	1.350	3,265,920	121,170,470
	Mar	2.700	1.200	3,214,080	124,384,550
	Apr	1.580	0.080	207,360	124,591,910
	May	1.610	0.110	294,624	124,886,534
	Jun	1.630	0.130	336,960	125,223,494
	Jul	1.730	0.230	616,032	125,839,526
	Aug	1.690	0.190	508,896	126,348,422
	Sep	1.600	0.100	259,200	126,607,622
	Oct	1.280	-0.220	-589,248	126,018,374
	Nov	1.250	-0.250	-648,000	125,370,374
	Dec	1.230	-0.270	-723,168	124,647,206

Appendix 2.7 (10) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1952	Jan	6.360	4.860	13,017,024	137,664,230
	Feb	6.590	5.090	12,313,728	149,977,958
	Mar	3.680	2.180	5,838,912	155,816,870
	Apr	2.420	0.920	2,384,640	158,201,510
	May	2.140	0.640	1,714,176	159,915,686
	Jun	2.390	0.890	2,306,880	162,222,566
	Jul	3.410	1.910	5,115,744	167,338,310
	Aug	2.390	0.890	2,383,776	169,722,086
	Sep	2.260	0.760	1,969,920	171,692,006
	Oct	1.760	0.260	696,384	172,388,390
	Nov	1.600	0.100	259,200	172,647,590
	Dec	1.790	0.290	776,736	173,424,326
1953	Jan	4.050	2.550	6,829,920	180,254,246
	Feb	11.900	10.400	25,159,680	205,413,926
	Mar	12.800	11.300	30,265,920	235,679,846
	Apr	1.761	0.261	676,512	236,356,358
	May	1.762	0.262	701,741	237,058,099
	Jun	1.811	0.311	806,112	237,864,211
	Jul	1.935	0.435	1,165,104	239,029,315
	Aug	1.726	0.226	605,318	239,634,634
	Sep	1.600	0.100	259,200	239,893,834
	Oct	1.540	0.040	107,136	240,000,970
	Nov	1.790	0.290	751,680	240,752,650
	Dec	2.120	0.620	1,660,608	242,413,258
1954	Jan	2.930	1.430	3,830,112	246,243,370
	Feb	12.100	10.600	25,643,520	271,886,890
	Mar	4.181	2.681	7,180,790	279,067,680
	Apr	1.761	0.261	676,512	279,744,192
	May	1.762	0.262	701,741	280,445,933
	Jun	1.811	0.311	806,112	281,252,045
	Jul	1.935	0.435	1,165,104	282,417,149
	Aug	1.726	0.226	605,318	283,022,467
	Sep	1.549	0.049	127,008	283,149,475
	Oct	1.330	-0.170	-455,328	282,694,147
	Nov	1.275	-0.225	-583,200	282,110,947
	Dec	1.469	-0.031	-83,030	282,027,917

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1955	Jan	2.876	1.376	3,685,478	285,713,395
	Feb	4.727	3.227	7,806,758	293,520,154
	Mar	4.181	2.681	7,180,790	300,700,944
	Apr	1.761	0.261	676,512	301,377,456
	May	1.762	0.262	701,741	302,079,197
	Jun	1.811	0.311	806,112	302,885,309
	Jul	1.935	0.435	1,165,104	304,050,413
	Aug	1.726	0.226	605,318	304,655,731
	Sep	1.549	0.049	127,008	304,782,739
	Oct	1.380	-0.120	-321,408	304,461,331
	Nov	1.320	-0.180	-466,560	303,994,771
	Dec	2.010	0.510	1,365,984	305,360,755
1956	Jan	2.050	0.550	1,473,120	306,833,875
	Feb	3.920	2.420	5,854,464	312,688,339
	Mar	1.920	0.420	1,124,928	313,813,267
	Apr	1.570	0.070	181,440	313,994,707
	May	1.762	0.262	701,741	314,696,448
	Jun	1.811	0.311	806,112	315,502,560
	Jul	1.790	0.290	776,736	316,279,296
	Aug	1.690	0.190	508,896	316,788,192
	Sep	1.570	0.070	181,440	316,969,632
	Oct	1.390	-0.110	-294,624	316,675,008
	Nov	1.320	-0.180	-466,560	316,208,448
	Dec	1.110	-0.390	-1,044,576	315,163,872
1957	Jan	1.190	-0.310	-830,304	314,333,568
	Feb	2.790	1.290	3,120,768	317,454,336
	Mar	4.181	2.681	7,180,790	324,635,126
	Apr	1.761	0.261	676,512	325,311,638
	May	1.762	0.262	701,741	326,013,379
	Jun	1.860	0.360	933,120	326,946,499
	Jul	1.650	0.150	401,760	327,348,259
	Aug	1.680	0.180	482,112	327,830,371
	Sep	1.420	-0.080	-207,360	327,623,011
	Oct	1.190	-0.310	-830,304	326,792,707
	Nov	1.200	-0.300	-777,600	326,015,107
	Dec	2.710	1.210	3,240,864	329,255,971

Appendix 2.7 (11) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1958	Jan	3.270	1.770	4,740,768	333,996,739
	Feb	4.727	3.227	7,806,758	341,803,498
	Mar	4.181	2.681	7,180,790	348,984,288
	Apr	1.761	0.261	676,512	349,660,800
	May	2.400	0.900	2,410,560	352,071,360
	Jun	2.550	1.050	2,721,600	354,792,960
	Jul	2.520	1.020	2,731,968	357,524,928
	Aug	2.100	0.600	1,607,040	359,131,968
	Sep	2.020	0.520	1,347,840	360,479,808
	Oct	1.820	0.320	857,088	361,336,896
	Nov	1.350	-0.150	-388,800	360,948,096
	Dec	1.250	-0.250	-669,600	360,278,496
1959	Jan	1.290	-0.210	-562,464	359,716,032
	Feb	4.727	3.227	7,806,758	367,522,790
	Mar	4.181	2.681	7,180,790	374,703,581
	Apr	1.761	0.261	676,512	375,380,093
	May	1.762	0.262	701,741	376,081,834
	Jun	1.811	0.311	806,112	376,887,946
	Jul	1.935	0.435	1,165,104	378,053,050
	Aug	1.726	0.226	605,318	378,658,368
	Sep	1.549	0.049	127,008	378,785,376
	Oct	1.330	-0.170	-455,328	378,330,048
	Nov	1.275	-0.225	-583,200	377,746,848
	Dec	1.469	-0.031	-83,030	377,663,818
1960	Jan	2.876	1.376	3,685,478	381,349,296
	Feb	4.727	3.227	7,806,758	389,156,054
	Mar	4.181	2.681	7,180,790	396,336,845
	Apr	1.761	0.261	676,512	397,013,357
	May	1.762	0.262	701,741	397,715,098
	Jun	1.811	0.311	806,112	398,521,210
	Jul	1.935	0.435	1,165,104	399,686,314
	Aug	1.726	0.226	605,318	400,291,632
	Sep	1.549	0.049	127,008	400,418,640
	Oct	1.330	-0.170	-455,328	399,963,312
	Nov	1.275	-0.225	-583,200	399,380,112
	Dec	1.469	-0.031	-83,030	399,297,082

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1961	Jan	2.876	1.376	3,685,478	402,982,560
	Feb	4.727	3.227	7,806,758	410,789,318
	Mar	4.181	2.681	7,180,790	417,970,109
	Apr	1.761	0.261	676,512	418,646,621
	May	1.762	0.262	701,741	419,348,362
	Jun	1.811	0.311	806,112	420,154,474
	Jul	1.935	0.435	1,165,104	421,319,578
	Aug	1.760	0.260	696,384	422,015,962
	Sep	1.390	-0.110	-285,120	421,730,842
	Oct	1.100	-0.400	-1,071,360	420,659,482
	Nov	1.275	-0.225	-583,200	420,076,282
	Dec	1.469	-0.031	-83,030	419,993,251
1962	Jan	3.700	2.200	5,892,480	425,885,731
	Feb	3.560	2.060	4,983,552	430,869,283
	Mar	4.181	2.681	7,180,790	438,050,074
	Apr	1.761	0.261	676,512	438,726,586
	May	1.820	0.320	857,088	439,583,674
	Jun	2.060	0.560	1,451,520	441,035,194
	Jul	1.980	0.480	1,285,632	442,320,826
	Aug	1.980	0.480	1,285,632	443,606,458
	Sep	1.650	0.150	388,800	443,995,258
	Oct	1.200	-0.300	-803,520	443,191,738
	Nov	1.450	-0.050	-129,600	443,062,138
	Dec	1.530	0.030	80,352	443,142,490
1963	Jan	2.020	0.520	1,392,768	444,535,258
	Feb	7.470	5.970	14,442,624	458,977,882
	Mar	4.790	3.290	8,811,936	467,789,818
	Apr	2.030	0.530	1,373,760	469,163,578
	May	2.650	1.150	3,080,160	472,243,738
	Jun	2.370	0.870	2,255,040	474,498,778
	Jul	2.350	0.850	2,276,640	476,775,418
	Aug	2.200	0.700	1,874,880	478,650,298
	Sep	2.020	0.520	1,347,840	479,998,138
	Oct	1.690	0.190	508,896	480,507,034
	Nov	1.640	0.140	362,880	480,869,914
	Dec	1.469	-0.031	-83,030	480,786,883

Appendix 2.7 (12) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1964	Jan	2.876	1.376	3,685,478	484,472,362
	Feb	1.750	0.250	604,800	485,077,162
	Mar	1.850	0.350	937,440	486,014,602
	Apr	1.290	-0.210	-544,320	485,470,282
	May	1.660	0.160	428,544	485,898,826
	Jun	1.850	0.350	907,200	486,806,026
	Jul	1.935	0.435	1,165,104	487,971,130
	Aug	2.150	0.650	1,740,960	489,712,090
	Sep	2.080	0.580	1,503,360	491,215,450
	Oct	1.700	0.200	535,680	491,751,130
	Nov	1.390	-0.110	-285,120	491,466,010
	Dec	1.970	0.470	1,258,848	492,724,858
1965	Jan	3.340	1.840	4,928,256	497,653,114
	Feb	4.220	2.720	6,580,224	504,233,338
	Mar	4.110	2.610	6,990,624	511,223,962
	Apr	2.250	0.750	1,944,000	513,167,962
	May	1.110	-0.390	-1,044,576	512,123,386
	Jun	1.030	-0.470	-1,218,240	510,905,146
	Jul	3.610	2.110	5,651,424	516,556,570
	Aug	2.330	0.830	2,223,072	518,779,642
	Sep	2.310	0.810	2,099,520	520,879,162
	Oct	2.520	1.020	2,731,968	523,611,130
	Nov	2.490	0.990	2,566,080	526,177,210
	Dec	2.260	0.760	2,035,584	528,212,794
1966	Jan	2.380	0.880	2,356,992	530,569,786
	Feb	2.450	0.950	2,298,240	532,868,026
	Mar	1.810	0.310	830,304	533,698,330
	Apr	1.510	0.010	25,920	533,724,250
	May	1.930	0.430	1,151,712	534,875,962
	Jun	2.280	0.780	2,021,760	536,897,722
	Jul	1.750	0.250	669,600	537,567,322
	Aug	1.320	-0.180	-482,112	537,085,210
	Sep	1.240	-0.260	-673,920	536,411,290
	Oct	1.150	-0.350	-937,440	535,473,850
	Nov	1.160	-0.340	-881,280	534,592,570
	Dec	1.060	-0.440	-1,178,496	533,414,074

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1967	Jan	1.150	-0.350	-937,440	532,476,634
	Feb	3.400	1.900	4,596,480	537,073,114
	Mar	4.150	2.650	7,097,760	544,170,874
	Apr	1.761	0.261	676,512	544,847,386
	May	1.762	0.262	701,741	545,549,126
	Jun	1.811	0.311	806,112	546,355,238
	Jul	1.935	0.435	1,165,104	547,520,342
	Aug	1.726	0.226	605,318	548,125,661
	Sep	1.549	0.049	127,008	548,252,669
	Oct	1.330	-0.170	-455,328	547,797,341
	Nov	1.060	-0.440	-1,140,480	546,656,861
	Dec	1.160	-0.340	-910,656	545,746,205
1968	Jan	2.000	0.500	1,339,200	547,085,405
	Feb	4.727	3.227	7,806,758	554,892,163
	Mar	5.500	4.000	10,713,600	565,605,763
	Apr	1.950	0.450	1,166,400	566,772,163
	May	0.970	-0.530	-1,419,552	565,352,611
	Jun	0.352	-1.148	-2,975,616	562,376,995
	Jul	1.935	0.435	1,165,104	563,542,099
	Aug	1.726	0.226	605,318	564,147,418
	Sep	1.549	0.049	127,008	564,274,426
	Oct	1.330	-0.170	-455,328	563,819,098
	Nov	1.275	-0.225	-583,200	563,235,898
	Dec	1.469	-0.031	-83,030	563,152,867
1969	Jan	2.876	1.376	3,685,478	566,838,346
	Feb	4.727	3.227	7,806,758	574,645,104
	Mar	4.181	2.681	7,180,790	581,825,894
	Apr	1.761	0.261	676,512	582,502,406
	May	1.762	0.262	701,741	583,204,147
	Jun	1.811	0.311	806,112	584,010,259
	Jul	1.935	0.435	1,165,104	585,175,363
	Aug	1.726	0.226	605,318	585,780,682
	Sep	1.530	0.030	77,760	585,858,442
	Oct	1.240	-0.260	-696,384	585,162,058
	Nov	1.080	-0.420	-1,088,640	584,073,418
	Dec	1.390	-0.110	-294,624	583,778,794

Appendix 2.7 (13) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1970	Jan	2.420	0.920	2,464,128	586,242,922
	Feb	1.820	0.320	774,144	587,017,066
	Mar	2.160	0.660	1,767,744	588,784,810
	Apr	1.230	-0.270	-699,840	588,084,970
	May	1.350	-0.150	-401,760	587,683,210
	Jun	1.300	-0.200	-518,400	587,164,810
	Jul	1.550	0.050	133,920	587,298,730
	Aug	1.410	-0.090	-241,056	587,057,674
	Sep	1.200	-0.300	-777,600	586,280,074
	Oct	1.040	-0.460	-1,232,064	585,048,010
	Nov	0.903	-0.597	-1,547,424	583,500,586
	Dec	1.020	-0.480	-1,285,632	582,214,954
1971	Jan	2.510	1.010	2,705,184	584,920,138
	Feb	5.090	3.590	8,684,928	593,605,066
	Mar	2.090	0.590	1,580,256	595,185,322
	Apr	1.420	-0.080	-207,360	594,977,962
	May	1.430	-0.070	-187,488	594,790,474
	Jun	1.570	0.070	181,440	594,971,914
	Jul	1.580	0.080	214,272	595,186,186
	Aug	1.470	-0.030	-80,352	595,105,834
	Sep	1.260	-0.240	-622,080	594,483,754
	Oct	1.080	-0.420	-1,124,928	593,358,826
	Nov	1.120	-0.380	-984,960	592,373,866
	Dec	1.100	-0.400	-1,071,360	591,302,506
1972	Jan	9.790	8.290	22,203,936	613,506,442
	Feb	6.820	5.320	12,870,144	626,376,586
	Mar	7.760	6.260	16,766,784	643,143,370
	Apr	1.761	0.261	676,512	643,819,882
	May	2.790	1.290	3,455,136	647,275,018
	Jun	2.730	1.230	3,188,160	650,463,178
	Jul	2.340	0.840	2,249,856	652,713,034
	Aug	2.000	0.500	1,339,200	654,052,234
	Sep	1.850	0.350	907,200	654,959,434
	Oct	1.240	-0.260	-696,384	654,263,050
	Nov	1.275	-0.225	-583,200	653,679,850
	Dec	1.469	-0.031	-83,030	653,596,819

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1973	Jan	2.876	1.376	3,685,478	657,282,298
	Feb	4.727	3.227	7,806,758	665,089,056
	Mar	4.181	2.681	7,180,790	672,269,846
	Apr	1.761	0.261	676,512	672,946,358
	May	1.762	0.262	701,741	673,648,099
	Jun	1.811	0.311	806,112	674,454,211
	Jul	1.935	0.435	1,165,104	675,619,315
	Aug	1.726	0.226	605,318	676,224,634
	Sep	1.549	0.049	127,008	676,351,642
	Oct	1.330	-0.170	-455,328	675,896,314
	Nov	1.110	-0.390	-1,010,880	674,885,434
	Dec	1.010	-0.490	-1,312,416	673,573,018
1974	Jan	4.920	3.420	9,160,128	682,733,146
	Feb	3.000	1.500	3,628,800	686,361,946
	Mar	4.760	3.260	8,731,584	695,093,530
	Apr	1.761	0.261	676,512	695,770,042
	May	1.730	0.230	616,032	696,386,074
	Jun	1.810	0.310	803,520	697,189,594
	Jul	1.960	0.460	1,232,064	698,421,658
	Aug	2.930	1.430	3,830,112	702,251,770
	Sep	1.360	-0.140	-362,880	701,888,890
	Oct	1.260	-0.240	-642,816	701,246,074
	Nov	1.120	-0.380	-984,960	700,261,114
	Dec	0.988	-0.512	-1,371,341	698,889,773
1975	Jan	2.300	0.800	2,142,720	701,032,493
	Feb	4.727	3.227	7,806,758	708,839,251
	Mar	4.181	2.681	7,180,790	716,020,042
	Apr	1.761	0.261	676,512	716,696,554
	May	1.710	0.210	562,464	717,259,018
	Jun	1.970	0.470	1,218,240	718,477,258
	Jul	2.150	0.650	1,740,960	720,218,218
	Aug	1.740	0.240	642,816	720,861,034
	Sep	1.470	-0.030	-77,760	720,783,274
	Oct	1.320	-0.180	-482,112	720,301,162
	Nov	1.275	-0.225	-583,200	719,717,962
	Dec	2.520	1.020	2,731,968	722,449,930

Appendix 2.7 (14) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1976	Jan	2.550	1.050	2,812,320	725,262,250
	Feb	7.140	5.640	13,644,288	738,906,538
	Mar	11.800	10.300	27,587,520	766,494,058
	Apr	1.761	0.261	676,512	767,170,570
	May	2.010	0.510	1,365,984	768,536,554
	Jun	1.990	0.490	1,270,080	769,806,634
	Jul	1.900	0.400	1,071,360	770,877,994
	Aug	1.800	0.300	803,520	771,681,514
	Sep	2.000	0.500	1,296,000	772,977,514
	Oct	1.340	-0.160	-428,544	772,548,970
	Nov	1.030	-0.470	-1,218,240	771,330,730
	Dec	1.050	-0.450	-1,205,280	770,125,450
1977	Jan	2.876	1.376	3,685,478	773,810,928
	Feb	4.727	3.227	7,806,758	781,617,686
	Mar	4.820	3.320	8,892,288	790,509,974
	Apr	2.360	0.860	2,229,120	792,739,094
	May	2.420	0.920	2,464,128	795,203,222
	Jun	2.580	1.080	2,799,360	798,002,582
	Jul	1.935	0.435	1,165,104	799,167,686
	Aug	2.000	0.500	1,339,200	800,506,886
	Sep	1.670	0.170	440,640	800,947,526
	Oct	1.330	-0.170	-455,328	800,492,198
	Nov	1.180	-0.320	-829,440	799,662,758
	Dec	1.330	-0.170	-455,328	799,207,430
1978	Jan	3.660	2.160	5,785,344	804,992,774
	Feb	2.600	1.100	2,661,120	807,653,894
	Mar	1.340	-0.160	-428,544	807,225,350
	Apr	1.500	0.000	0	807,225,350
	May	1.540	0.040	107,136	807,332,486
	Jun	1.520	0.020	51,840	807,384,326
	Jul	1.800	0.300	803,520	808,187,846
	Aug	1.620	0.120	321,408	808,509,254
	Sep	1.330	-0.170	-440,640	808,068,614
	Oct	1.120	-0.380	-1,017,792	807,050,822
	Nov	1.320	-0.180	-466,560	806,584,262
	Dec	1.210	-0.290	-776,736	805,807,526

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1979	Jan	2.560	1.060	2,839,104	808,646,630
	Feb	1.110	-0.390	-943,488	807,703,142
	Mar	3.400	1.900	5,088,960	812,792,102
	Apr	1.460	-0.040	-103,680	812,688,422
	May	1.590	0.090	241,056	812,929,478
	Jun	1.790	0.290	751,680	813,681,158
	Jul	1.830	0.330	883,872	814,565,030
	Aug	1.726	0.226	605,318	815,170,349
	Sep	1.740	0.240	622,080	815,792,429
	Oct	1.720	0.220	589,248	816,381,677
	Nov	1.360	-0.140	-362,880	816,018,797
	Dec	1.180	-0.320	-857,088	815,161,709
1980	Jan	2.876	1.376	3,685,478	818,847,187
	Feb	4.727	3.227	7,806,758	826,653,946
	Mar	4.181	2.681	7,180,790	833,834,736
	Apr	1.761	0.261	676,512	834,511,248
	May	1.762	0.262	701,741	835,212,989
	Jun	1.530	0.030	77,760	835,290,749
	Jul	1.690	0.190	508,896	835,799,645
	Aug	1.680	0.180	482,112	836,281,757
	Sep	1.380	-0.120	-311,040	835,970,717
	Oct	1.170	-0.330	-883,872	835,086,845
	Nov	1.040	-0.460	-1,192,320	833,894,525
	Dec	0.939	-0.561	-1,502,582	832,391,942
1981	Jan	1.660	0.160	428,544	832,820,486
	Feb	9.410	7.910	19,135,872	851,956,358
	Mar	8.590	7.090	18,989,856	870,946,214
	Apr	1.560	0.060	155,520	871,101,734
	May	1.630	0.130	348,192	871,449,926
	Jun	1.840	0.340	881,280	872,331,206
	Jul	1.920	0.420	1,124,928	873,456,134
	Aug	1.726	0.226	605,318	874,061,453
	Sep	1.580	0.080	207,360	874,268,813
	Oct	1.250	-0.250	-669,600	873,599,213
	Nov	1.275	-0.225	-583,200	873,016,013
	Dec	1.000	-0.500	-1,339,200	871,676,813

Appendix 2.7 (14) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1976	Jan	2.550	1.050	2,812,320	725,262,250
	Feb	7.140	5.640	13,644,288	738,906,538
	Mar	11.800	10.300	27,587,520	766,494,058
	Apr	1.761	0.261	676,512	767,170,570
	May	2.010	0.510	1,365,984	768,536,554
	Jun	1.990	0.490	1,270,080	769,806,634
	Jul	1.900	0.400	1,071,360	770,877,994
	Aug	1.800	0.300	803,520	771,681,514
	Sep	2.000	0.500	1,296,000	772,977,514
	Oct	1.340	-0.160	-428,544	772,548,970
	Nov	1.030	-0.470	-1,218,240	771,330,730
	Dec	1.050	-0.450	-1,205,280	770,125,450
1977	Jan	2.876	1.376	3,685,478	773,810,928
	Feb	4.727	3.227	7,806,758	781,617,686
	Mar	4.820	3.320	8,892,288	790,509,974
	Apr	2.360	0.860	2,229,120	792,739,094
	May	2.420	0.920	2,464,128	795,203,222
	Jun	2.580	1.080	2,799,360	798,002,582
	Jul	1.935	0.435	1,165,104	799,167,686
	Aug	2.000	0.500	1,339,200	800,506,886
	Sep	1.670	0.170	440,640	800,947,526
	Oct	1.330	-0.170	-455,328	800,492,198
	Nov	1.180	-0.320	-829,440	799,662,758
	Dec	1.330	-0.170	-455,328	799,207,430
1978	Jan	3.660	2.160	5,785,344	804,992,774
	Feb	2.600	1.100	2,661,120	807,653,894
	Mar	1.340	-0.160	-428,544	807,225,350
	Apr	1.500	0.000	0	807,225,350
	May	1.540	0.040	107,136	807,332,486
	Jun	1.520	0.020	51,840	807,384,326
	Jul	1.800	0.300	803,520	808,187,846
	Aug	1.620	0.120	321,408	808,509,254
	Sep	1.330	-0.170	-440,640	808,068,614
	Oct	1.120	-0.380	-1,017,792	807,050,822
	Nov	1.320	-0.180	-466,560	806,584,262
	Dec	1.210	-0.290	-776,736	805,807,526

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1979	Jan	2.560	1.060	2,839,104	808,646,630
	Feb	1.110	-0.390	-943,488	807,703,142
	Mar	3.400	1.900	5,088,960	812,792,102
	Apr	1.460	-0.040	-103,680	812,688,422
	May	1.590	0.090	241,056	812,929,478
	Jun	1.790	0.290	751,680	813,681,158
	Jul	1.830	0.330	883,872	814,565,030
	Aug	1.726	0.226	605,318	815,170,349
	Sep	1.740	0.240	622,080	815,792,429
	Oct	1.720	0.220	589,248	816,381,677
	Nov	1.360	-0.140	-362,880	816,018,797
	Dec	1.180	-0.320	-857,088	815,161,709
1980	Jan	2.876	1.376	3,685,478	818,847,187
	Feb	4.727	3.227	7,806,758	826,653,946
	Mar	4.181	2.681	7,180,790	833,834,736
	Apr	1.761	0.261	676,512	834,511,248
	May	1.762	0.262	701,741	835,212,989
	Jun	1.530	0.030	77,760	835,290,749
	Jul	1.690	0.190	508,896	835,799,645
	Aug	1.680	0.180	482,112	836,281,757
	Sep	1.380	-0.120	-311,040	835,970,717
	Oct	1.170	-0.330	-883,872	835,086,845
	Nov	1.040	-0.460	-1,192,320	833,894,525
	Dec	0.939	-0.561	-1,502,582	832,391,942
1981	Jan	1.660	0.160	428,544	832,820,486
	Feb	9.410	7.910	19,135,872	851,956,358
	Mar	8.590	7.090	18,989,856	870,946,214
	Apr	1.560	0.060	155,520	871,101,734
	May	1.630	0.130	348,192	871,449,926
	Jun	1.840	0.340	881,280	872,331,206
	Jul	1.920	0.420	1,124,928	873,456,134
	Aug	1.726	0.226	605,318	874,061,453
	Sep	1.580	0.080	207,360	874,268,813
	Oct	1.250	-0.250	-669,600	873,599,213
	Nov	1.275	-0.225	-583,200	873,016,013
	Dec	1.000	-0.500	-1,339,200	871,676,813

Appendix 2.7 (15) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1982	Jan	1.620	0.120	321,408	871,998,221
	Feb	2.090	0.590	1,427,328	873,425,549
	Mar	1.320	-0.180	-482,112	872,943,437
	Apr	1.440	-0.060	-155,520	872,787,917
	May	1.570	0.070	187,488	872,975,405
	Jun	1.600	0.100	259,200	873,234,605
	Jul	1.590	0.090	241,056	873,475,661
	Aug	0.558	-0.942	-2,523,053	870,952,608
	Sep	0.551	-0.949	-2,459,808	868,492,800
	Oct	0.524	-0.976	-2,614,118	865,878,682
	Nov	0.931	-0.569	-1,474,848	864,403,834
	Dec	1.650	0.150	401,760	864,805,594
1983	Jan	0.980	-0.520	-1,392,768	863,412,826
	Feb	0.950	-0.550	-1,330,560	862,082,266
	Mar	1.210	-0.290	-776,736	861,305,530
	Apr	1.100	-0.400	-1,036,800	860,268,730
	May	1.200	-0.300	-803,520	859,465,210
	Jun	1.330	-0.170	-440,640	859,024,570
	Jul	1.420	-0.080	-214,272	858,810,298
	Aug	1.340	-0.160	-428,544	858,381,754
	Sep	1.320	-0.180	-466,560	857,915,194
	Oct	1.170	-0.330	-883,872	857,031,322
	Nov	1.030	-0.470	-1,218,240	855,813,082
	Dec	1.090	-0.410	-1,098,144	854,714,938
1984	Jan	2.230	0.730	1,955,232	856,670,170
	Feb	4.727	3.227	7,806,758	864,476,928
	Mar	4.181	2.681	7,180,790	871,657,718
	Apr	1.761	0.261	676,512	872,334,230
	May	1.560	0.060	160,704	872,494,934
	Jun	1.670	0.170	440,640	872,935,574
	Jul	1.640	0.140	374,976	873,310,550
	Aug	1.610	0.110	294,624	873,605,174
	Sep	1.350	-0.150	-388,800	873,216,374
	Oct	1.260	-0.240	-642,816	872,573,558
	Nov	1.620	0.120	311,040	872,884,598
	Dec	1.240	-0.260	-696,384	872,188,214

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1985	Jan	1.470	-0.030	-80,352	872,107,862
	Feb	5.110	3.610	8,733,312	880,841,174
	Mar	4.181	2.681	7,180,790	888,021,965
	Apr	1.761	0.261	676,512	888,698,477
	May	1.762	0.262	701,741	889,400,218
	Jun	1.811	0.311	806,112	890,206,330
	Jul	1.790	0.290	776,736	890,983,066
	Aug	1.660	0.160	428,544	891,411,610
	Sep	1.549	0.049	127,008	891,538,618
	Oct	1.330	-0.170	-455,328	891,083,290
	Nov	1.480	-0.020	-51,840	891,031,450
	Dec	2.150	0.650	1,740,960	892,772,410
1986	Jan	2.876	1.376	3,685,478	896,457,888
	Feb	4.727	3.227	7,806,758	904,264,646
	Mar	4.181	2.681	7,180,790	911,445,437
	Apr	1.761	0.261	676,512	912,121,949
	May	1.762	0.262	701,741	912,823,690
	Jun	1.811	0.311	806,112	913,629,802
	Jul	1.935	0.435	1,165,104	914,794,906
	Aug	1.726	0.226	605,318	915,400,224
	Sep	1.549	0.049	127,008	915,527,232
	Oct	1.330	-0.170	-455,328	915,071,904
	Nov	1.275	-0.225	-583,200	914,488,704
	Dec	1.469	-0.031	-83,030	914,405,674
1987	Jan	2.876	1.376	3,685,478	918,091,152
	Feb	4.727	3.227	7,806,758	925,897,910
	Mar	4.181	2.681	7,180,790	933,078,701
	Apr	1.761	0.261	676,512	933,755,213
	May	1.762	0.262	701,741	934,456,954
	Jun	1.811	0.311	806,112	935,263,066
	Jul	1.935	0.435	1,165,104	936,428,170
	Aug	1.726	0.226	605,318	937,033,488
	Sep	1.570	0.070	181,440	937,214,928
	Oct	1.340	-0.160	-428,544	936,786,384
	Nov	1.210	-0.290	-751,680	936,034,704
	Dec	1.060	-0.440	-1,178,496	934,856,208

Appendix 2.7 (16) Monthly Storage Volume at Tocontasi & Chapisca

<Volumen Mensual de Almacenamiento en Tocontasi y Chapisca>

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1988	Jan	3.350	1.850	4,955,040	939,811,248
	Feb	13.200	11.700	28,304,640	968,115,888
	Mar	2.610	1.110	2,973,024	971,088,912
	Apr	1.920	0.420	1,088,640	972,177,552
	May	1.500	0.000	0	972,177,552
	Jun	1.590	0.090	233,280	972,410,832
	Jul	1.660	0.160	428,544	972,839,376
	Aug	1.520	0.020	53,568	972,892,944
	Sep	1.480	-0.020	-51,840	972,841,104
	Oct	1.380	-0.120	-321,408	972,519,696
	Nov	1.310	-0.190	-492,480	972,027,216
	Dec	1.510	0.010	26,784	972,054,000
1989	Jan	2.230	0.730	1,955,232	974,009,232
	Feb	3.660	2.160	5,225,472	979,234,704
	Mar	4.181	2.681	7,180,790	986,415,494
	Apr	1.761	0.261	676,512	987,092,006
	May	1.762	0.262	701,741	987,793,747
	Jun	1.150	-0.350	-907,200	986,886,547
	Jul	1.150	-0.350	-937,440	985,949,107
	Aug	1.100	-0.400	-1,071,360	984,877,747
	Sep	1.040	-0.460	-1,192,320	983,685,427
	Oct	0.967	-0.533	-1,427,587	982,257,840
	Nov	0.975	-0.525	-1,360,800	980,897,040
	Dec	1.010	-0.490	-1,312,416	979,584,624

Year	Month	Inflow (Qobs) (m3/s)	Outflow = 1.50 m3/s Balance (m3/s)	Excess Q (m3/s*mon)	Storage (m3)
1990	Jan	1.190	-0.310	-830,304	978,754,320
	Feb	1.320	-0.180	-435,456	978,318,864
	Mar	1.280	-0.220	-589,248	977,729,616
	Apr	1.420	-0.080	-207,360	977,522,256
	May	1.480	-0.020	-53,568	977,468,688
	Jun	1.850	0.350	907,200	978,375,888
	Jul	1.700	0.200	535,680	978,911,568
	Aug	1.560	0.060	160,704	979,072,272
	Sep	1.670	0.170	440,640	979,512,912
	Oct	1.220	-0.280	-749,952	978,762,960
	Nov	1.030	-0.470	-1,218,240	977,544,720
	Dec	1.470	-0.030	-80,352	977,464,368

Appendix A, 3.1 (1) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01080050-1 UJINA													
1974	102.50	70.50	0.00	5.00	0.00	0.00	0.00	0.00	0.00	1.40	0.40	0.00	179.80
1975	81.50	229.00	117.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.00	500.00
1976	182.00	29.50	20.00	0.00	3.30	62.00	0.00	50.00	59.00	0.00	0.00	2.00	407.80
1977	7.80	87.10	24.00	0.00	11.00	0.00	0.00	0.00	0.00	7.00	0.00	43.00	179.90
1978	42.00	44.00	17.00	0.00	0.00	0.00	0.00	4.20	0.00	0.00	0.00	8.00	115.20
1979	98.00	11.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	128.00
1980	0.00	9.00	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00
1981	60.50	99.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	176.00
1982	36.50	0.00	12.00	2.00	4.40	5.00	0.00	0.40	3.00	0.00	12.00	4.80	80.10
1983	8.00	12.00	3.80	0.00	0.00	6.00	2.00	0.00	0.00	0.00	0.00	0.00	31.80
1984	96.00	82.00	34.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	212.00
1985	0.00	157.30	12.50	0.00	0.00	20.00	0.00	0.00	0.00	0.00	15.50	16.00	221.30
1986	29.20	14.00	66.30	0.00	0.00	0.00	0.00	56.00	0.00	0.00	17.00	158.50	341.00
1987	169.50	18.50	0.00	0.00	0.00	0.00	0.00	0.00	2.00	39.00	0.00	0.00	229.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	117.00	27.00	14.50	0.70	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	162.20
Avg.	64.41	55.62	22.57	0.48	1.17	6.00	0.13	6.91	4.00	2.96	2.81	19.96	187.01
Max.	182.00	229.00	117.50	5.00	11.00	62.00	2.00	56.00	59.00	39.00	17.00	158.50	500.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (2) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01510051-6 ENQUELCA													
1985	3.50	94.50	13.00	11.40	1.50	3.00	0.00	1.00	0.50	0.00	17.40	39.00	184.80
1986	28.90	27.90	41.00	0.00	0.00	0.00	0.00	0.00	1.60	2.10	16.00	32.90	150.40
1987	0.00	0.00	0.00	0.00	0.00	7.00	13.20	0.00	0.00	0.00	5.00	0.00	25.20
1988	82.40	3.00	23.00	23.10	0.00	0.00	0.00	0.00	5.40	0.00	0.00	2.00	138.90
1989	6.60	12.90	6.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.80
1990	55.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	33.00	89.00
1991	120.00	11.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.30	0.00	144.30
Avg.	42.34	21.33	13.33	4.93	0.21	1.43	1.89	0.14	1.07	0.73	5.67	15.27	108.34
Max.	120.00	94.50	41.00	23.10	1.50	7.00	13.20	1.00	5.40	3.00	17.40	39.00	184.80
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.20

Appendix A, 3.1 (3) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01611050-7 CAMIGNA													
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00
1972	9.30	33.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.90
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	3.00
1976	156.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	191.00
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00
1981	0.00	5.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00
1982	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
1983	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	3.00	9.00
1984	63.00	25.00	31.00	0.00	0.00	0.00	0.00	0.40	0.00	4.50	0.00	0.00	123.90
1985	0.20	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.80
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	18.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.10
1990	0.00	115.00	5.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.50	122.50
1991	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00
1992	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.50	11.00
1993	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Avg.	12.66	12.65	1.89	0.11	0.00	0.53	0.00	0.02	0.00	0.24	0.00	1.26	29.35
Max.	156.00	115.00	31.00	2.00	0.00	6.00	0.00	0.40	0.00	4.50	0.00	10.50	191.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (4) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01611051-5 APAMILCA (CAMIGNA)													
1986	0.10	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	2.00
1987	0.80	12.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	15.80
1988	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00
Avg.	0.38	3.90	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.08	4.96
Max.	1.00	12.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.40	15.80
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (5) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01700050-0 ESMERALDA													
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1971	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1972	0.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00
Avg.	0.00	5.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.60
Max.	0.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (6) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01700051-9 HUAYTANI													
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	2.10	13.50	24.60
1983	0.00	2.50	3.50	0.00	0.00	1.50	0.00	0.00	12.50	2.50	0.00	12.00	34.50
1984	136.00	143.00	45.50	0.00	0.00	0.00	0.00	0.00	0.00	5.50	18.50	0.00	348.50
1985	9.00	52.50	2.50	31.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	33.50	147.00
1986	33.00	20.00	35.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	23.50	57.00	178.50
1987	85.50	30.00	0.00	15.00	0.00	7.50	15.00	0.00	0.00	0.00	0.00	0.00	153.00
1988	20.00	0.00	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	41.00
1989	18.00	18.50	40.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60	0.00	89.10
1990	11.40	4.50	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	17.90
1991	76.50	3.00	49.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.50	138.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	20.00
Avg.	35.40	24.91	17.50	6.00	0.00	1.00	1.36	0.00	1.14	1.55	5.93	13.59	108.37
Max.	136.00	143.00	49.00	31.00	0.00	7.50	15.00	0.00	12.50	9.00	23.50	57.00	348.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.90

Appendix A, 3.1 (7) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01700052-7 COPOSA													
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1983	0.00	20.20	0.00	0.00	0.00	16.10	2.30	0.00	4.10	0.00	0.00	0.00	42.70
1984	80.00	90.20	2.10	0.00	0.00	31.00	0.00	3.10	0.00	0.00	0.00	0.00	206.40
1985	0.00	30.40	7.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	11.20	49.70
1986	12.10	1.00	13.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	12.30	39.40
1987	83.20	4.10	0.00	0.00	0.00	1.00	6.10	0.00	0.00	3.10	0.00	0.00	97.50
Avg.	29.22	24.32	3.70	0.00	0.00	8.18	1.40	0.52	0.68	0.52	0.17	3.92	72.62
Max.	83.20	90.20	13.00	0.00	0.00	31.00	6.10	3.10	4.10	3.10	1.00	12.30	206.40
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (8) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01720050-K PUCHULTIZA													
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.50	13.50
1983	0.00	0.50	4.50	0.00	2.50	18.00	0.00	0.00	11.50	0.00	0.00	6.20	43.20
1984	125.10	143.50	41.40	1.00	0.00	32.80	0.00	16.50	0.00	16.50	34.50	6.50	417.80
1985	26.70	57.20	34.20	0.10	0.30	1.50	0.00	0.00	11.00	0.00	19.90	39.60	190.50
1986	28.10	16.70	27.80	4.50	0.00	0.10	0.00	13.00	0.10	0.00	22.50	50.90	163.70
1987	157.20	6.50	5.80	0.00	0.50	1.20	19.00	0.00	0.00	8.00	0.00	0.00	198.20
1988	20.20	0.00	4.60	5.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.10
Avg.	51.04	32.06	16.90	1.56	0.47	7.66	2.71	4.21	3.23	3.50	10.99	16.67	151.00
Max.	157.20	143.50	41.40	5.30	2.50	32.80	19.00	16.50	11.50	16.50	34.50	50.90	417.80
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.50

Appendix A, 3.1 (9) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01730051-2 PAMPA LIRIMA													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.50	0.00	17.50	23.00
1978	43.50	18.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	4.80	9.50	83.30
1979	92.00	11.00	36.10	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	19.50	160.60
1980	15.50	7.00	19.50	1.60	0.00	0.00	8.00	0.00	0.00	3.00	0.00	0.00	54.60
1981	28.00	98.90	9.00	5.20	0.00	0.00	0.00	1.50	0.00	0.00	0.00	19.00	161.60
1982	14.50	0.00	12.50	0.00	0.00	6.00	0.00	1.50	0.00	10.50	0.00	5.50	50.50
1983	7.50	8.50	7.30	0.00	0.00	4.00	0.00	0.00	10.50	0.00	0.00	5.20	43.00
1984	162.10	74.00	9.80	1.00	0.00	10.10	0.00	9.00	0.00	10.60	2.00	5.00	283.60
1985	15.00	76.70	9.60	0.00	0.00	0.00	0.00	0.00	0.40	0.00	9.70	0.00	111.40
1986	31.40	16.30	11.30	0.00	0.00	0.20	0.00	6.00	0.10	0.00	15.50	49.00	129.80
1987	84.90	17.50	4.80	0.00	0.00	4.90	5.80	0.00	0.00	5.30	0.00	0.00	123.20
1988	36.40	3.00	6.20	3.20	0.00	0.00	0.00	0.00	0.10	0.00	0.00	4.70	53.60
1989	10.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10
Avg.	41.61	25.45	10.16	0.85	0.00	1.94	1.22	1.38	0.85	2.80	2.46	10.38	99.10
Max.	162.10	98.90	36.10	5.20	0.00	10.10	8.00	9.00	10.50	10.60	15.50	49.00	283.60
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10

Appendix A, 3.1 (10) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01730052-0 POROMA													
1968	0.00	0.00	0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00	43.00
1969	130.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	131.00
1973	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	40.50	16.50	0.00	0.00	0.00	0.00	0.00	8.40	65.40
1976	45.00	6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.50
1977	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00
1978	18.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	32.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.50
1982	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
1983	0.00	16.00	0.00	0.00	0.00	2.00	0.00	0.00	10.50	0.00	0.00	0.00	28.50
1984	66.00	27.00	8.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	102.00
1985	3.00	8.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.10	24.10
1986	11.00	15.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	1.50	34.00
1987	33.50	0.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	44.50
1988	5.00	0.00	42.00	0.00	0.00	0.00	0.00	0.00	0.50	2.00	0.00	0.00	49.50
1989	0.00	36.90	11.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.90
1990	0.00	27.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.00	41.00
1991	17.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00
1992	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
Avg.	16.19	8.09	3.95	0.00	3.83	0.88	0.00	0.05	0.52	0.19	0.21	1.57	35.50
Max.	130.00	36.90	42.00	0.00	40.50	16.50	0.00	1.00	10.50	2.00	3.00	13.00	131.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (11) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01730053-9 PAMPA LIRIMA (PUEBLO NUEVO)													
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.90	0.00	5.30	16.20
1983	7.00	15.10	0.20	0.00	0.00	0.00	0.00	0.00	13.60	0.00	0.00	2.00	37.90
1984	173.80	122.70	12.60	1.50	0.00	4.30	0.00	5.80	0.00	23.00	5.00	6.20	354.90
1985	25.90	86.80	23.80	0.00	0.00	0.00	0.00	0.00	0.50	0.00	7.70	12.20	156.90
1986	33.60	7.40	16.70	1.20	0.00	0.40	0.00	3.80	0.00	0.00	12.40	59.10	134.60
1987	124.80	8.20	5.70	0.00	0.00	5.20	7.10	0.00	0.00	5.80	0.00	0.00	156.80
1988	46.60	1.80	5.60	2.80	0.00	0.00	0.00	0.00	0.20	0.00	0.00	4.70	61.70
1989	20.30	62.50	24.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.90	0.00	108.50
1990	23.70	25.80	13.10	0.00	2.10	1.70	0.00	0.00	0.00	0.00	0.00	59.50	125.90
1991	65.40	16.20	19.40	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	2.50	104.00
1992	40.90	0.00	0.50	0.00	0.00	0.10	0.00	0.20	0.80	0.00	5.20	59.40	107.10
1993	71.30	0.00	15.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.60
Avg.	52.78	28.88	11.41	0.53	0.18	0.98	0.63	0.82	1.26	3.31	2.60	17.58	120.93
Max.	173.80	122.70	24.00	2.80	2.10	5.20	7.10	5.80	13.60	23.00	12.40	59.50	354.90
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.20

Appendix A, 3.1 (12) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01730054-7 T. ISLUGA (COLCHANE)													
1975	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.00	27.00
1976	95.00	33.00	13.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	141.50
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.30	7.30
1979	158.90	1.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.30	172.90
1980	0.00	0.00	38.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.00
1981	61.00	81.90	20.00	13.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	175.90
1982	38.00	30.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.00
1983	2.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	0.00	0.00	9.00
1984	153.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.90	5.00	181.40
1985	19.00	90.50	13.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	28.00	50.60	209.10
1986	58.00	32.00	59.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	45.00	211.00
1987	113.00	18.00	3.50	0.00	0.00	3.00	0.00	0.00	0.00	9.00	0.00	0.00	146.50
1988	74.00	0.00	13.50	16.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	6.00	114.50
1989	8.00	16.00	23.00	35.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.00
1990	32.00	12.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	86.00
1991	95.00	13.00	16.50	3.00	0.00	0.00	0.00	0.00	0.00	5.00	6.00	0.00	138.50
1992	0.00	0.00	5.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	22.00	14.00	42.00
1993	58.00	1.00	23.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.00
Avg.	53.63	18.24	14.09	4.67	0.00	0.17	0.00	0.00	0.39	0.89	4.88	11.29	108.26
Max.	158.90	90.50	59.00	35.00	0.00	3.00	0.00	0.00	5.00	9.00	28.00	50.60	211.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.30

Appendix A, 3.1 (13) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01730055-5 MOCHA													
1988	0.80	0.00	12.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.20
1989	0.00	19.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.80
1990	0.00	12.30	0.20	0.00	1.20	2.30	0.00	0.00	0.00	0.00	0.00	12.40	28.40
1991	1.60	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.10
1992	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.10
1993	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.90
Avg.	0.55	5.35	2.35	0.00	0.20	0.40	0.00	0.00	0.00	0.00	0.00	2.07	10.92
Max.	1.60	19.80	12.40	0.00	1.20	2.30	0.00	0.00	0.00	0.00	0.00	12.40	28.40
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10

Appendix A, 3.1 (14) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01740050-9 PARCA													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
1979	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1980	0.00	6.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
1981	3.00	15.00	0.00	0.00	0.00	0.00	0.00	5.50	0.00	0.00	0.00	0.00	23.50
1982	0.00	0.00	3.50	0.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50
1983	0.00	9.50	0.00	0.00	0.00	4.50	0.00	0.00	11.00	0.00	0.00	4.50	29.50
1984	94.50	35.50	17.50	0.00	0.00	2.00	0.00	3.00	0.00	1.00	0.00	0.00	153.50
1985	3.00	7.50	14.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	28.00
1986	6.50	7.50	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	20.00
1987	29.50	6.50	26.00	0.00	0.00	1.00	0.00	0.00	0.00	2.50	0.00	0.00	65.50
1988	0.50	0.00	3.20	0.00	0.00	0.00	0.00	0.00	0.00	4.50	0.00	0.00	8.20
1989	0.00	21.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.50
1990	0.00	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	9.50
1991	15.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.00
1992	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.50	24.50
1993	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Avg.	9.79	6.62	4.04	0.24	0.00	0.62	0.00	0.50	0.65	0.47	0.00	2.06	24.98
Max.	94.50	35.50	26.00	4.00	0.00	4.50	0.00	5.50	11.00	4.50	0.00	17.50	153.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (15) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01750050-3 SAGASCA													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1979	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30
1980	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	1.20	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.30
1982	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
1983	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
1984	1.10	1.10	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	3.20
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.21	0.42	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.01	0.76
Max.	1.30	3.10	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.10	4.30
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (16) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01750051-1 MAMIGNA													
1986	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
1987	33.60	0.00	17.90	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	53.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	8.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	8.50
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.70	22.70
Avg.	6.10	1.33	2.98	0.00	0.00	0.08	0.00	0.00	0.00	0.25	0.00	3.78	14.53
Max.	33.60	8.00	17.90	0.00	0.00	0.50	0.00	0.00	0.00	1.50	0.00	22.70	53.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (17) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01770050-2 COPAQUIRE													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50	0.00	7.50	14.00
1978	10.00	10.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	1.00	0.00	0.00	22.50
1979	53.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.50
1980	0.00	4.50	10.50	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	16.50
1981	20.50	20.00	1.00	0.00	0.00	0.00	0.00	6.00	2.50	0.00	0.00	0.00	50.00
1982	1.00	0.00	1.00	0.00	14.00	8.00	0.00	0.00	1.50	0.00	0.00	4.00	29.50
1983	0.00	0.00	0.00	0.00	1.50	15.00	0.00	0.00	7.00	0.00	0.00	1.50	25.00
1984	47.00	44.00	0.00	0.00	0.00	26.50	0.00	0.00	0.00	3.50	0.00	0.00	121.00
1985	2.00	49.00	3.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	3.00	57.50
1986	13.40	2.00	11.00	0.00	0.00	1.50	0.00	1.50	0.00	0.00	0.00	11.00	40.40
1987	43.60	14.00	27.60	0.00	0.00	4.50	1.00	0.00	0.00	2.50	0.00	0.00	93.20
1988	1.50	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	0.00	0.00	15.50
1989	5.00	23.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	30.50
1990	5.00	20.00	12.40	0.00	0.00	1.50	0.30	0.00	0.00	0.00	0.00	18.50	57.70
1991	20.00	12.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	35.00
1992	9.00	0.00	0.00	0.00	0.00	11.00	0.00	0.00	0.00	0.00	0.00	20.00	40.00
1993	8.50	6.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Avg.	14.09	12.09	4.76	0.06	0.97	4.03	0.14	0.53	0.65	1.09	0.12	3.88	42.40
Max.	53.00	49.00	27.60	1.00	14.00	26.50	1.00	6.00	7.00	6.50	2.00	20.00	121.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.00

Appendix A, 3.1 (18) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01820050-3 IQUIQUE													
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.40
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.10
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.30
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
1992	7.00	0.00	0.00	0.00	10.50	0.00	0.00	0.00	0.00	0.00	0.00	1.90	19.40
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	0.78	0.00	0.00	0.00	1.05	0.02	0.05	0.00	0.01	0.00	0.00	0.19	2.10
Max.	7.00	0.00	0.00	0.00	10.50	0.20	0.30	0.00	0.10	0.00	0.00	1.90	19.40
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.1 (19) Average Monthly Precipitation observed by DGA in Pampa del Tamarugal Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Pamapa del Tamarugal >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 02113050-8 GUATACONDO DGA													
1977	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1978	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.40
1979	8.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.50
1980	0.00	0.00	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
1981	4.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00
1982	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
1983	0.00	0.00	0.00	0.00	0.00	12.00	0.00	0.00	0.00	0.00	0.00	5.00	17.00
1984	42.00	1.50	0.00	0.00	0.00	9.00	0.00	0.00	0.00	3.00	0.00	3.00	58.50
1985	0.00	10.50	9.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.50
1986	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
1987	8.00	0.00	25.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.50
1988	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
1989	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
1990	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
1991	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
1992	0.00	0.00	0.00	0.00	1.00	6.00	0.00	0.00	0.00	0.00	0.00	0.00	7.00
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg.	4.05	1.59	2.37	0.00	0.06	1.65	0.00	0.00	0.00	0.18	0.00	0.47	10.36
Max.	42.00	10.50	25.50	0.00	1.00	12.00	0.00	0.00	0.00	3.00	0.00	5.00	58.50
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix A, 3.2 (1) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Pampa del Tamarugal Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Pampa del Tamarugal>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Tarapaca River in Mina San Juan													
1984												0.223	0.223
1985	0.153			0.296	0.460	0.490	0.391	0.408	0.395	0.218	0.126	0.183	0.312
1986	0.340	0.443	0.438	0.280	0.312	0.278	0.305	0.230	0.237	0.208	0.201	0.284	0.296
1987	0.752	0.933	1.070	0.306	0.248	0.295	0.373	0.320	0.276	0.258	0.149	0.154	0.428
1988	0.271	0.191	0.282	0.254	0.273	0.326	0.383	0.286	0.262	0.185	0.082	0.125	0.243
1989	0.145	0.208	0.087	0.148	0.365	0.313	0.471	0.417	0.262	0.200	0.195	0.198	0.251
1990	0.233	0.417	0.267	0.184	0.210	0.265	0.257	0.285	0.224	0.205	0.202	0.436	0.265
AVG	0.316	0.438	0.429	0.245	0.311	0.328	0.363	0.324	0.276	0.212	0.159	0.229	0.303

Appendix A, 3.2 (2) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Pampa del Tamarugal Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Pampa del Tamarugal>

Unit : m3/s

ST: Coscaya River in Saitoco

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1985					0.094	0.118	0.130	0.139	0.135	0.113	0.127	0.128	0.123
1986	0.141	0.119	0.140	0.113	0.125			0.143	0.130	0.109	0.112	0.141	0.127
1987	0.417	0.160	0.118	0.109	0.130	0.138	0.156	0.140	0.133	0.125	0.093	0.097	0.151
1988	0.150	0.230	0.132	0.149	0.146	0.118	0.120	0.130	0.131	0.076	0.053	0.092	0.127
1989	0.116	0.176	0.146	0.121	0.124	0.126	0.144	0.157	0.114	0.102	0.116	0.104	0.129
1990	0.139	0.143	0.139	0.123	0.148	0.168	0.175	0.119	0.117	0.100	0.103	0.180	0.138
AVG	0.193	0.166	0.135	0.123	0.128	0.134	0.145	0.138	0.127	0.104	0.101	0.124	0.135

Appendix A, 3.2 (3) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Pampa del Tamarugal Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Pampa del Tamarugal>

Unit : m3/s

ST: Coscaya River in Pampa Lirima

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1977												0.141	0.141
1978	0.156	0.160	0.144	0.146		0.147	0.172	0.172	0.171	0.168	0.140	0.148	0.157
1979	0.232	0.181	0.248	0.253	0.297	0.295	0.290	0.214	0.193	0.091	0.078	0.102	0.206
1980	0.111	0.132	0.191	0.159	0.171	0.171	0.133	0.128	0.111	0.118	0.139	0.029	0.133
1981	0.068	0.205	0.254	0.171	0.112	0.156	0.247	0.218	0.236	0.165	0.097	0.075	0.167
1982	0.128	0.123	0.108	0.125	0.119	0.045	0.056	0.057	0.164	0.119	0.125	0.108	0.106
1983	0.119	0.172	0.205	0.221	0.261	0.343	0.197	0.183	0.177	0.152	0.142	0.151	0.194
1984	0.544	0.992	0.369	0.127	0.134	0.075	0.058	0.160	0.163	0.131	0.126	0.113	0.249
1985	0.127	0.273	0.189	0.151	0.158	0.155	0.130	0.097	0.113	0.112	0.111	0.104	0.143
1986	0.120	0.113	0.141	0.133	0.144	0.143	0.203	0.191	0.167	0.152	0.120	0.154	0.148
1987	0.387	0.198	0.169	0.168	0.178	0.205	0.264	0.123	0.141	0.091	0.091	0.094	0.176
1988	0.138	0.134	0.169	0.177	0.162	0.152	0.135	0.123	0.106	0.108	0.114	0.119	0.136
1989	0.141												0.141
AVG	0.189	0.244	0.199	0.166	0.174	0.172	0.171	0.151	0.158	0.128	0.117	0.112	0.165

Appendix A, 3.3 (1) Average Water Quality observed by DGA at Major Stations in Pampa del Tamarugal Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Pampa del Tamarugal>

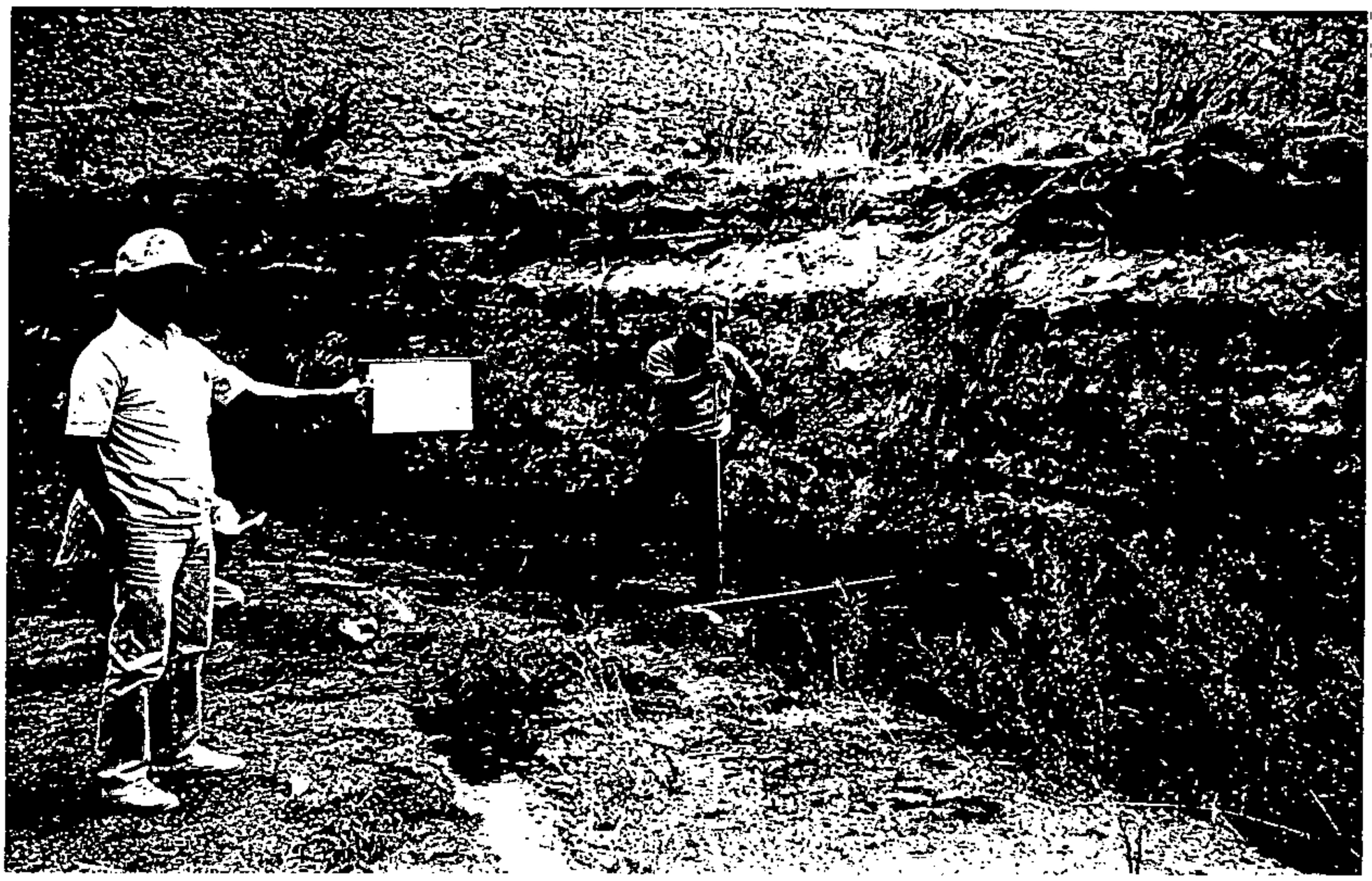
YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Quebrada Tarapaca in Pachica																		
1970	7.88	2,488	0.000	171.6	293	505	164.0	38.4	21.6	322.1	4.25							
1971	7.83	2,830	2.400	156.7	384	780	207.0	43.5	23.3	345.8	17.09	0.000	0.000					
1972	8.15	1,733	6.300	198.5	204	301	86.1	28.6	15.7	226.0	9.18							
1975	7.98	1,615	0.000	183.0	157	392	86.8	23.7	14.9	175.0	4.50	0.072		1.040	0.253			
1976	8.32	1,638	24.600	193.0	170	355	75.2	41.6	19.2	264.0	6.50	0.117	0.000	0.540	0.221			
1977	7.53	1,348	0.000	207.0	152	281	78.8	23.0	16.8	200.0	5.20	0.044	0.050	1.980	0.145	0.003		0.100
1978	7.00	1,131	0.000	173.3	98	305	66.9	27.3	20.2	138.7	5.61	0.129	0.050	4.160	0.122	0.001	0.163	0.025
1980	7.77	1,789	0.000	160.0	189	401	65.4	36.9	31.1	231.5	6.48	0.099		0.420				
1981	7.93	1,480	0.000	244.0	146	420	116.0	19.7	22.3	199.0	6.25	0.003						
1983	8.23	1,805	0.000	209.0		456	115.0	26.1	26.2	250.5	7.90	0.102		0.010				
1984	7.75	1,758	0.000	226.0		444	122.3	21.2	35.5	230.3	6.92	0.084		1.533				
1986	7.63	1,397	0.932	280.5		277	113.3	19.9	20.2	150.0								
1987	7.98	1,160	0.000	177.1		292	93.0	12.9	18.4	129.1								
Average	7.84	1,706	2.633	198.4	199	401	106.9	27.9	21.9	220.1	7.26	0.072	0.025	1.383	0.185	0.002	0.163	0.063

Appendix A, 3.3 (2) Average Water Quality observed by DGA at Major Stations in Pampa del Tamarugal Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Pampa del Tamarugal>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Coscaya River at Pampa Lirima																		
1975	7.75	794	0.000	92.1	49	223	60.1	13.5	12.5	79.5	1.13	0.264	0.000	0.330	0.000			
1976	7.85	748	0.000	85.4	149	120	31.5	26.6	13.3	77.5	2.90	0.145	0.000	0.710	0.294			
1977	7.00	969	0.000	86.9	151	165	17.8	13.8	17.8	155.4	4.42	0.225	0.050	2.330	0.000	0.002		0.356
1978	7.38	650	0.000	81.3	44	199	40.0	18.8	15.6	64.5	4.82	0.198	0.040	0.580	0.057	0.005	0.130	0.121
1980	7.66	803	0.000	84.8	73	226	40.4	22.0	19.6	85.7	2.79	0.315		1.120				
1981	7.29	688	0.000	85.4	45	220	61.3	7.3	14.1	77.9	4.25	0.015						
1983	7.51	794	0.000	82.7	58	234	63.0	10.6	15.8	81.5	4.04	0.231		0.538				
1984	7.50	762	0.000	87.6		217	63.5	8.0	14.1	76.4	2.33	0.190		0.250				
1985	7.50	732	0.000	81.8		207	63.5	5.8	20.6	73.6	3.28	0.194						
1986	7.55	769	0.000	98.3		187	63.3	7.8	15.3	73.8	2.39	0.177		0.210				
1987	7.58	771	0.000	82.1		204			14.5	78.4	1.81	0.268					0.138	
1989	7.60	790	0.000	88.5		234			14.9	79.1	1.02	0.267			0.002		0.100	
Average	7.51	772	0.000	86.4	81	203	50.4	13.4	15.7	83.6	2.93	0.207	0.023	0.758	0.071	0.003	0.123	0.238

Appendix A, 3.3 (3) Average Water Quality observed by DGA at Major Stations in Pampa del Tamarugal Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Pampa del Tamarugal>

YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	Cl mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l
ST: Quebrada Tarapaca in Mocha																		
1970	7.28	2,170	0.000	195.5	282	512	120.6	31.3	22.0	308.4	5.53							
1971	7.68	1,832	4.800	173.8	263	453	114.5	26.6	21.1	281.5	6.76	0.000	0.000					
1972	7.93	1,427	0.000	207.5	186	255	94.6	22.1	14.7	188.5	2.00							
1975	7.50	1,237	0.000	185.0	120	282	83.4	15.6	12.5	149.0	6.00	0.082	0.200	4.660	0.000			
1976	8.37	1,466	18.300	199.0	143	274	75.2	30.6	18.4	205.0		0.078	0.050	1.120	0.176	5.650		
1981	7.32	1,480	0.000	247.0	141	410	73.9	43.4	23.1	212.0		0.158				6.550		
Average	7.68	1,602	3.850	201.3	189	364	93.7	28.3	18.6	224.1	5.07	0.080	0.083	2.890	0.088	6.100		

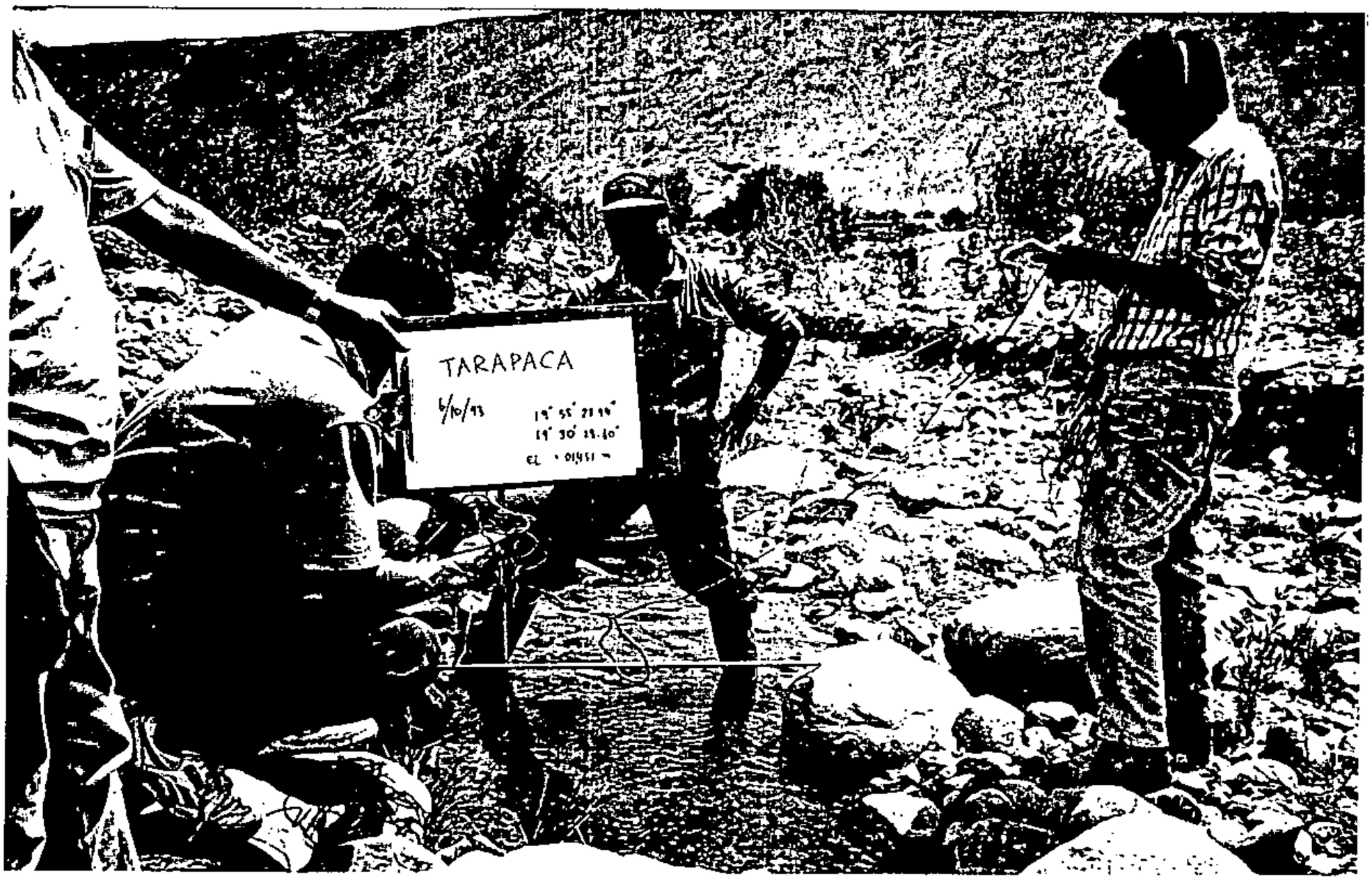


Aroma River

Quipisca River

Appendix A, 3.4 (1) Field Observation in Pampa del Tamarugal Basin on 6th October 1993

<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octobre 1993>

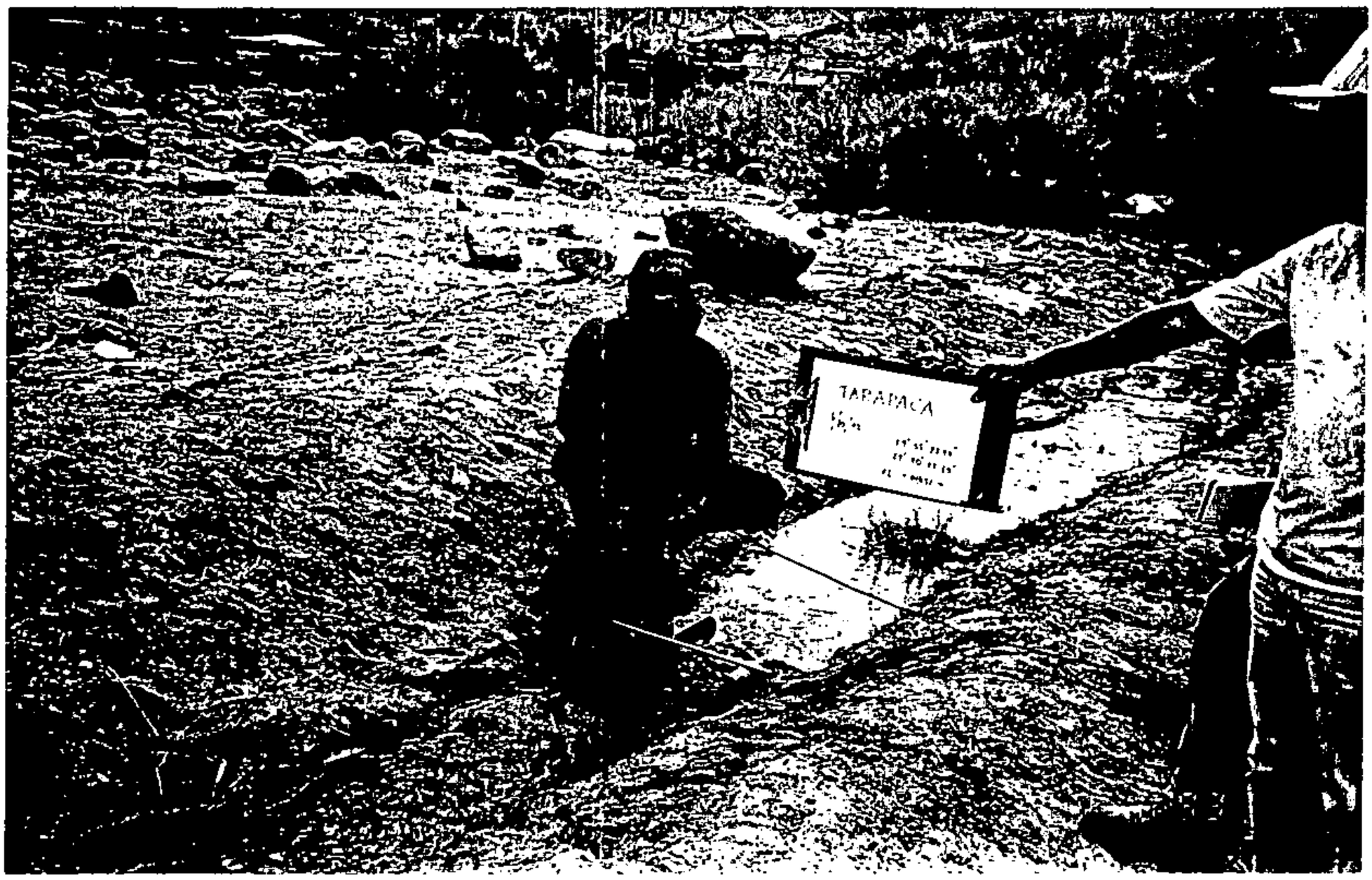


Tarapaca River (1)

Tarapaca River (2)

Appendix A, 3.4 (2) Field Observation in Pampa del Tamarugal Basin on 6th October 1993

<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octobre 1993>



Tarapaca River (3)

Tarapaca River (4)

Sagasca River

Water Sampling in Sagasca River

Appendix A, 3.4 (4) Field Observation in Pampa del Tamarugal Basin on 6th October 1993

<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octobre 1993>

Appendix A, 4.1 (1) Average Monthly Precipitation observed by DGA in Salar de Huasco Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Salar de Huasco >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01042050-4 CANCOSA													
1976	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	18.00	19.00
1977	52.00	152.00	62.00	1.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	275.00
1978	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	11.00	0.00	15.00
1979	137.00	0.00	18.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	157.00
1980	0.00	0.00	17.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.00
1981	36.00	225.00	35.00	18.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	314.00
1982	118.00	12.00	0.00	26.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.00	165.00
1983	0.00	0.00	5.00	0.00	0.00	4.00	0.00	0.00	3.00	0.20	0.00	0.00	12.20
1984	217.00	210.00	39.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.00	0.00	477.00
1985	121.00	167.00	31.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	11.30	36.60	368.90
1986	39.00	29.00	53.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	36.00	34.00	192.50
1987	138.50	47.50	0.00	0.00	0.00	28.00	22.00	0.00	0.00	22.00	1.00	0.00	259.00
1988	4.80	0.00	2.40	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00	38.70
1989	29.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.00
1991	65.50	33.50	58.00	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	159.50
1992	70.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	12.00	20.50	102.80
1993	55.00	0.00	21.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.00
Avg.	63.69	51.53	20.11	3.12	0.47	2.00	1.31	0.00	0.24	1.54	4.84	8.65	157.51
Max.	217.00	225.00	62.00	26.00	8.00	28.00	22.00	0.00	3.00	22.00	36.00	36.60	477.00
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.20

Appendix A, 4.1 (2) Average Monthly Precipitation observed by DGA in Salar de Huasco Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Salar de Huasco >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01050050-8 COYACAGUA													
1961	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.70	71.00	73.70
1962	23.50	13.00	1.50	19.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.00
1963	41.00	48.00	10.00	0.00	0.00	2.00	0.00	0.00	1.50	0.00	0.00	6.50	109.00
1964	17.00	42.00	10.50	5.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	7.00	83.00
1965	23.50	7.00	7.50	0.00	0.00	0.00	0.00	0.00	32.50	0.00	0.00	16.00	86.50
1966	0.00	13.00	7.50	0.00	0.50	0.50	0.00	0.00	0.00	0.00	1.50	4.00	27.00
1967	16.50	97.20	28.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	20.50	163.70
1968	46.00	70.50	51.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	10.00	1.50	184.00
1969	62.50	62.50	20.00	0.00	0.00	12.00	0.00	1.50	0.50	0.00	0.00	12.50	171.50
1970	15.00	28.00	13.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	7.50	0.00	69.50
1971	44.00	97.50	0.00	7.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	16.50	171.00
1972	132.00	14.50	17.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	22.50	187.00
1973	85.00	105.10	41.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	234.10
1974	165.50	103.00	13.50	0.00	0.00	0.00	2.00	5.50	1.00	0.00	0.00	0.00	290.50
1975	72.00	132.00	32.00	4.00	0.50	5.00	0.00	0.00	0.00	0.00	0.00	0.00	245.50
1976	75.00	18.50	28.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	122.00
1977	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	12.00	0.00	18.50	31.00
1978	80.00	26.50	5.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	3.50	4.00	122.50
1979	112.00	1.00	61.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	194.50
1980	0.00	6.00	43.50	0.50	1.50	0.00	8.00	0.00	0.00	2.00	0.00	0.00	61.50
1981	23.00	74.00	8.00	2.50	0.00	0.00	0.00	1.50	0.00	0.00	0.00	35.50	144.50
1982	52.50	7.00	14.00	6.00	3.50	1.50	0.00	0.00	2.50	19.00	4.50	0.50	111.00
1983	5.50	5.00	10.00	0.00	0.00	9.50	0.00	0.00	14.00	0.00	0.00	2.00	46.00
1984	131.00	143.50	27.70	0.00	0.00	9.80	0.00	7.50	0.00	9.00	7.20	0.00	335.70
1985	16.50	88.50	16.30	1.20	0.00	3.50	0.00	0.00	0.50	0.00	16.20	38.00	180.70
1986	28.50	43.90	24.50	0.00	0.00	1.50	0.00	1.00	0.00	0.00	13.00	53.60	166.00
1987	124.30	7.00	20.60	0.00	0.00	7.20	1.00	0.00	0.00	0.00	0.00	0.00	160.10
1988	24.30	0.00	10.80	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.30
1989	17.40	39.70	32.10	1.20	0.00	0.50	0.00	0.00	0.00	0.00	1.80	0.00	92.70
1990	28.40	17.60	11.00	0.00	4.80	5.30	0.00	0.00	0.00	0.00	0.00	23.10	90.20
1991	56.00	0.00	11.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	75.00
1992	44.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	21.10	34.50	100.30
1993	48.20	0.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.20
Avg.	48.80	39.74	18.18	1.55	0.68	1.96	0.33	0.56	1.60	1.41	2.70	12.64	130.16
Max.	165.50	143.50	61.50	19.00	6.00	12.00	8.00	7.50	32.50	19.00	21.10	71.00	335.70
Min.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.00

Appendix A, 4.1 (3) Average Monthly Precipitation observed by DGA in Salar de Huasco Basin

< Precipitacion Mensual Promedio observada por DGA en la Cuenca del Salar de Huasco >

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station : 01051050-3 SALAR HUASCO													
1981	0.00	0.10	0.00	8.20	0.00	0.20	0.00	0.00	0.00	0.00	0.00	28.50	37.00
1982	2.70	1.60	10.50	5.50	3.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	27.30
Avg.	1.35	0.85	5.25	6.85	1.50	2.10	0.00	0.00	0.00	0.00	0.00	14.25	32.15
Max.	2.70	1.60	10.50	8.20	3.00	4.00	0.00	0.00	0.00	0.00	0.00	28.50	37.00
Min.	0.00	0.10	0.00	5.50	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	27.30

Appendix A, 4.2 (1) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Salar de Huasco Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Salar de Huasco>

Unit : m3/s

ST: Quebrada Piga in Collacagua

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1947	0.462	0.285	0.210	0.210	0.230	0.239	0.245	0.122	0.126	0.128	0.122	0.175	0.213
1948	0.210	0.318	0.562	0.472	0.289	0.229							0.347
1959											0.103	0.104	0.104
1960	0.128	0.103	0.098	0.105	0.132	0.172	0.195	0.158	0.134	0.106	0.093	0.097	0.127
1961		0.125	0.106		0.120	0.195	0.179	0.146	0.120	0.101	0.093	0.100	0.129
1962	0.102	0.097	0.095	0.104	0.119	0.142	0.173	0.185	0.140	0.116	0.115	0.113	0.125
1963	0.127	0.136	0.125	0.107	0.112	0.162	0.148	0.138	0.124	0.104	0.095	0.092	0.123
1964	0.097	0.114	0.102	0.104	0.123	0.163	0.192	0.197	0.152	0.127	0.100	0.099	0.131
1965	0.101	0.099	0.101	0.107	0.134	0.156	0.184		0.162	0.125	0.105	0.094	0.124
1966	0.085	0.083	0.085	0.085	0.128	0.161	0.190	0.176	0.158	0.112	0.094	0.087	0.120
1967	0.086	0.127	0.113	0.090	0.100	0.122	0.131	0.143	0.117	0.087	0.082	0.094	0.108
1968	0.112	0.125	0.138	0.104	0.115	0.154	0.161	0.153	0.135	0.106	0.093	0.079	0.123
1969	0.098	0.107	0.104	0.086	0.102	0.150		0.138	0.117		0.084	0.081	0.107
1970	0.086									0.108	0.090	0.085	0.092
1971	0.112	0.169	0.102	0.109	0.132			0.149	0.110	0.107	0.088	0.086	0.116
1977											0.076	0.083	0.080
1978	0.090	0.183	0.108	0.110	0.113	0.118	0.116	0.112	0.103	0.104	0.105	0.109	0.114
1979	0.149	0.134	0.138	0.125	0.135	0.138	0.141	0.133	0.143	0.154	0.154	0.145	0.141
1980	0.146	0.160	0.171	0.164	0.170	0.174	0.075	0.079	0.080	0.087	0.098	0.116	0.127
1981	0.132	0.157	0.170	0.160	0.169	0.163	0.155	0.109	0.108	0.110	0.128	0.195	0.146
1982	0.119	0.116	0.132	0.138	0.141	0.140	0.134	0.105	0.071	0.067	0.075	0.110	0.112
1983	0.113	0.135	0.180	0.181	0.174	0.187	0.171	0.160	0.165	0.156	0.167	0.201	0.166
1984	0.386	0.369	0.155	0.142	0.127	0.139	0.123	0.117	0.116	0.140	0.130	0.137	0.173
1985	0.157	0.185	0.200	0.160	0.169	0.192	0.188	0.180	0.167	0.161	0.169	0.160	0.174
1986	0.089	0.093	0.106	0.100	0.129	0.146	0.145	0.147	0.127	0.102	0.103	0.109	0.116
1987	0.321	0.157	0.142	0.143	0.151	0.165	0.170	0.163	0.157	0.167	0.084	0.089	0.159
1988	0.098	0.105	0.124	0.151	0.170	0.182	0.160	0.125	0.124	0.137	0.146	0.140	0.139
1989	0.084	0.140	0.170	0.166	0.149	0.119	0.097	0.149	0.146	0.141	0.148	0.157	0.139
1990	0.120	0.160	0.187	0.147	0.157	0.144	0.140	0.095	0.081	0.083	0.097	0.119	0.128
AVG	0.147	0.153	0.151	0.143	0.146	0.162	0.157	0.141	0.127	0.117	0.108	0.116	0.139

Appendix A, 4.2 (2) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Salar de Huasco Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Salar de Huasco>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Quebrada Piga in Ojos de Agua													
1959											0.060	0.065	0.063
1960	0.065	0.062	0.060	0.060	0.064	0.072	0.072	0.072	0.072	0.069	0.060	0.061	0.066
1961		0.086	0.063								0.072	0.079	0.075
1962	0.077	0.084	0.084	0.084	0.084	0.084		0.084	0.084	0.081	0.060	0.060	0.079
1963	0.060	0.060	0.060	0.060	0.060	0.084	0.084	0.084	0.084	0.077	0.072	0.065	0.071
1964	0.070	0.075	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072
1967				0.052									0.052
AVG	0.068	0.073	0.068	0.066	0.070	0.078	0.076	0.078	0.078	0.075	0.066	0.067	0.072

Appendix A, 4.2 (3) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Salar de Huasco Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Salar de Huasco>

Unit : m3/s

ST: Collacagua River in Pegnablanca

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
1981		0.490	0.499	0.259	0.171	0.247	0.188	0.267	0.245	0.151	0.145	0.129	0.254
1982	0.146	0.128	0.133	0.130	0.254	0.149	0.165	0.208	0.177	0.197	0.172	0.168	0.169
1983	0.119	0.103	0.110	0.146	0.215	0.245							0.156
1984			0.297	0.186	0.223	0.329	0.291	0.442	0.823	1.070		1.020	0.520
1985	0.203	0.209	0.050	0.182	0.201	0.272	0.459	0.282	0.322	0.359	0.163	0.183	0.240
1986	0.148	0.106	0.185	0.127	0.143				0.094	0.081	0.075	0.095	0.117
1987	0.281			0.108	0.123	0.125	0.127	0.123	0.098		0.117	0.133	0.137
1988	0.168	0.176	0.163	0.100	0.091	0.142	0.135	0.149	0.119	0.093	0.075	0.076	0.124
1989	0.078	0.092	0.094	0.094	0.105	0.136	0.198	0.199	0.164	0.135	0.122	0.112	0.127
1990	0.131	0.133	0.144	0.136	0.174	0.182	0.189	0.188	0.154	0.125	0.120	0.142	0.152
AVG	0.159	0.180	0.186	0.147	0.170	0.203	0.219	0.232	0.244	0.276	0.124	0.229	0.197

Appendix A, 4.2 (4) Average Monthly Surface Flow Rate observed by DGA at Major Stations in Salar de Huasco Basin

<Nivel Promedio Mensual de Flujo de Superficie Observado por DGA en las Principales Estaciones en la Cuenca del Salar de Huasco>

Unit : m3/s

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Batea River in Confluencia													
1980									0.026	0.037	0.029	0.027	0.030
1981	0.025	0.047	0.017	0.018	0.032	0.027	0.024	0.031	0.027	0.023	0.023	0.031	0.027
1982	0.029	0.025	0.027	0.028	0.030	0.035	0.031	0.033	0.029	0.027	0.023	0.026	0.029
1983	0.023	0.023	0.021	0.027	0.035	0.037	0.026	0.025	0.021	0.017	0.028	0.033	0.026
1984	0.024	0.031								0.022	0.020	0.019	0.023
1985	0.021	0.026	0.021	0.023	0.021	0.024	0.024	0.023	0.024	0.022	0.021	0.021	0.023
1986	0.022	0.020	0.021	0.022	0.021	0.022	0.022	0.022	0.021	0.019	0.019	0.020	0.021
1987	0.027	0.020	0.022	0.013	0.014	0.018	0.023	0.021	0.022	0.023	0.023	0.021	0.021
1988	0.022	0.020	0.021	0.020	0.021	0.022	0.021	0.021	0.020	0.019	0.019	0.020	0.021
1989	0.021	0.020	0.022	0.018	0.020	0.020	0.021	0.021	0.020	0.018	0.018	0.016	0.020
1990	0.018	0.019	0.022	0.024	0.022	0.022	0.020	0.024	0.024				0.022
AVG	0.023	0.025	0.022	0.021	0.024	0.025	0.024	0.025	0.023	0.023	0.022	0.023	0.023

Appendix A, 5 Water Quality Standard for Potable Water
<Normas Sobre AGua Potable>

Item		Unit	WHO	USA	Chile	Japan
Health Significance	As	(mg/l)	0.05	0.05	0.05	0.05
	Cd	(mg/l)	0.005	0.010	0.010	0.010
	Cr	(mg/l)	0.05	0.05	0.05	0.05
	CN	(mg/l)	0.10	0.20	0.20	-
	F	(mg/l)	1.50	-	1.50	0.80
	Pb	(mg/l)	0.05	0.05	0.05	0.10
	NO3	(mg/l)	10.0	10.0	10.0	9.0
Aesthetic Quality	pH		6.5-8.0	6.0-8.0	6.0-8.5	6.5-8.6
	CaCO3	(mg/l)	500.0	-	-	-
	Cl	(mg/l)	250.0	250.0	250.0	-
	SO4	(mg/l)	400.0	250.0	250.0	-
	Na	(mg/l)	200.0	-	-	-
	Zn	(mg/l)	5.00	5.00	5.00	1.00
	Al	(mg/l)	0.20	-	-	-
	Cu	(mg/l)	1.00	1.00	1.00	1.00
	Fe	(mg/l)	0.30	0.30	0.30	0.30
	Mn	(mg/l)	0.10	0.05	0.10	0.05
	TDS	(mg/l)	1,000	500	-	-
Others	Temp	(C)	-	-	-	-
	EC	(mh/cm)	-	-	-	-
	CO3	(mg/l)	-	-	-	-
	HCO3	(mg/l)	-	-	-	-
	Ca	(mg/l)	-	-	-	-
	Mg	(mg/l)	-	-	125.0	-
	K	(mg/l)	-	-	-	-
	Turbidity	(mg/l)	-	-	5.00	2.00
	DO	(mg/l)	-	4.00	-	-
	B	(mg/l)	-	1.00	-	-

Note : "WHO" refers to the Standard of World Health Organization
"USA" refers to the Standard of FWPCA, USA
"Chile" refers to the Standard of Ministry of Health, Chile
"Japan" refers to the Standard of Ministry of Welfare, Japan