

Appendix A,1.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
<u>ST: Bocatoma Lauca</u>													
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,1.1 (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

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,1.1 (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
<u>ST: Ausipar</u>													
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,1:1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Antes Bocatoma Azapa													
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,1.1 (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
<u>ST: Ausipar & Antes Bocatoma Azapa</u>													
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,1.1 (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,1.1 (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, I2.(1) Field Observation in San José River Basin on 12th June 1993

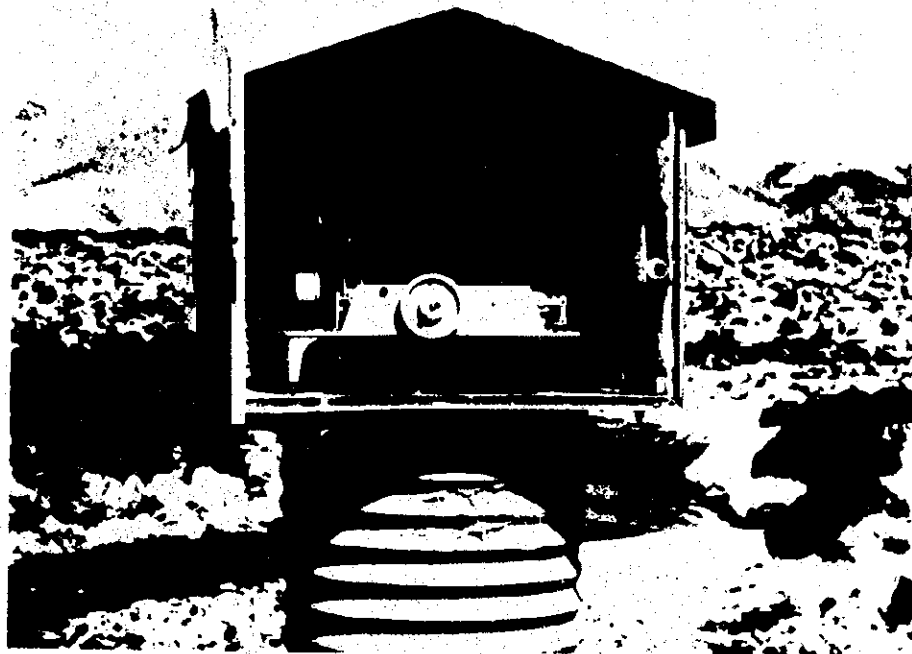
<Observacion en Terreno en la Cuenca del Rio San José el 12 Junio 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Tignamar River



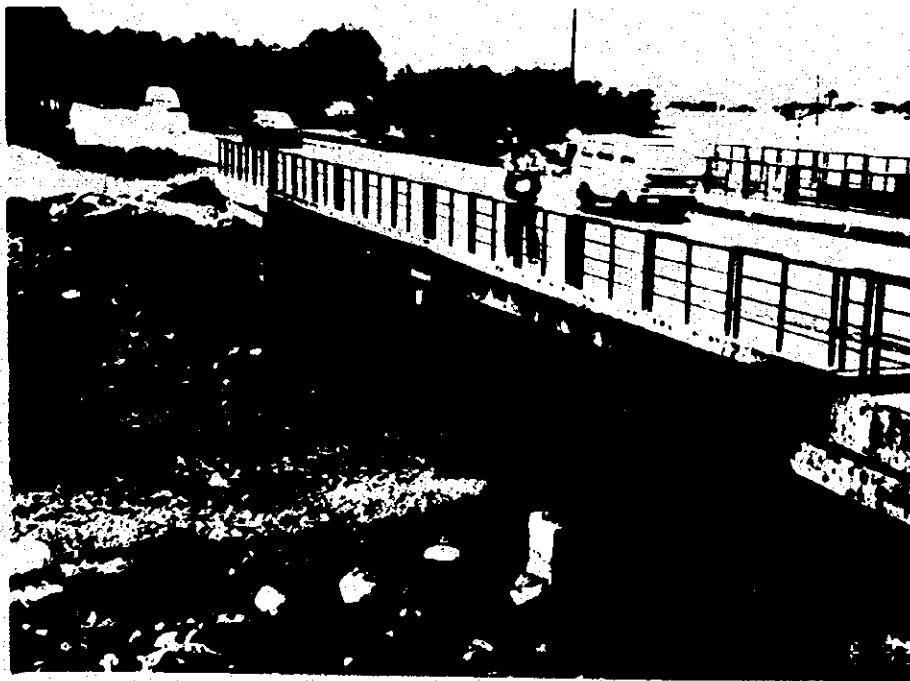
Automatic Water Level Recorder

Appendix A, 1.2.(2) Field Observation in San José River Basin on 12th June 1993

<Observacion en Terreno en la Cuenca del Río San José el 12 Junio 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Saucache Bridge



Field Water Quality Examination

Appendix A, L2(3) Field Observation in San José River Basin on 12th June 1993

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

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA

Appendix A.1.3 (1) Average Water Quality Observed by DGA at Major Stations in San José River Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San José>

YEAR	PH	EC mhos/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-NO ₃ mg/l	N-NO ₂ mg/l	P mg/l	N-NH ₃ 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.1.3 (2)

Average Water Quality Observed by DGA at Major Stations in San José River Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San José>

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
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			

ST: San Jose River at Ausipal

Appendix A.1.3 (3) Average Water Quality Observed by DGA at Major Stations in San José River Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Río San José>

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	0.00	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, 1.3 (4)

Average Water Quality Observed by DGA at Major Stations in San José River Basin
<Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio San José>

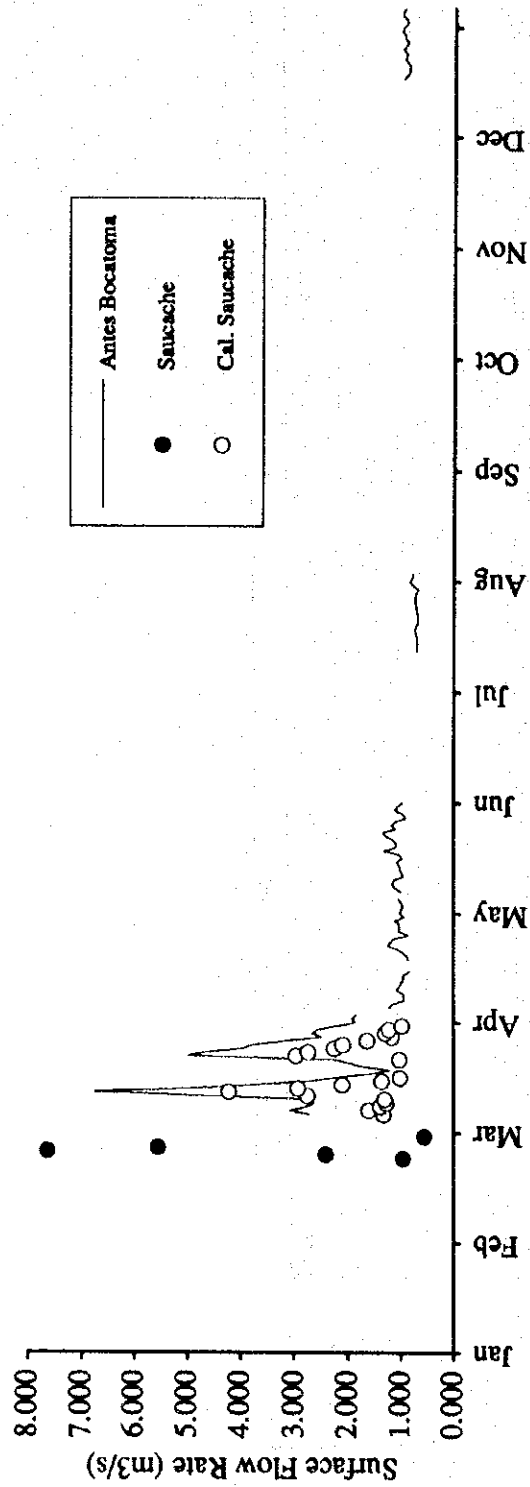
YEAR	PH	EC mhos/cm	CO3 mg/l	HCO3 mg/l	CL mg/l	SO4 mg/l	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	B mg/l	As mg/l	Cu mg/l	Fe mg/l	N-NO3 mg/l	N-NO2 mg/l	P mg/l	N-NH3 mg/l		
1970	7.70	1165.00	11.25	213.50	83.30	210.00	52.40	36.95	11.54	103.50	2.50									
1971	8.20	984.50	0.00	178.00	85.80	262.00	72.85	41.00	6.06	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	0.10	
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				
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.1.3 (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	
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

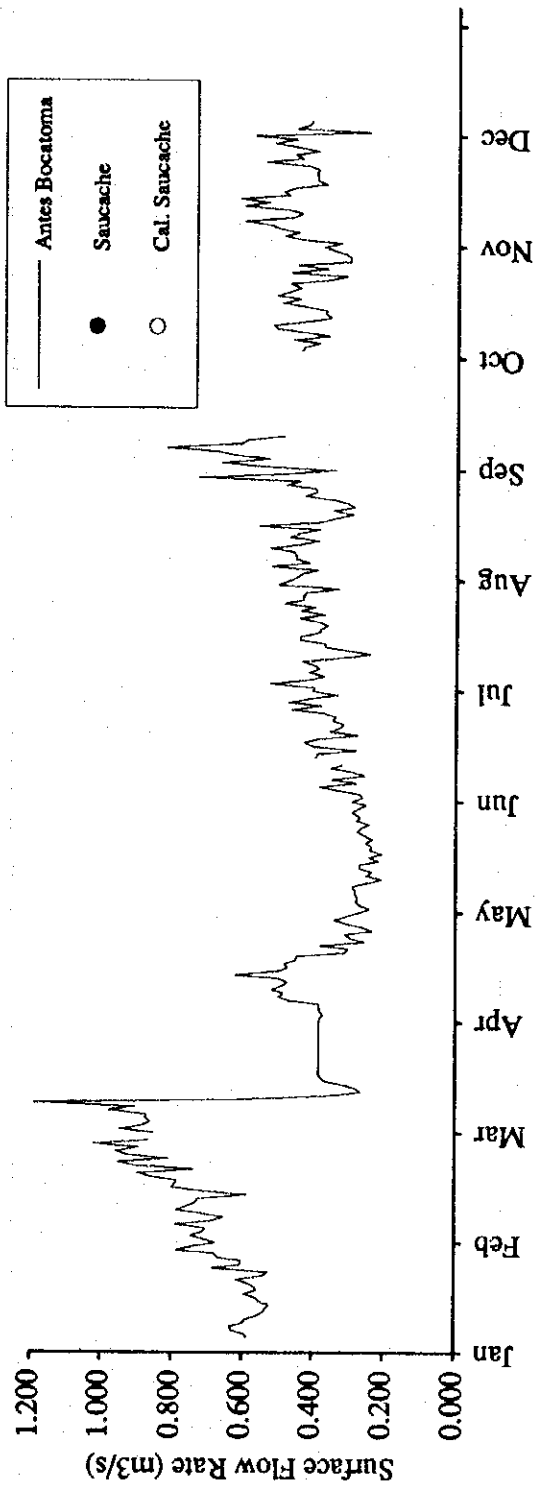
ST: San Jose River at Saucache

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1984



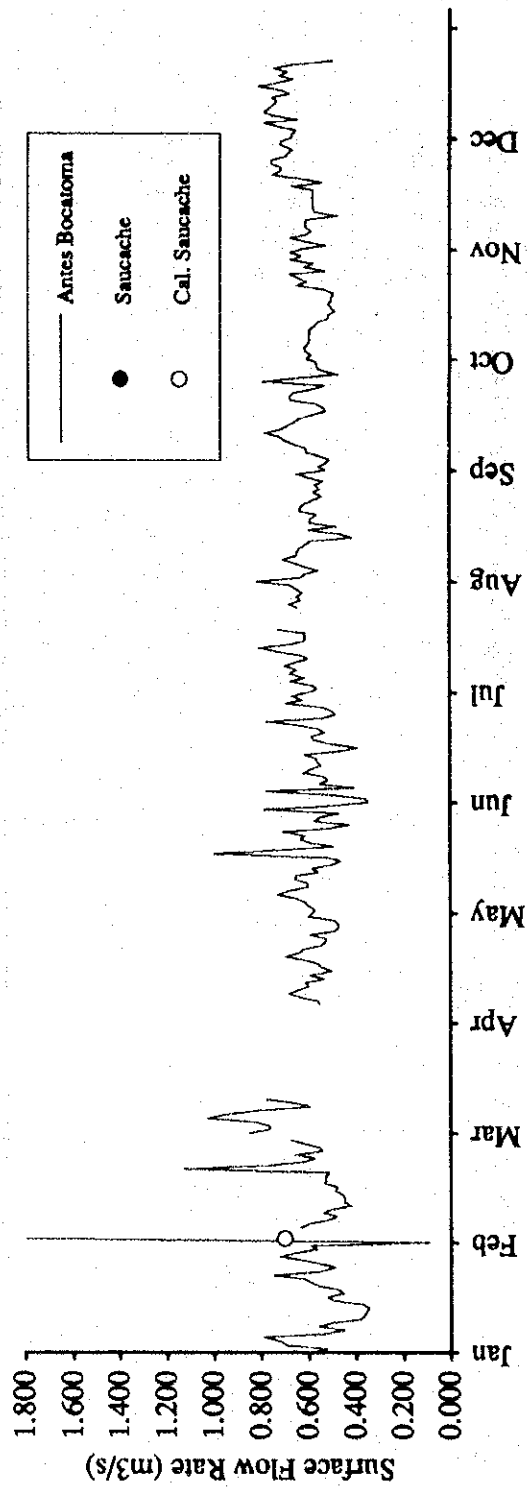
Appendix A, 1.4 (1) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1983



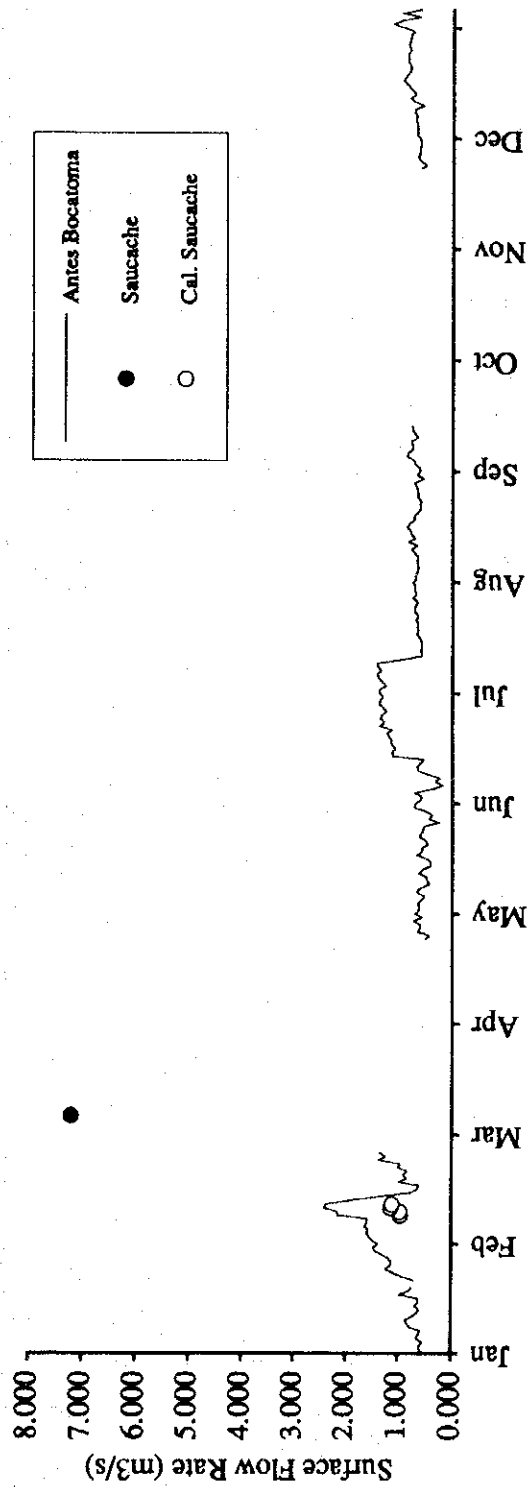
Appendix A,1.4(2) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1982



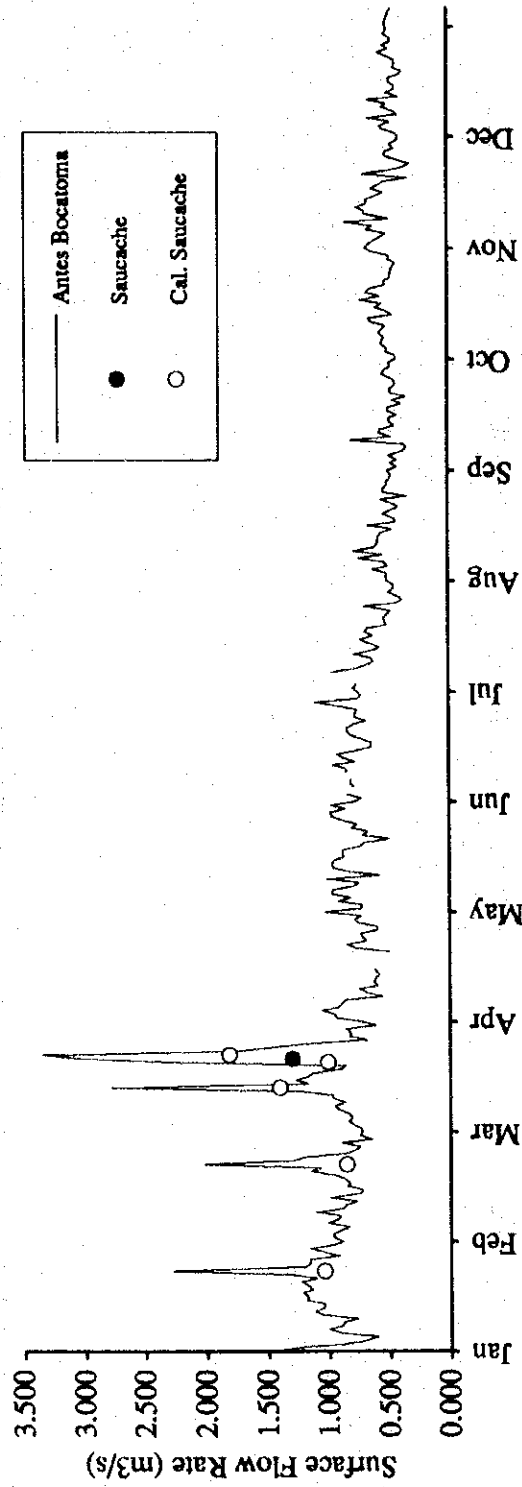
Appendix A,1.4 (3) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

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



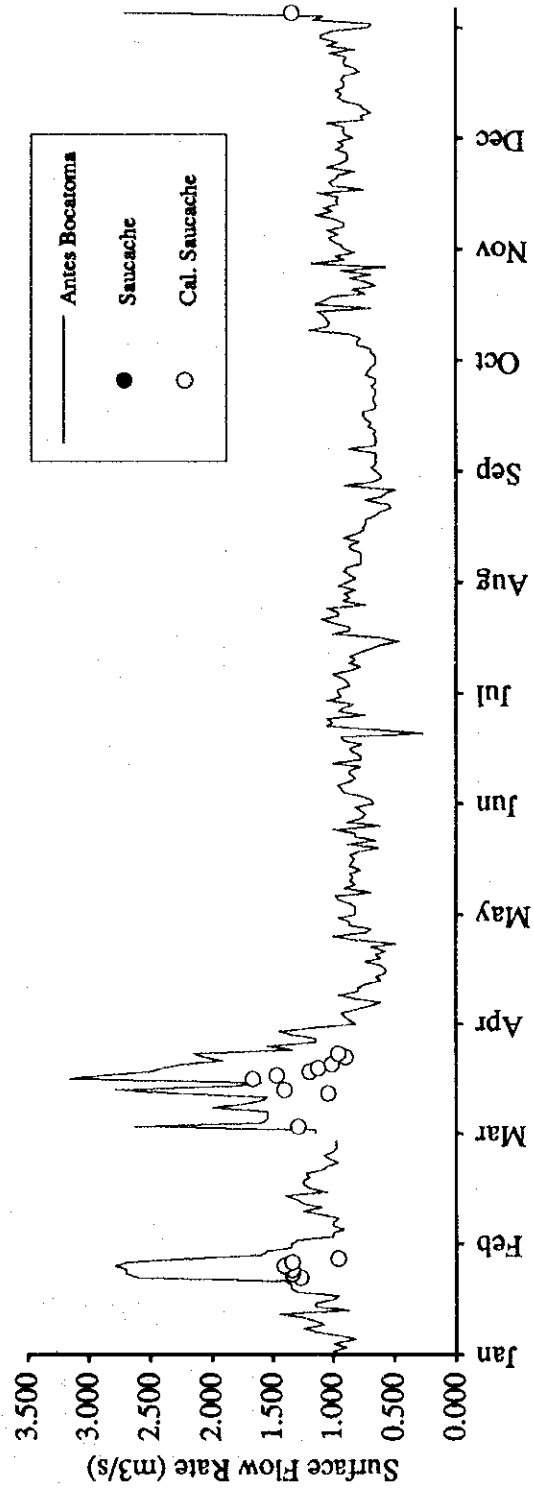
Appendix A, 1.4(4) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1980



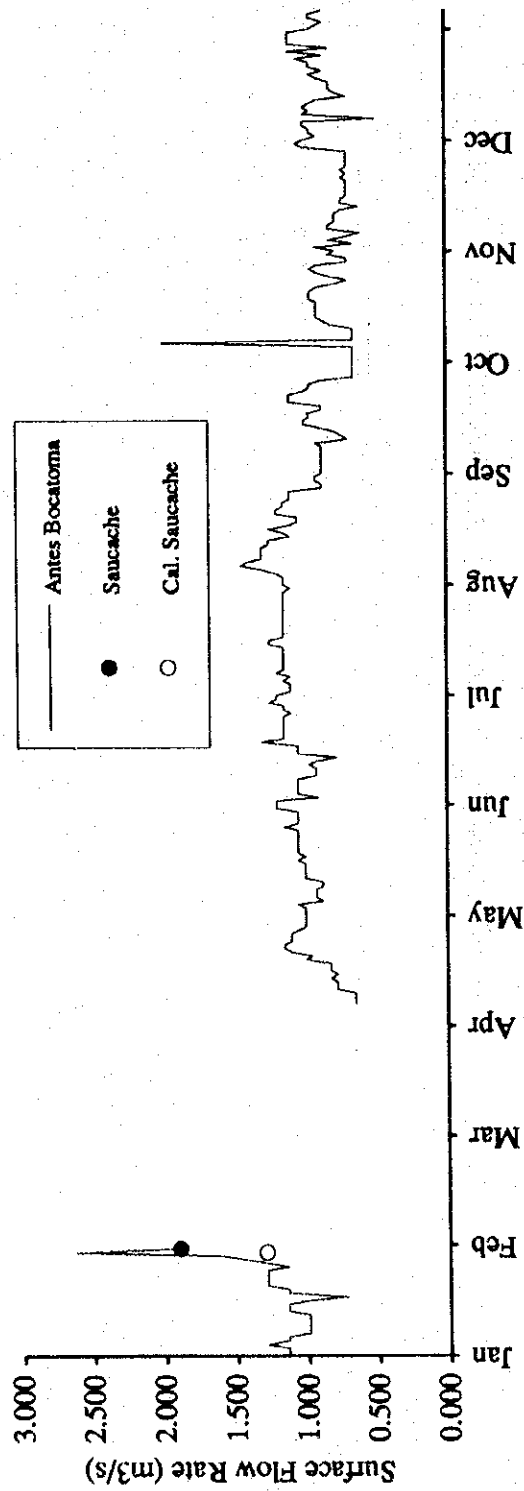
Appendix A.1.4 (5) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

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



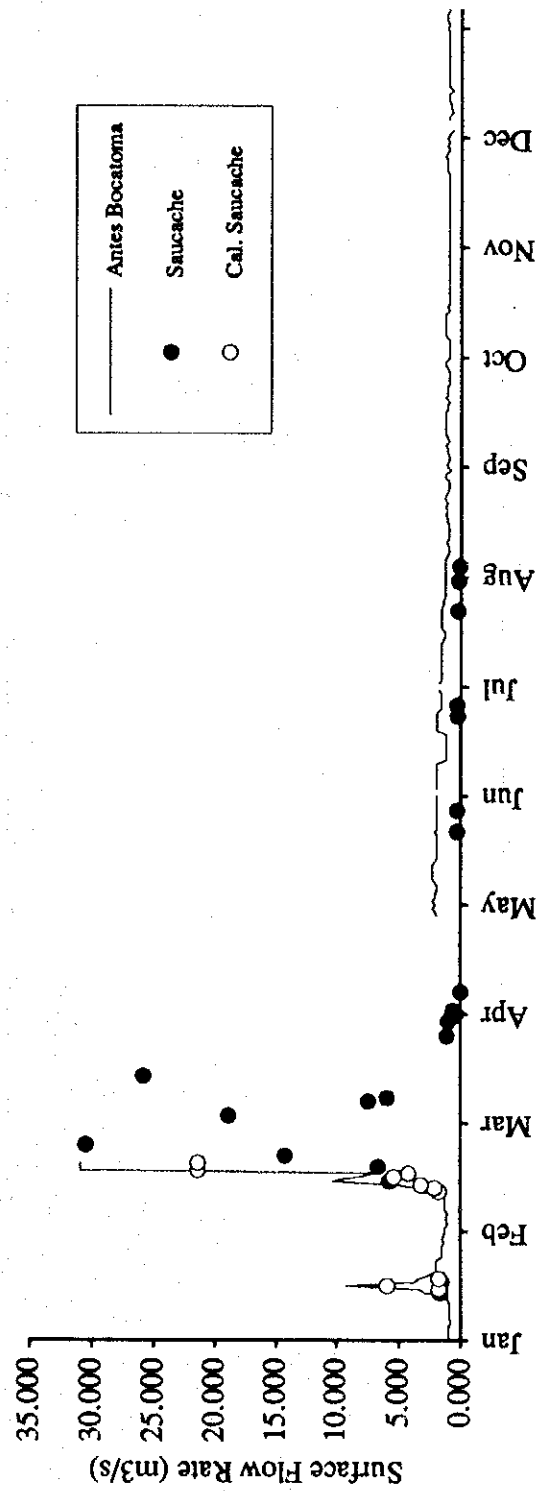
Appendix A,1.4 (6) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1978



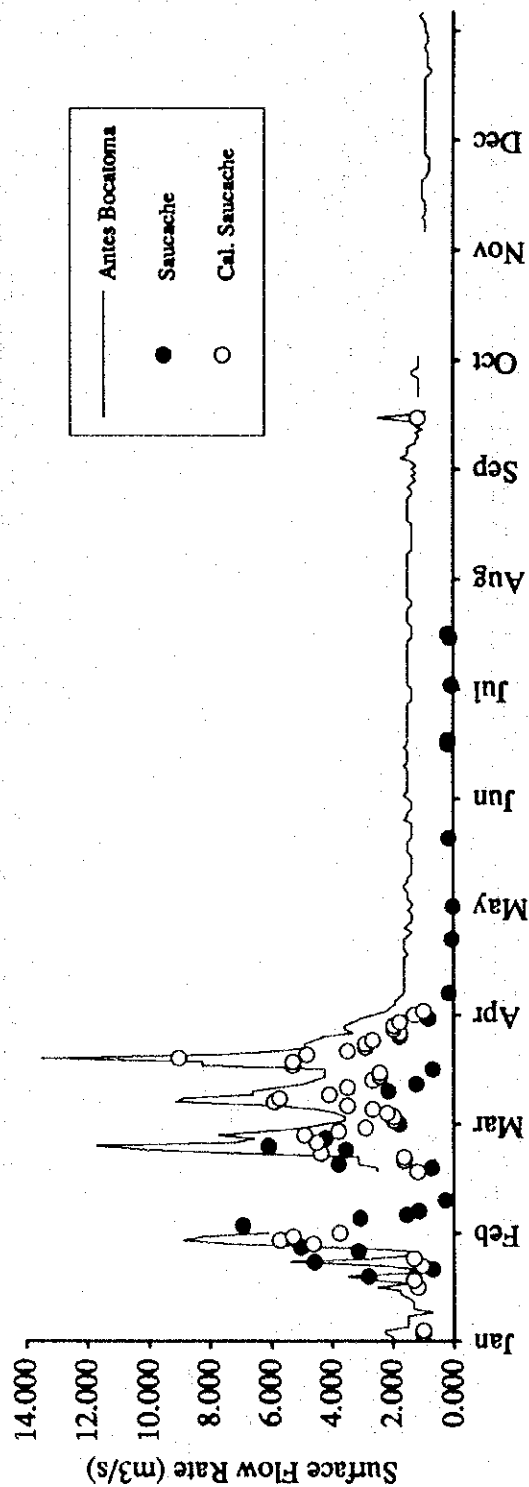
Appendix A, 1.4 (7) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1977



Appendix A,1.4 (8) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Observed and Calculated Daily Surface Flow Rate at Antes Bocatoma and Saucache in 1976



Appendix A, 1.4(9) Observed and Calculated Daily Flow Rate at Antes Bocatoma and Saucache
 <Nivel Diario de Flujo Observado y Calculado Antes Bocatoma y Saucache>

Appendix A, 1.4 (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>

Unit : m³/s

(No observation at Saucache in 1983)

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		Saucache	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	Qcal	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			0.698			0.618									
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									
6	1.500		0.860	0.954			1.140			0.935			0.910			0.630			0.535								0.589	
7	1.500		0.954	0.930			0.994			1.150			1.010			0.579			0.453								0.596	
8	1.500		0.930	0.930			0.994			1.250			0.905			0.767			0.558								0.629	
9	0.716		0.930	0.930			0.994			1.080			0.890			0.833			0.502								0.634	
10	1.340		0.930	0.930			0.994			1.150			0.774			0.858			0.384								0.601	
11	1.340		0.930	0.930			0.994			1.250			1.060			0.736			0.369								0.592	
12	1.340		1.120	1.120			0.994			1.450			1.120			0.654			0.362								0.562	
13	1.500		1.120	1.120			1.140			0.875			1.050			0.613			0.351								0.541	
14	1.750		2.900	1.710			1.140			1.150			1.040			0.697			0.375								0.535	
15	1.750		3.360	3.360			1.140			1.150			1.190			0.625			0.496								0.526	
16	2.520		1.217	9.280			0.994			1.000			1.180			0.619			0.572								0.552	
17	1.500		3.800	1.580			0.722			0.956			1.220			0.977			0.455								0.565	
18	2.680		1.331	3.360			1.140			1.300			1.140			0.818			0.478								0.595	
19	3.490	2.810		2.560			1.140			1.350			1.180			0.749			0.557								0.561	
20	1.500		2.000	2.000			1.290			1.350			1.230			0.709			0.593								0.557	
21	1.340	0.710		2.000			1.290			1.400			1.110			0.922			0.622								0.586	
22	2.320		1.075	2.000			1.290			2.600			1.274			0.922			0.747								0.618	
23	5.380	4.600		2.000			1.290			2.700			1.345			0.922			0.747								0.545	
24	2.680		1.331	1.520			1.290			2.700			1.345			1.046			0.562								0.527	
25	1.170		1.520	1.520			1.140			2.700			1.409			1.250			0.489								0.683	
26	1.170	3.150		1.520			1.290			2.790			1.345			1.150			0.554								0.608	
27	3.860	5.030		1.520			1.450			2.160			0.961			1.130			0.624								0.603	
28	7.340		4.649	1.410			1.620			1.600			1.050			1.300			0.660								0.668	
29	8.860		5.731	1.520			2.630			1.550			1.160			1.440			0.566								0.679	
30	8.240		5.290	1.410			1.940		1.900	1.350			0.966			1.480			0.592								0.786	
31	6.100		3.766	1.310						1.350			0.894			1.380			0.091								0.738	
										1.350			0.894			1.380			0.091									0.675

Appendix A, 1.4 (11) Observed and Calculated Daily Surface Flow Rate at Antes Bocatomá and Saucache
 <Nivel Diario de flujo de Superficie Observado y Calculado Antes Bocatomá y Saucache>

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

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		Saucache	Ant.B		Saucache	
	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal		
Feb 1			1.310																									
2		6.920	1.120																									
3			1.210																									
4		3.090	1.210																									
5		1.560	1.120																									
6		1.170	1.310																									
7			1.310																									
8			1.310																									
9		0.290	1.310																									
10			1.310																									
11			3.360		1.815																							
12			3.800		2.129																							
13			5.310		3.204																							
14			10.300		5.810																							
15			8.460		5.447																							
16			6.820		4.279																							
17	2.520	1.217	30.900		21.424																							
18	2.520	0.750	30.900	6.710																								
19	3.130	3.820	30.900		21.424																							
20	3.130	1.652																										
21	3.130	1.652		14.300																								
22	6.980	4.393																										
23	10.100	3.580																										
24	11.700	6.100		30.500																								
25	7.170	4.528																										
26	6.550	4.240																										
27	7.720	4.920																										
28	6.160	3.809																										
29	4.900	2.912																										

Appendix A, 1.4 (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>

Unit: m³/s

(No observation at Saucache in 1983)

Date	1976			1977			1978			1979			1980			1981			1982			1983			1984		
	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal	Ant.B Qobs	Saucache Qobs	Qcal
Mar 1	4.240	1.810																									
2	3.590		1.979																								
3	3.590		1.979			18.900																					
4	3.920		2.214																								
5	4.570		2.677																								
6	5.740		3.510																								
7	9.120		5.916			7.510																					
8	8.860		5.731			6.010																					
9	6.580	2.160	4.108																								
10	5.740		3.510																								
11	5.740		3.510																								
12	4.900	1.250																									
13	4.570		2.677																								
14	4.240		2.442			25.850																					
15	4.240		2.442																								
16	4.240	0.710																									
17	8.240		5.290																								
18	8.240		5.290																								
19	13.500		9.035																								
20	7.620		4.848																								
21	5.740		3.510																								
22	4.900		2.912																								
23	4.900		2.912																								
24	4.570		2.677																								
25	4.240	1.790				1.160																					
26	3.320		1.787																								
27	3.590		1.979																								
28	3.590		1.979																								
29	3.320		1.787			1.050																					
30	3.050	0.850				0.780																					
31	2.640		1.303			0.400																					

Appendix A, 1.4 (13) Observed and Calculated Daily Surface Flow Rate at Antes Bocatomá and Saucache
 <Nivel Diario de flujo de Superficie Observado y Calculado Antes Bocatomá y Saucache>

Date	1976		1977		1978		1979		1980		1981		1982		1983		1984	
	Saucache		Saucache		Saucache		Saucache		Saucache		Saucache		Saucache		Saucache		Saucache	
	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B Qobs	Qcal	Ant.B 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						0.384	1.170		
6	1.630	0.190		0.050		0.650		0.610		0.859			0.554		0.471	0.947		
7	1.630					0.650		0.821		0.562			0.563		0.502	0.970		
8	1.630					0.650		0.956		0.690			0.640		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	1.250		
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					1.000		0.869		0.757		0.606	0.478		0.310	1.040		
28	1.370					1.000		0.863		0.785		0.723	0.495		0.340	1.120		
29	1.500					1.000		0.956		0.734		0.570	0.604		0.310	0.957		
30	1.370	0.050				1.000		0.818		1.020		0.697	0.585		0.273	1.030		

(No observation at Saucache in 1983)

Unit : m³/s

Appendix A. 1.4 (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>

Unit : m³/s

(No observation at Saucache in 1983)

Date	1976			1977			1978			1979			1980			1981			1982			1983			1984							
	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs		
May 1	1.370		2.280			1.000			0.821			0.741			0.636			0.576			0.242			1.010			0.270			0.981		
2	1.500		2.110			1.000			0.821			0.723			0.620			0.605			0.282			1.010			0.282			1.010		
3	1.500		2.110			1.050			0.863			0.924			0.649			0.618														
4	1.500		1.940			0.875			0.959			0.817			0.563			0.563														
5	1.630		1.940			0.925			0.980			0.966			0.536			0.577														
6	1.630		2.110			0.925			0.692			0.969			0.667			0.687														
7	1.500		2.280			0.925			0.911			0.800			0.600			0.606														
8	1.500		2.280			0.875			0.821			0.748			0.434			0.605														
9	1.370		2.280			0.875			0.863			1.010			0.480			0.659														
10	1.370		2.280			1.000			0.839			0.582			0.502			0.556														
11	1.370		2.280			1.000			0.863			0.829			0.635			0.562														
12	1.370		2.110			1.000			0.776			0.956			0.571			0.587														
13	1.370		1.940			1.000			0.869			0.967			0.410			0.507														
14	1.370		1.940			1.000			0.848			0.959			0.412			0.464														
15	1.500		1.940			1.050			0.827			0.874			0.490			0.522														
16	1.500		1.940			1.000			0.863			0.882			0.666			1.000														
17	1.500		1.940			1.050			0.787			0.880			0.562			0.753														
18	1.500		1.940			1.050			0.630			0.740			0.563			0.495														
19	1.570	0.190	1.940			1.050			0.890			0.704			0.467			0.590														
20	1.370		2.110	0.370		1.050			0.650			0.490			0.504			0.635														
21	1.370		1.940			1.050			0.818			0.718			0.616			0.615														
22	1.370		1.940			1.050			0.818			0.675			0.586			0.710														
23	1.370		1.940			1.050			1.000			0.810			0.556			0.521														
24	1.630		1.940			1.150			0.610			0.764			0.536			0.429														
25	1.500		1.940			1.050			0.887			0.873			0.251			0.577														
26	1.500		1.940	0.350		1.050			0.776			0.968			0.441			0.554														
27	1.370		1.940			1.050			0.734			0.983			0.374			0.473														
28	1.370		1.940			1.050			0.776			0.858			0.521			0.788														
29	1.370		1.940			1.200			0.821			0.978			0.718			0.520														
30	1.500		1.940			1.200			0.672			0.789			0.705			0.350														
31	1.630		1.940			1.200			0.692			0.724			0.598			0.362														

Appendix A, 1.4 (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>

Unit : m³/s

(No observation at Saucache in 1983)

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

Appendix A, 1.4 (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		Saucache	Ant.B		Saucache
	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	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				0.645		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		1.150					0.959				0.505		0.653								0.471		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								0.398		0.720	
23	1.370		1.450		1.150					0.734				0.440		0.689								0.487		0.738	
24	1.500		1.290		1.150					0.917				0.382		0.660								0.432		0.750	
25	1.500		1.290		1.150					0.863				0.425		0.750								0.433		0.737	
26	1.500		1.290		1.150					0.908				0.496		0.676								0.424		0.721	
27	1.500		1.290		1.150					0.821				0.455		0.713								0.334		0.683	
28	1.500		1.290	0.240	1.100					0.956				0.459		0.709								0.505		0.793	
29	1.500		1.290		1.150					0.890				0.513		0.732								0.476		0.842	
30	1.500		1.290		1.150					0.821				0.517		0.694								0.452		0.794	
31	1.500		1.290		1.150					0.863				0.512		0.696								0.435		0.786	

Appendix A, 1.4 (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>

Unit : m3/s

(No observation at Saucache in 1983)

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

Appendix A, 1.4 (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>

Unit : m³/s

(No observation at Saucache in 1983)

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

Appendix A, 1.4 (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>

Unit : m3/s

(No observation at Saucache in 1985)

Date	1976			1977			1978			1979			1980			1981			1982			1983			1984				
	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs	Ant.B	Saucache	Qobs		
Oct 1			0.994																										
2			0.994			0.650					0.803																		
3			1.290			0.650					0.803																		
4			1.290			0.650					0.776																		
5			1.290			0.650					0.875																		
6			1.290			0.650					1.200																		
7			1.290			0.650					1.050																		
8			1.290			0.818					1.030																		
9			1.290			0.863					1.050																		
10			0.994			0.908					1.080																		
11			1.140			0.908					1.130																		
12			0.994			0.908					0.690																		
13			0.994			0.908					1.150																		
14			0.994			0.956					1.080																		
15			0.994			0.956					1.020																		
16			0.994			0.956					0.734																		
17			0.994			0.911					0.839																		
18			0.994			0.779					0.652																		
19			0.994			0.694					0.734																		
20			0.994			0.818					0.660																		
21			0.994			0.908					0.690																		
22			0.994			0.956					0.932																		
23			0.994			0.911					0.571																		
24			0.994			0.692					0.431																		
25			0.994			0.692					1.180																		
26			0.994			0.827					0.908																		
27			0.994			0.779					0.980																		
28			0.994			0.917					0.821																		
29			0.994			0.652					0.908																		
30			0.994			0.821					0.679																		
31			0.994			0.692					0.932																		

Appendix A, 1.4 (20) Observed and Calculated Daily Surface Flow Rate at Antes Bocatomá and Saucache
 <Nivel Diario de flujo de Superficie Observado y Calculado Antes Bocatomá y Saucache>

Unit: m³/s

(No observation at Saucache in 1983)

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		Saucache		Ant.B		Saucache	
	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	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								0.423							
19	0.790		1.140		0.692					0.956				0.315							0.750								0.545							
20	0.790		1.140		0.692					0.887				0.431							0.751								0.441							
21	0.790		1.290		0.692					0.884				0.515							0.693								0.462							
22	0.930		1.140		0.692					0.890				0.518							0.681								0.394							
23	0.930		0.994		0.692					0.980				0.440							0.662								0.450							
24	0.930		1.140		1.000					0.911				0.482							0.711								0.523							
25	0.930		0.994		1.050					0.959				0.423							0.712								0.460							
26	0.930		1.140		1.000					0.839				0.407							0.668								0.579							
27	0.930		0.994		0.911					0.908				0.682							0.667								0.250							
28	0.930		0.722		0.956					0.917				0.532							0.649								0.456							
29	0.930				0.956					0.908				0.563							0.668								0.422							
30	0.930				1.000					1.050				0.474							0.782								0.413							

Appendix A, 1.4 (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>

Unit : m³/s

(No observation at Saucache in 1983)

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		Saucache	Ant.B		Saucache
	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	Qobs	Qcal	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			0.718			0.783						
4	0.930		0.858		0.956			0.755				0.543			0.549			0.744			0.763						
5	0.930		0.858		1.000			0.776				0.509			0.727			0.751			0.744						
6	0.930		0.994		0.956			0.908				0.658			0.805			0.676			0.729						
7	0.930		0.994		0.911			0.956				0.400			0.709			0.709			0.751						
8	0.930		0.994		0.692			0.932				0.505			0.754			0.806			0.676						
9	0.930		0.722		0.776			0.980				0.435			0.821			0.733			0.709						
10	0.930		0.994		0.818			0.908				0.437			0.875			0.934			0.806						
11	0.930		0.994		0.818			0.908				0.484			0.889			0.719			0.733						
12	0.930		0.994		0.818			0.932				0.493			0.833			0.687			0.806						
13	0.930		0.994		0.911			0.908				0.409			0.789			0.660			0.806						
14	0.930		0.994		0.956			0.779				0.376			0.811			0.934			0.733						
15	0.720		0.994		0.863			0.824				0.445			0.855			0.889			0.661						
16	0.860		0.994		0.956			0.908				0.444			0.844			0.719			0.661						
17	0.860		0.994		0.956			0.908				0.444			0.851			0.889			0.660						
18	0.860		0.994		1.050			0.893				0.509			0.844			0.889			0.660						
19	0.860		0.994		0.869			1.030				0.574			0.851			0.889			0.660						
20	0.860		0.994		1.100			0.821				0.491			0.800			0.833			0.660						
21	0.930		0.994		0.827			1.050				0.536			0.827			0.833			0.660						
22	0.930		0.994		1.100			0.956				0.466			0.833			0.833			0.660						
23	0.860		0.994		1.100			1.100				0.478			0.812			0.812			0.660						
24	0.860		0.994		1.100			1.100				0.528			0.790			0.790			0.660						
25	0.860		0.994		1.100			1.000				0.505			0.740			0.740			0.660						
26	0.930		1.140		0.959			0.713				0.505			0.912			0.912			0.660						
27	0.930		0.994		0.908			0.683				0.522			1.140			1.140			0.660						
28	0.930		1.140		0.863			1.170				0.508			0.957			0.957			0.660						
29	1.020		1.140		0.956			1.080				0.498			0.650			0.650			0.660						
30	1.120		1.140		0.956			2.700				1.345			0.948			0.948			0.660						
31	1.020		0.994		0.869							0.465			0.605			0.605			0.660						

Appendix A, 2.1 (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	0.350	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, 2.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Colpitas River in Alcerreca													
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, 2.1 (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
<u>ST: Caracarani River in Alcerreca</u>													
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, 2.1 (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
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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
1989	2.230	3.660				1.150	1.150	1.100	1.040	0.967	0.975	1.010	1.476

Appendix A, 2.1 (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, 2.1 (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 Río Lluta>*

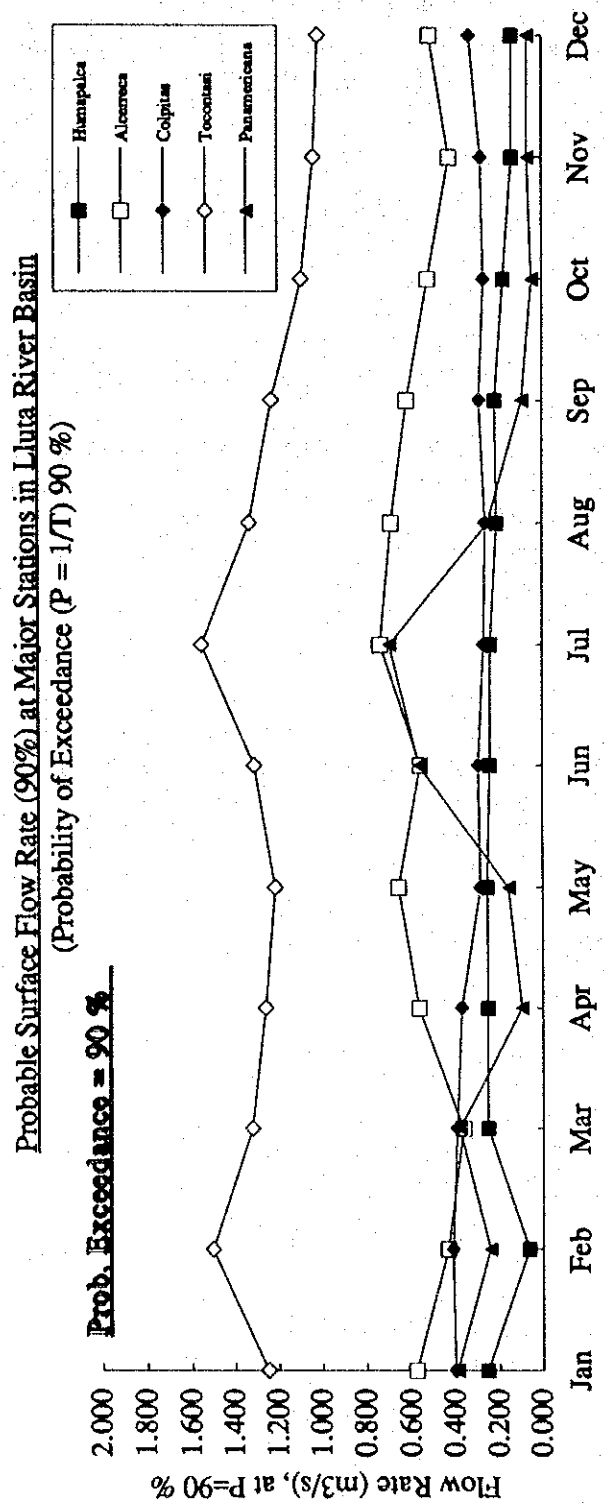
Unit : m³/s

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

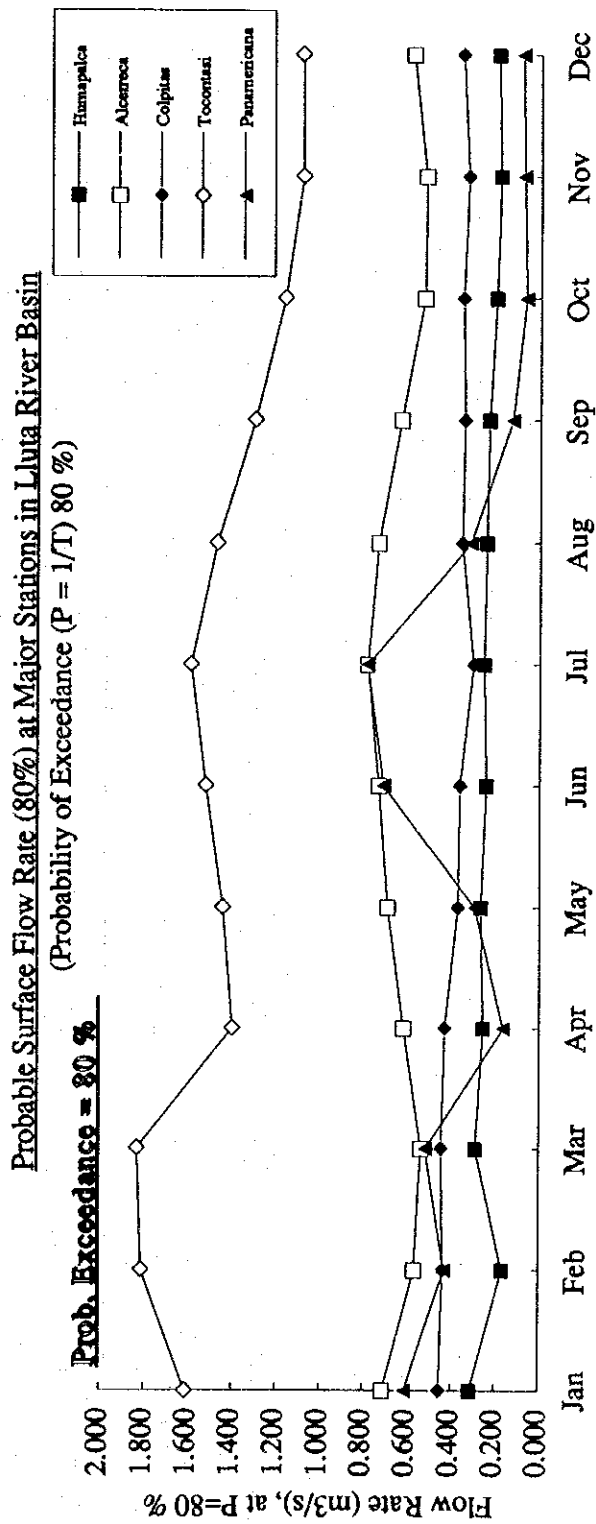
Appendix A, 2.1 (7) Average Monthly Surface Flow Rate Observed by DGA
at Major Stations in Lluta River Basin
<Nivel Promedio Mensual de Flujo de Superficie Observado
por DGA en las Principales Estaciones en la Cuenca del Rio Lluta>

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

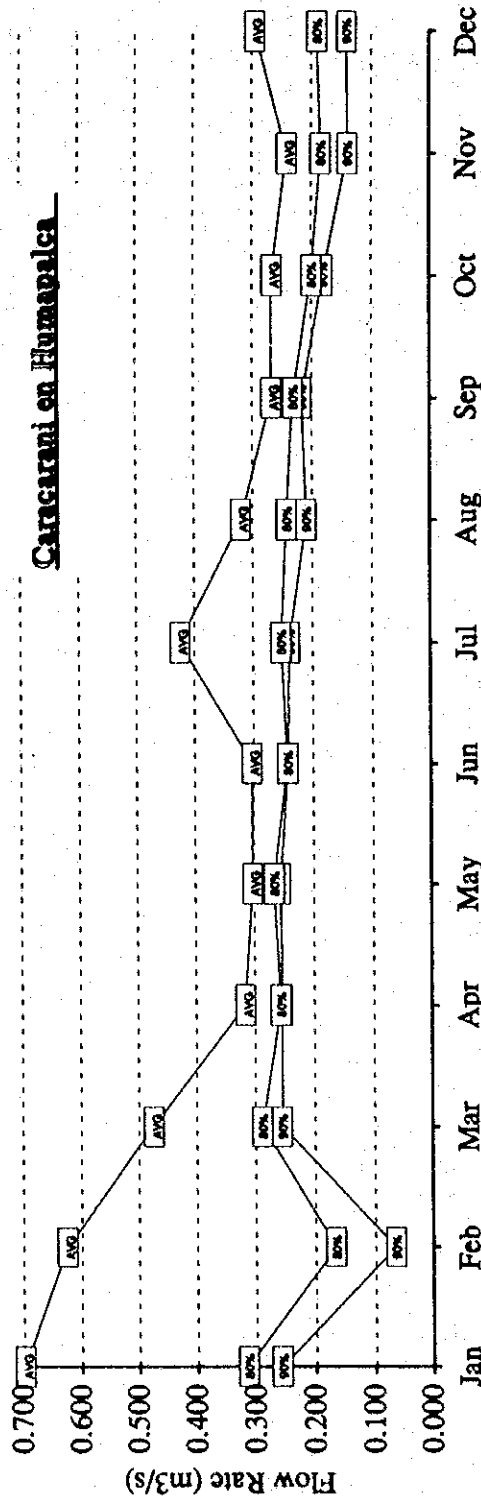


Appendix A,2.2 (1) Probable Surface Flow Rate (90%) at Major Stations in Lluta River Basin
<Nivel Probable de Flujo de Superficie (90%) en la Cuenca del Rio Lluta>



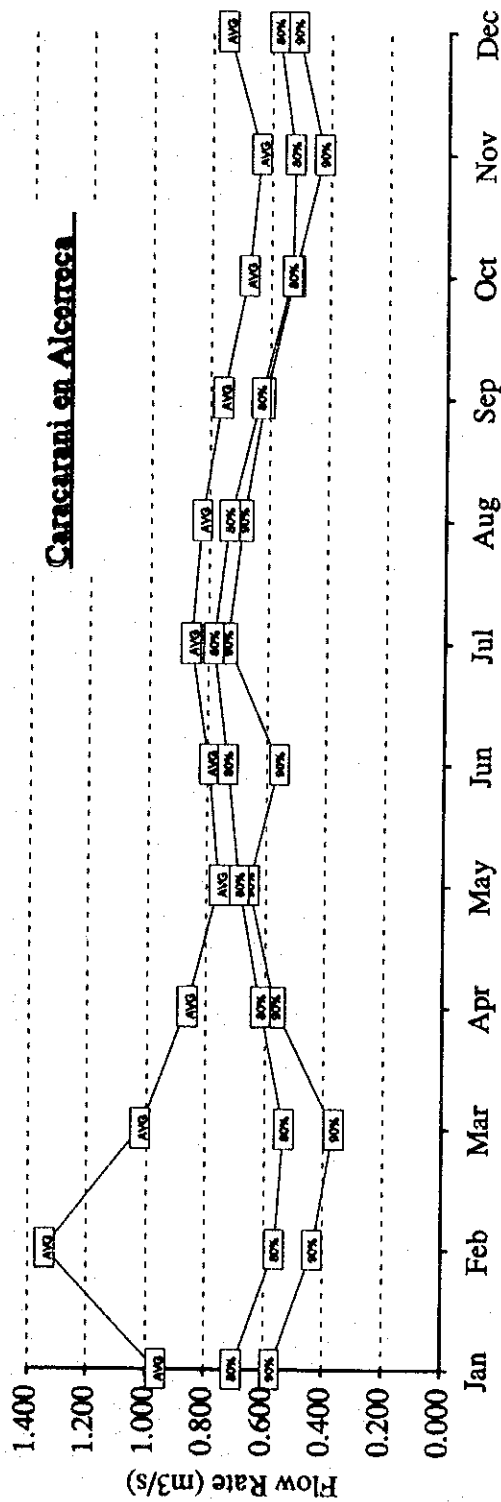
Appendix A,2.2 (2) Probable Surface Flow Rate (80%) at Major Stations in Lluta River Basin
<Nivel Probable de Flujo de Superficie (80%) en la Cuenca del Rio Lluta>

Surface Flow Rate in Average, with Probability of Exceedance 80 and 90 % of Caracarani River at Humapalca



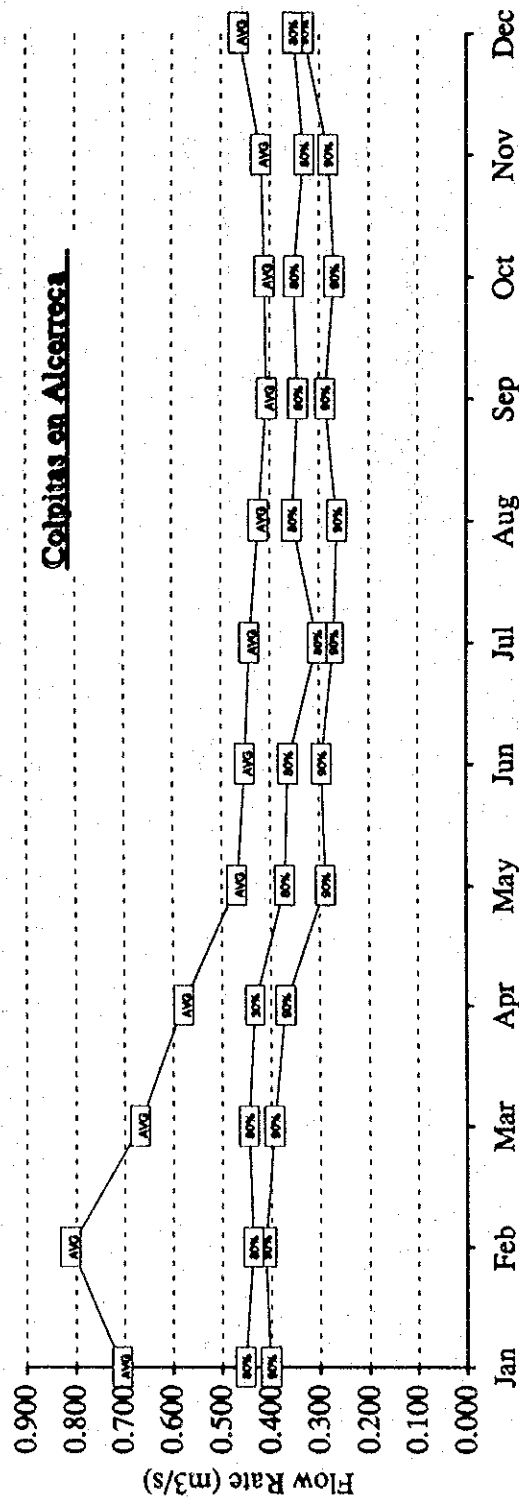
Appendix A, 2.2 (3) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%
 <Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>

Surface Flow Rate in Average, with Probability of Exceedance 80 and 90 % of Caracarani River at Alceireca



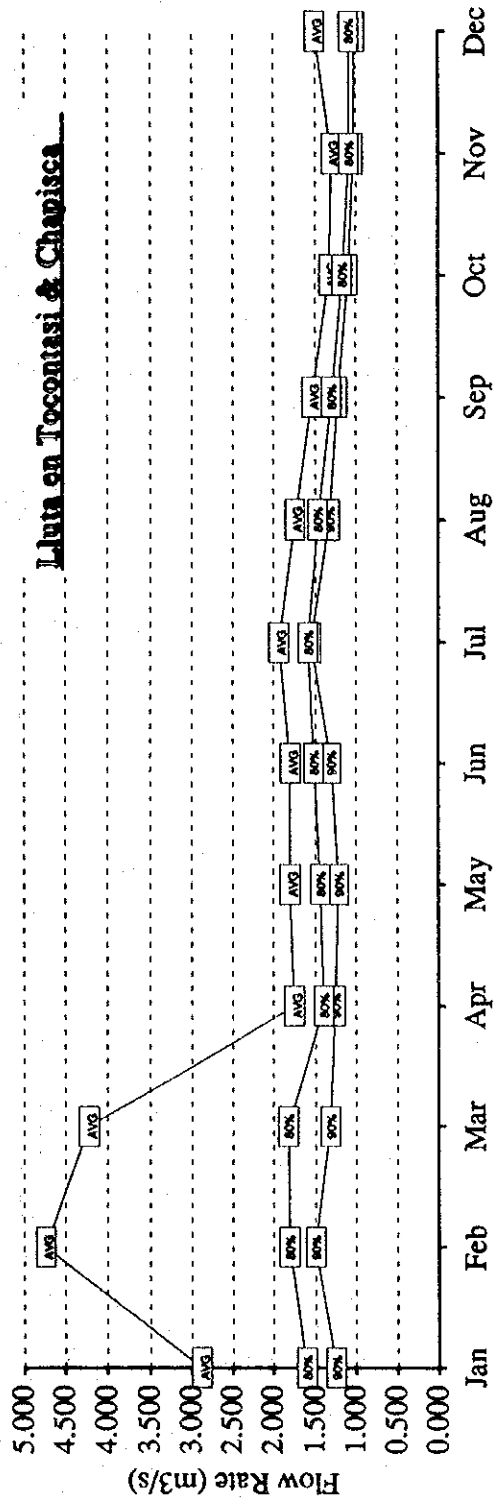
Appendix A, 2.2(4) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%
 <Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>

Surface Flow Rate in Average, with Probability of Exceedance 80 and 90 % of Colpitas River



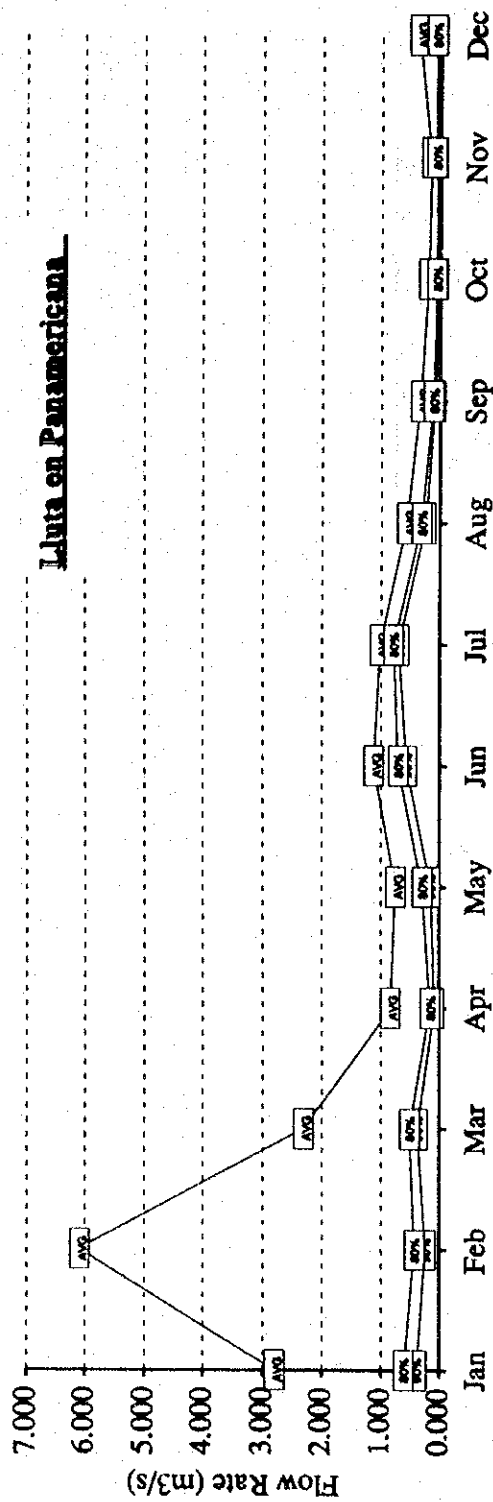
Appendix A,2.2 (5) Surface Flow Rate in Average, with Probability of Exceedance 80% and 90%
 <Nivel de Flujo de Superficie en Promedio, con Probabilidad de Excedencia 80% y 90%>

Surface Flow Rate in Average, with Probability of Exceedance 80 and 90 % of Liuta River at
Tocontasi & Chapisca



Appendix A, 2.2(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%>

Surface Flow Rate in Average, with Probability of Exceedance 80 and 90 % of Luta River at Panamericana



Appendix A, 2.2(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, 2.3 (1) Average Water Quality Observed by DGA at Major Stations in Luta River Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Luta>

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, 2.3 (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
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, 2.3 (3) Average Water Quality Observed by DGA at Major Stations in Luta River Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Rio Luta>

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, 2.3 (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
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, 2.3 (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							
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, 2.3 (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	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	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	276			22.7	134.0	6.38	0.463		5.630	0.397				
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, 2.3 (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
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					

ST: Lluta River at Poconchile

Appendix A, 2.3 (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	0.765	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					
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				0.044	
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				0.005	
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, 2.4(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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Cascavillane River



Teleschuno River

Appendix A,2.4(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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Guancarane River



Chuquiananta River

Appendix A, 2.4(3) 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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Colpitas River



Putre River

Appendix A,2.4(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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Quebrada Taipicahua



Quebrada Jurase

Appendix A, 2.4(5) 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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Aroma River



Socoroma River

Appendix A, 2.4(6) 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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Lluta River at Chapisca



Sampling of Water from the River

Appendix A 2.4(7) 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>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA

Appendix A, 3.1 (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, 3.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Coscaya River in Saitoco													
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, 3.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Coscaya River in Pampa Lirima													
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, 3.2 (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
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

ST: Quebrada Tarapaca in Pachica

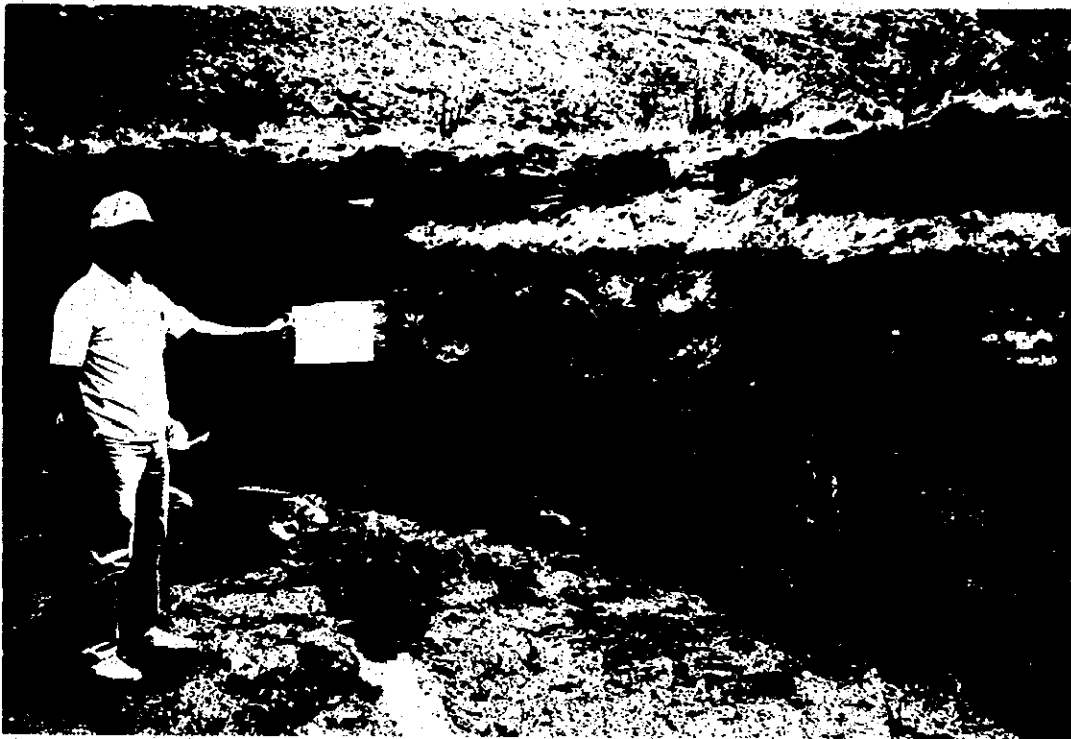
Appendix A, 3.2 (2) Average Water Quality Observed by DGA at Major Stations in Pampa del Tamarugal Basin
 <Calidad Promedio del Agua Observado por DGA en la Cuenca del Pampa del Tamarugal>

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
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		0.538				
1983	7.51	794	0.000	82.7	58	234	63.0	10.6	15.8	81.5	4.04	0.231		0.250				
1984	7.50	762	0.000	87.6		217	63.5	8.0	14.1	76.4	2.33	0.190						
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

ST: Coscaya River at Pampa Litima

Appendix A, 3.2 (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, 3-3 (1) Field Observation in Pampa del Tamarugal Basin on 6th October 1993
<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octubre 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Tarapaca River (1)



Tarapaca River (2)

Appendix A, 3-3(2) Field Observation in Pampa del Tamarugal Basin on 6th October 1993

<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octubre 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Tarapaca River (3)



Tarapaca River (4)

Appendix A, 3-3(3) Field Observation in Pampa del Tamarugal Basin on 6th October 1993
 <Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octubre 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA



Sagasca River



Water Sampling in Sagasca River

Appendix A, 3-3 (4) Field Observation in Pampa del Tamarugal Basin on 6th October 1993

<Observacion en Terreno en la Cuenca del Pampa del Tamarugal el 6 Octubre 1993>

THE STUDY ON THE DEVELOPMENT OF WATER RESOURCES IN NORTHERN CHILE

JICA

Appendix A.4.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
<u>ST: Quebrada Piga in Collacagua</u>													
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.4.1 (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
<u>ST: Quebrada Piga in Ojos de Agua</u>													
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.4.1 (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

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	AVG
ST: Collacagua River in Pagnablanca													
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,4.1 (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: Quebrada Piga 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

