References

<1: Cuadrangulos Arica y Poconchile, Región de Tarapacá, Carta Geologica de Chile (Escala 1:1,000,000), 1980 for Institute de Investigaciones Geologicas by Sania Vogel and Thomas Vila

<2: Cuadrangulos Camaraca y Azapa, Provincia de Tarapacá, Carta Geologica de Chile (Escala 1:50,000), 1968 for Institute de Investigaciones Geologicas by Alvaro Tobar B, Ivan Salar Y y Rene F. Kast

<3: Geologia y Recursos Minerales del Departmento de Arica, Provincia de Tarapacá, for Institute de Investigaciones Geologicas, 1966 by Raul Salas O., Rene F. Kast, Francisco Montecinos P. e Ivan Salas Y.

<4: Estudio Análisis de los Recursos de Agua de la Primera Región de Tarapacá, June 1991 for DGA by Ingenieria y Geotecnia Ltda.

Table B-II, 2.1 Well List (Lluta Valley)

<Lista de Sondaje (Valle de Lluta)>

BNA CODE		CORFO CODE (1975)		COORDINATE		COMMUN-ITY	LOCATION NAME	NAME OF OWNER	CONSTRUCTOR	ELEVA-TION (mASL)	DRILLING DEPTH (m)	SPECIFIC YIELD (m2/d)	DATE OF CONST-RUCTION	STAIC WATER LEVEL (1993)	
		LAT.-LONG.	NO.	LAT.	LONG.									(mBGL)	(mASL)
012 10	100-7	1820-6950	A-1			ARICA	BOCANEGRA	CORFO	CORFO-437		99		63/06		
		1820-6950	V-1			ARICA	BOCANEGRA				-		-		
		1820-7000	V-2			ARICA	STA. RAQUEL				-		-		
012 11	100-2	1820-7010	A-1			ARICA	COLONIA J FUENZALIDA	CORA	CORFO-373	350.00	332	30.9	62/11	5.83	344.17
		1820-7010	A-3			ARICA	GALLINAZOS	(MILITARY)							
012 11	101-0	1820-7010	A-4	18-23-45	70-17-47	ARICA	CARCEL DE ARICA	DIR. DE PROSIONES	CORFO-388	62.00	384	225.0	62/05	36.10	25.90
012 11	102-9	1820-7010	A-5	18-23-45	70-17-58	ARICA	VILLA FRONTERA	CORFO	CORFO-451	55.00	168	85.2	63/11	30.06	24.94
012 11	103-7	1820-7010	A-6	18-23-45	70-17-58	ARICA	VILLA FRONTERA	CORFO	CORFO-466	55.00	384	233.5	64/11	30.06	24.94
012 11	104-5	1820-7010	A-7			ARICA	HACIENDA VIPA	DUMJO TONINI	CORFO-631		65	387.7	67/06		
		1820-7010	N-0	18-24-10	70-18-43	ARICA	VILLA FRONTERA			32.00	38			27.22	4.78
		1820-7010	N-1	18-23-51	70-19-12	ARICA	VILLA FRONTERA			22.00	19			15.66	6.34
		1820-7010	N-2			ARICA	VILLA FRONTERA			22.00	-			-	
		1820-7010	N-3	18-24-56	70-18-33	ARICA	PLAYA LAS MACHAS			11.00	6			5.00	6.00
		1820-7010	N-4	18-24-20	70-19-01	ARICA	VILLA FRONTERA			22.00	20			19.98	2.02
		1820-7010	N-5	18-24-13	70-18-46	ARICA	VILLA FRONTERA			30.00	38			24.60	5.40
		1820-7010	N-6	18-24-05	70-18-51	ARICA	VILLA FRONTERA			32.00	28			24.53	7.47
		1820-7010	N-7	18-24-00	70-18-57	ARICA	VILLA FRONTERA			32.00	25			DRY	
		1820-7010	N-8	18-24-00	70-18-57	ARICA	VILLA FRONTERA			32.00	-			-	
		1820-7010	N-9	18-23-35	70-18-45	ARICA	VILLA FRONTERA			36.00	41			23.76	12.24
				18-25-43	70-13-03	ARICA	CHACABUCO	DGA-JICA	JICA J-1	219.52	145	124.2	93/12	21.69	197.83
				18-23-09	70-13-58	ARICA	PANAMERICANA	DGA-JICA	JICA J-A	178.03	150	20.4	93/12	9.82	168.21
				18-23-40	70-16-07	ARICA	LLUTA	DGA-JICA	JICA J-2	107.37	225	62.8	93/11	35.02	72.35
				18-24-04	70-17-19	ARICA	PANAMERICANA	DGA-JICA	JICA J-B	73.77	200	53.3	93/11	34.56	39.21

NOTE: (PUNPING TEST)
DW: DYNAMIC WATER LEVEL
SW: STATIC WATER LEVEL

(STAIC WATER LEVEL)
mBGL: m BELOW THE GROUND LEVEL
mMSL: m ABOVE THE MEAN SEA LEVEL

Table B-II 2.2 Result of Boring Test (Lower Lluta Valley)
< Resultado de Prueba de Sondaje en el Valle de Lluta Bajo>

Well No.	Bore hole Depth (m)	Casing Pipe		Screen Pipe		Geological Conditions of Aquifer			Geophysical Characteristics of Aquifer			
									Well Logging			TEM
		Size (inches)	Total Length (m)	Position (m)	Total Length (m)	Lithology	Formation	Period	Spontaneous Potential (mv)	Resistivity (ohm-m)	Gamma Ray (cps)	Resistivity (ohm-m)
J-A	150	8-5/8"	108.01	59.93 to 101.98	42.05	Sand, Sandy to clayey gravel	Fluvial Deposit	Quaternary	985-1025	15-30	50-70	12-26
J-B	200.4	8-5/8"	126.00	60.05 to 90.10	72.12	Clayey gravel, Sand	Fluvial Deposit	Quaternary	-8.2 to -8.4	15-30	25-50	17-26
				102.10 to 144.17		Fissured Ignimbrite	Oxaya Formation	Tertiary	-8.3 to -8.4	15-30	35-75	17-26
J-1	145	5-1/2"	85.00	31.00 to 91.00	60.00	Gravel, Sandy gravel	Fluvial Deposit	Quaternary	925-935	22-32	50-110	11-23
J-2	225	5-1/2"	136.00	64.02 to 154.01	89.99	Silty to sandy gravel	Fluvial Deposit	Quaternary	1060-1100	20-30	50-100	17-30

Table B-II, 2.3 Result of Pumping Test (Lower Lluta Valley)
< Resultado de Prueba de Bombeo en el Valle de Lluta Bajo>

Well No.	Pumping Data (from Constant Test)					Aquifer Constants			Well Capacity	
	Static Water Level (m)	Pumping Rate (l/s)	Dynamic Water Level (m)	Drawdown (m)	Specific Yield (l/s/m)	Transmissibility (m3/d/m)	Storage Coefficient	Permeability (cm/sec)	Critical Discharge (l/s)	Safe Yield (l/s)
J-A	9.82	15.30	74.51	64.69	0.24	22.72	8.54E-04	6.25E-04	15.30	7.50
J-B	34.56	18.90	65.19	30.63	0.62	310.44	4.72E-04	4.98E-03	20.30	13.00
J-1	21.69	4.40	24.75	3.06	1.44	368.06	6.62E-06	7.01E-03	4.40<	2.25
J-2	35.02	4.92	41.78	6.76	0.73	149.69	6.60E-06	1.93E-03	3.85	2.25

Table B-II, 2.4 Aquifer Constants (Lluta River Area)
<Coeficientos de Acúiferos (Area del Rio Lluta)>

Well No.	Aquifer Constant		Test Method				Average
			Thcis		Jacob		
			Constant	Recovery	Constant	Recovery	
J-A	Transmissibility	(m3/s/m)	3.41E-04	1.96E-04	3.31E-04	1.84E-04	2.63E-04
	Storage Coefficient		1.36E-03		3.47E-04		8.54E-04
	Permeability	(cm/sec)	8.11E-04	4.66E-04	7.87E-04	4.38E-04	6.26E-04
J-B	Transmissibility	(m3/s/m)	6.02E-04	2.55E-03	9.02E-03	2.20E-03	3.59E-03
	Storage Coefficient		2.41E-04		7.03E-04		4.72E-04
	Permeability	(cm/sec)	8.35E-04	3.54E-03	1.25E-02	3.05E-03	4.98E-03
J-1	Transmissibility	(m3/s/m)	4.03E-03	4.56E-03	4.16E-03	4.29E-03	4.26E-03
	Storage Coefficient		6.62E-06		6.86E-12		3.31E-06
	Permeability	(cm/sec)	6.72E-03	7.60E-03	6.93E-03	7.15E-03	7.10E-03
J-2	Transmissibility	(m3/s/m)	1.33E-03	2.24E-03	1.12E-03	2.24E-03	1.73E-03
	Storage Coefficient		1.59E-06		1.16E-05		6.60E-06
	Permeability	(cm/sec)	1.48E-03	2.49E-03	1.24E-03	2.49E-03	1.93E-03

Table B-II, 2.5 Estimation of Groundwater Storage

<Estimación de Reservas de Agua Subterránea>

DEPTH (m BSWL)	ZONE 1 (SECT.A-B) (x million m3)		ZONE2 (SECT. B-C) (x million m3)		ZONE3 (SECT. C-D) (x million m3)		ZONE4 (SECT. D-E) (x million m3)		ZONE5 (SECT. E-F) (x million m3)		TOTAL (SECT. A-F) (x million m3)	
		SUM		SUM		SUM		SUM		SUM		SUM
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	1.52	1.52	2.60	2.60	2.75	2.75	2.01	2.01	5.68	5.68	14.56	14.56
20	1.56	3.08	2.45	5.04	2.46	5.21	1.78	3.79	4.94	10.62	13.19	27.75
30	1.03	4.12	2.42	7.46	2.59	7.81	1.76	5.55	4.62	15.24	12.43	40.17
40	1.03	5.15	2.30	9.76	2.48	10.28	1.69	7.23	4.49	19.73	11.98	52.16
50	1.44	6.59	2.24	12.00	2.35	12.63	1.63	8.86	4.16	23.89	11.81	63.97
60	1.10	7.69	2.15	14.15	2.28	14.91	1.51	10.37	3.84	27.73	10.88	74.84
70	0.78	8.47	2.10	16.25	2.27	17.19	1.42	11.78	2.52	30.24	9.08	83.93
80	1.29	9.76	1.84	18.08	1.98	19.17	1.09	12.87	1.09	31.33	7.29	91.21
90	1.16	10.92	1.60	19.68	1.79	20.97	0.71	13.58	0.00	31.33	5.26	96.48
100	1.11	12.03	1.48	21.16	1.08	22.05	0.18	13.76	0.00	31.33	3.85	100.32
110	0.98	13.01	1.23	22.39	0.76	22.81	0.00	13.76	0.00	31.33	2.97	103.29
120	0.83	13.83	0.96	23.35	0.70	23.51	0.00	13.76	0.00	31.33	2.48	105.78
130	0.45	14.28	0.22	23.57	0.20	23.71	0.00	13.76	0.00	31.33	0.87	106.65
140	0.22	14.51	0.00	23.57	0.00	23.71	0.00	13.76	0.00	31.33	0.22	106.87
TOTAL	14.51		23.57		23.71		13.76		31.33		106.87	

NOTE: "BSWL" means below the static water level in 1993.

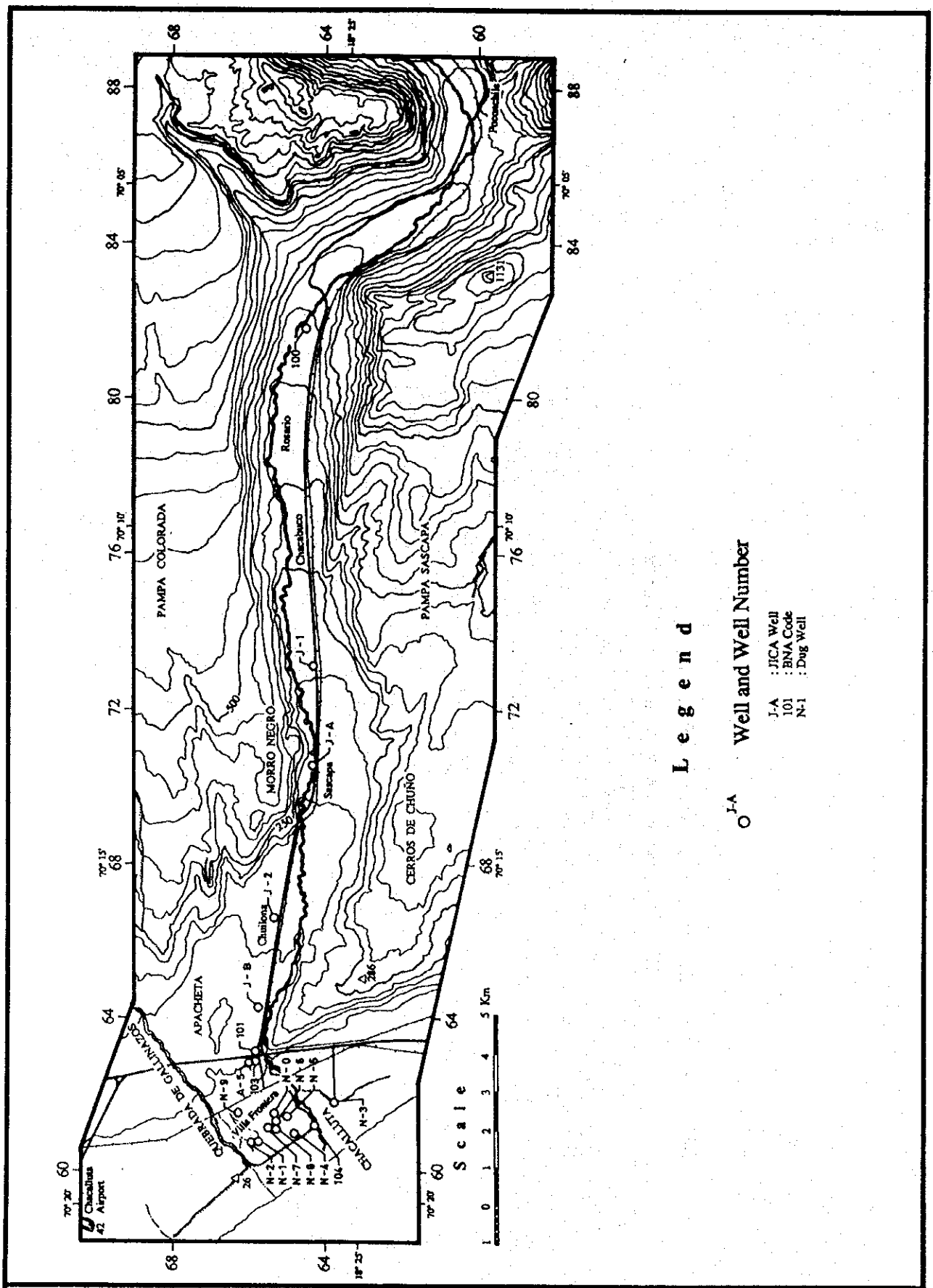

Fig. B-II, 2.1 Well Location (Lluta Valley)

< Ubicación de Pozos (LlutaValley)>

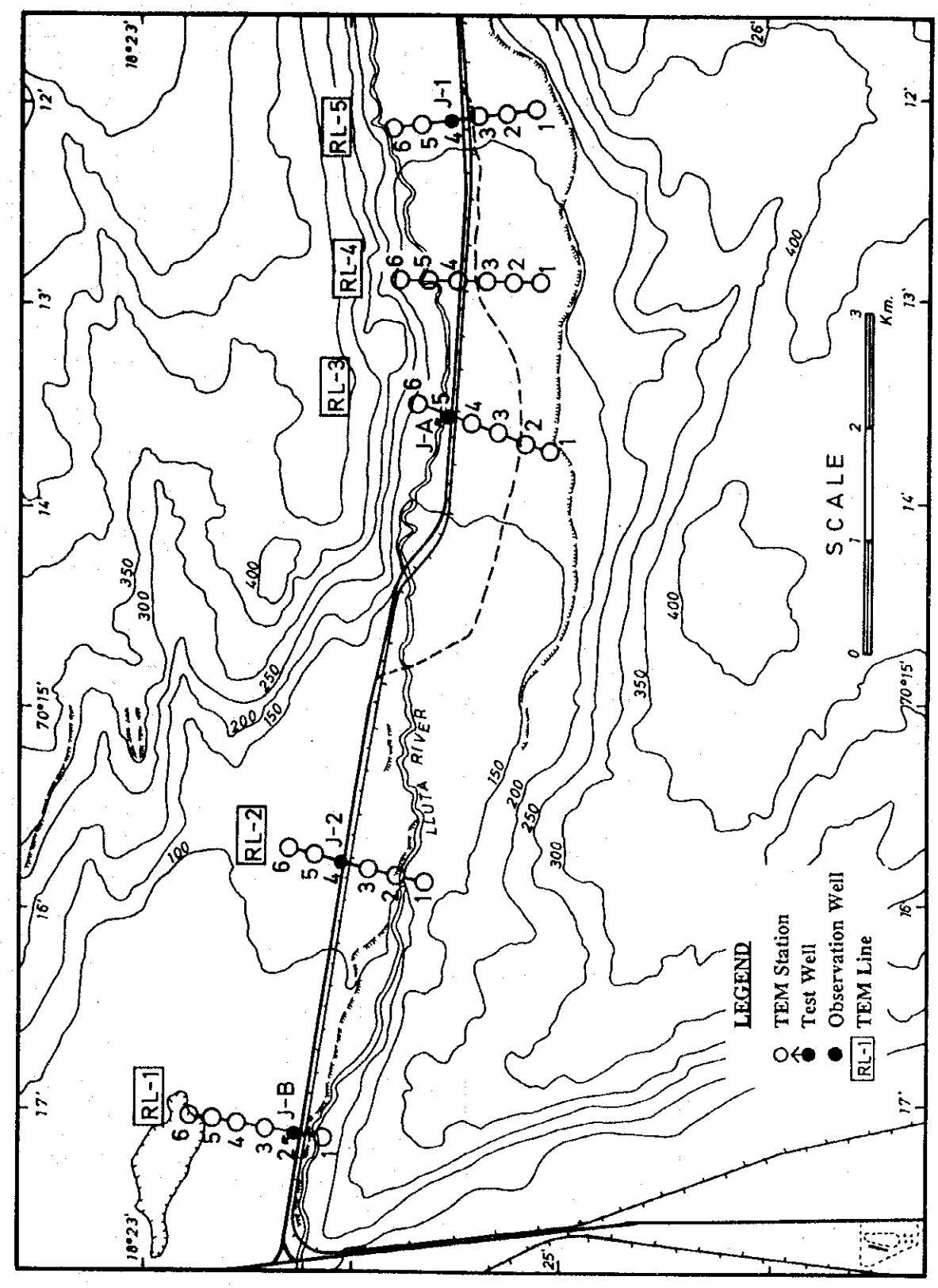

Fig. B-II, 2.2 Location of TEM Station and Test/Observation Well in LLuta River Area

<Ubicación de las Estaciones TEM y Pozos de Prueba y Observación en el Area del Río Lluta>

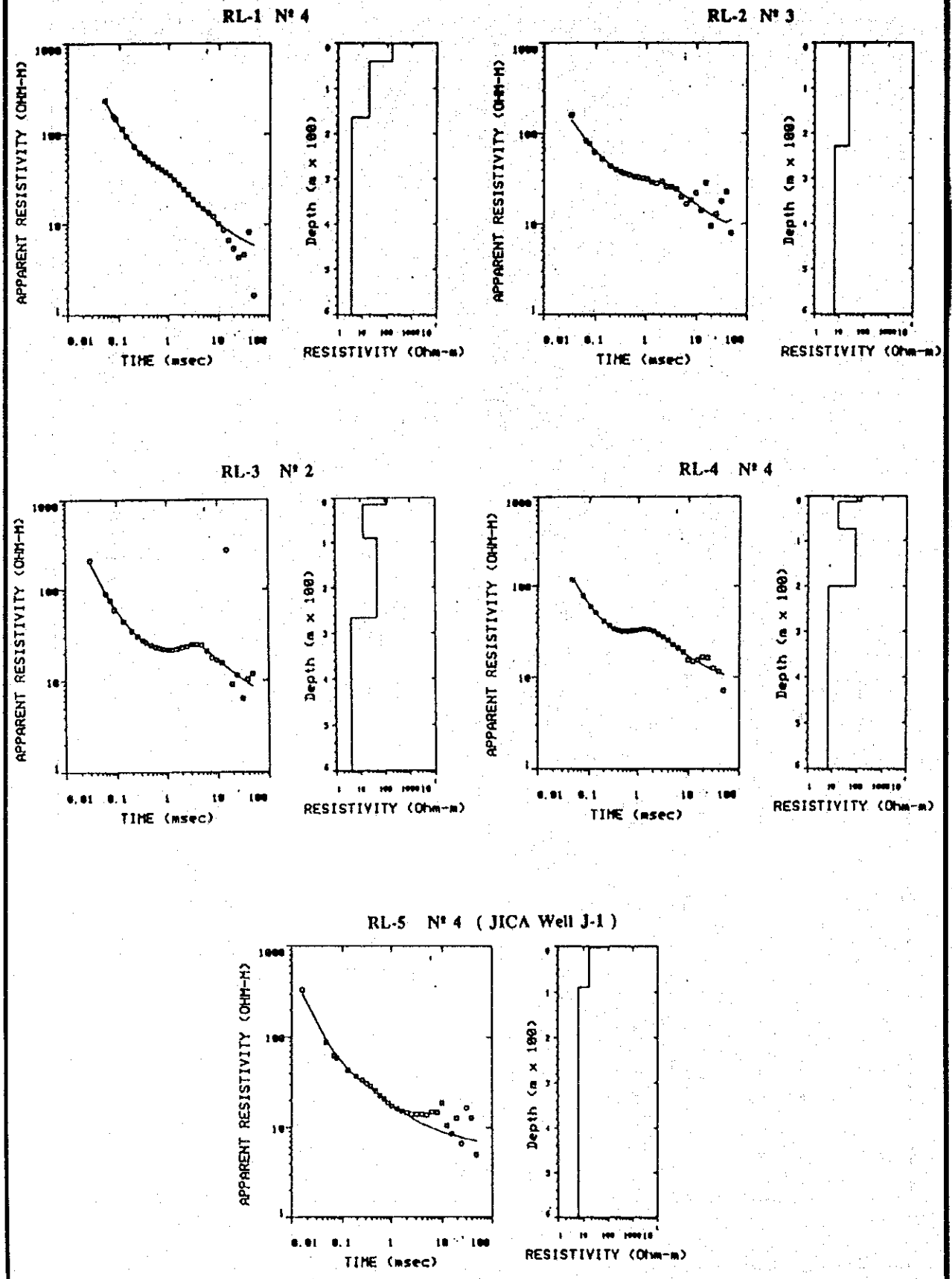

Fig. B-II, 2.3 Measured Apparent Resistivity Curves and Inverted Geoelectrical Section in Lluta River Area

<Curvas de resistividad Aparente y Secciones Geoeléctricas Invertidas en el Area del Río Lluta>

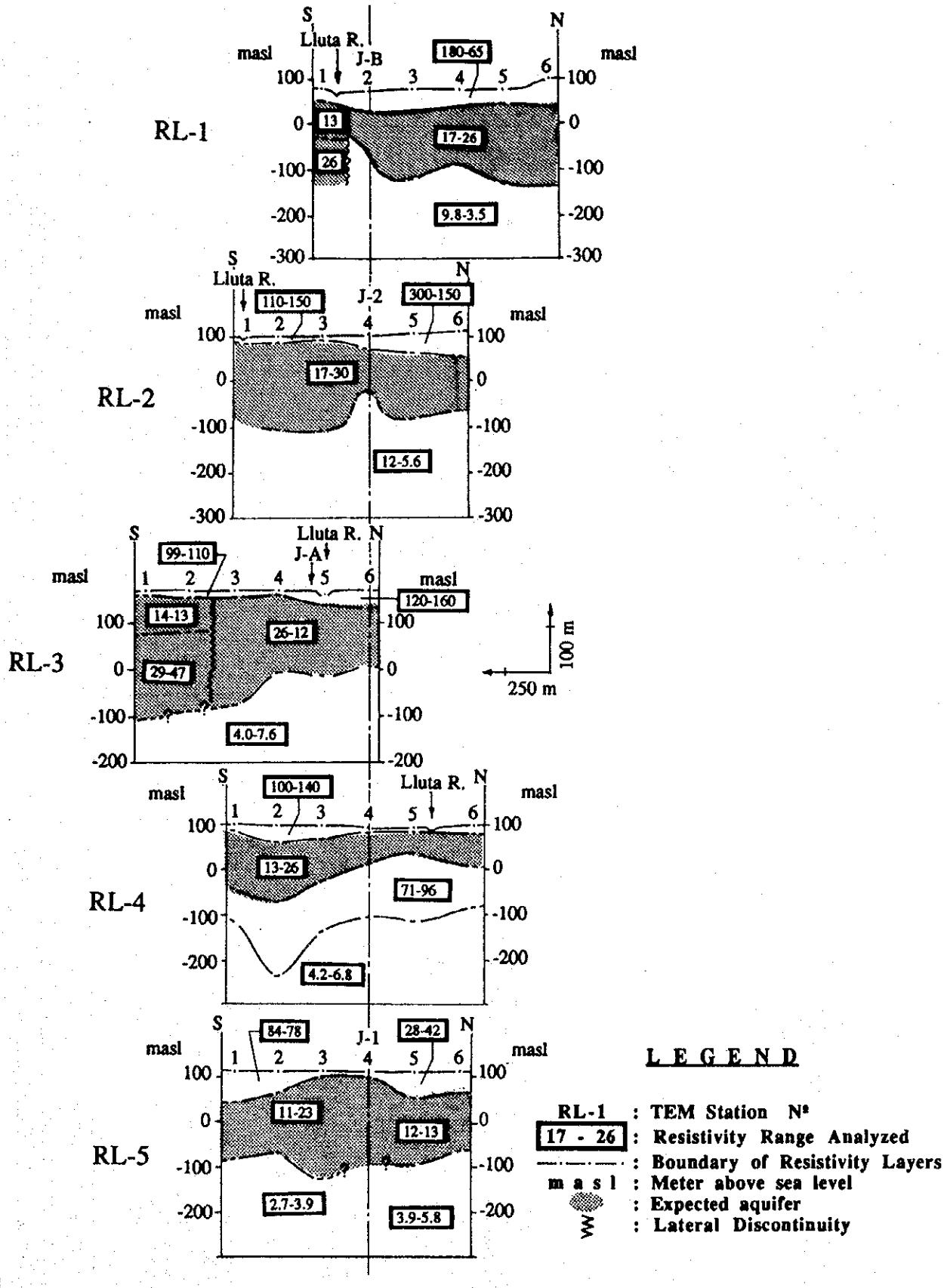

Fig. B-II, 2.4 Geoelectric Profiles Constructed from all TEM Soundings in Lluta River Area

<Perfiles Geoeléctricos Construídos de todos los sondeos TEM en el Area del Río Lluta>

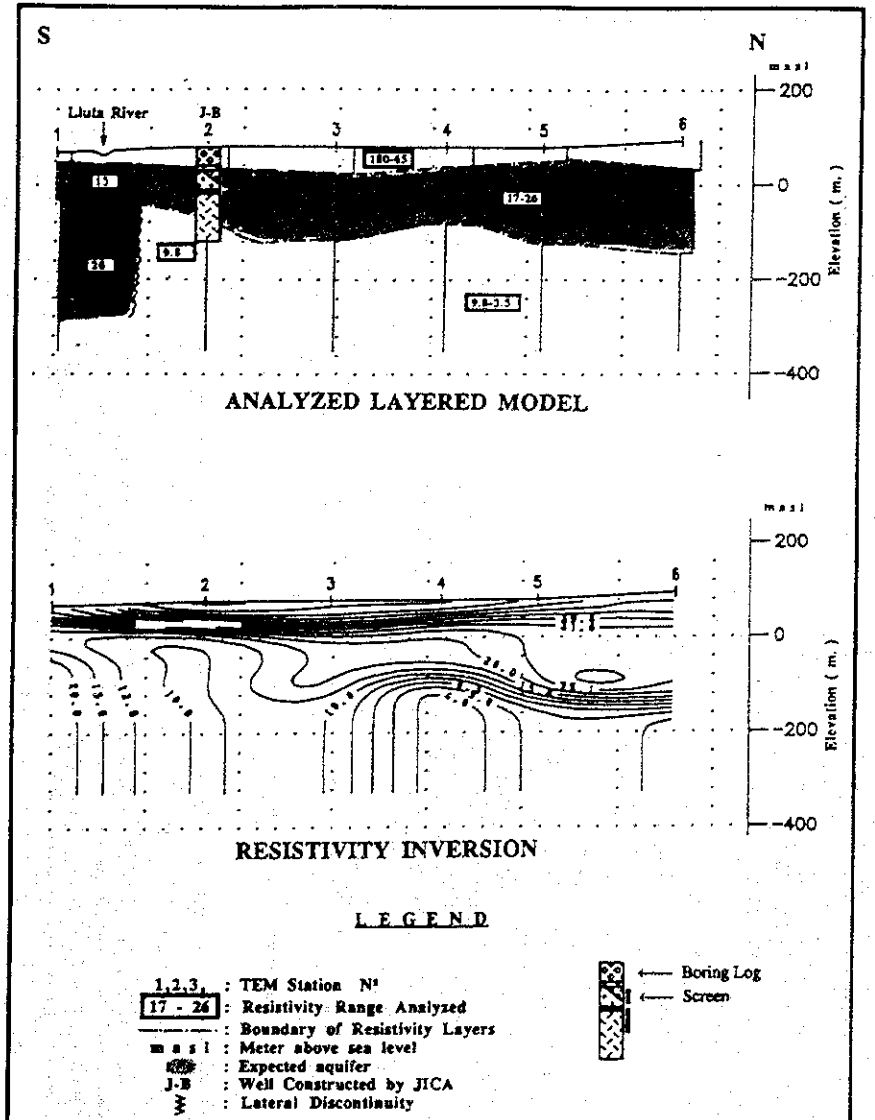

Fig. B-II, 2.5 Analized Resistivity Profile of RL-1 in Lluta River Area

< Perfil de Resistividad Analizado del RL-1 en el Area del Río Lluta>

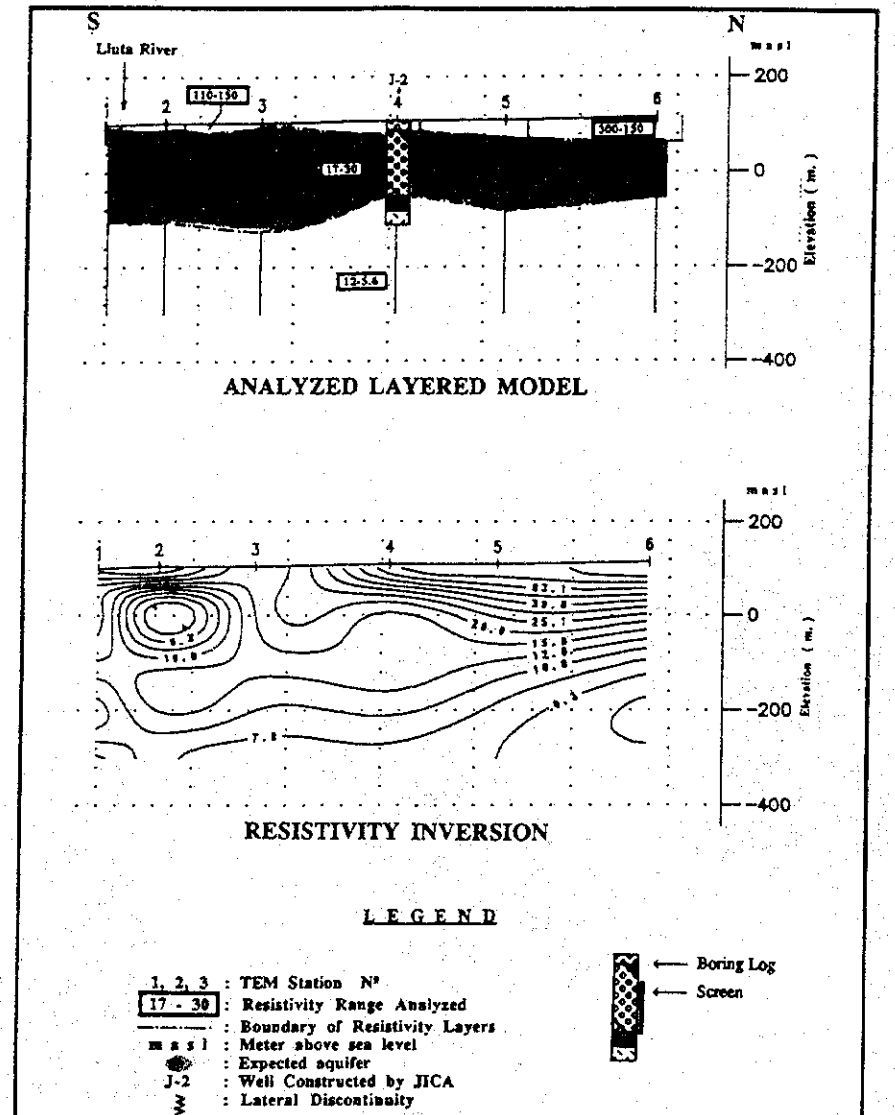

Fig. B-II, 2.6 Analized Resistivity Profile of RL-2 in Lluta River Area

< Perfil de Resistividad Analizado del RL-2 en el Area del Río Lluta>

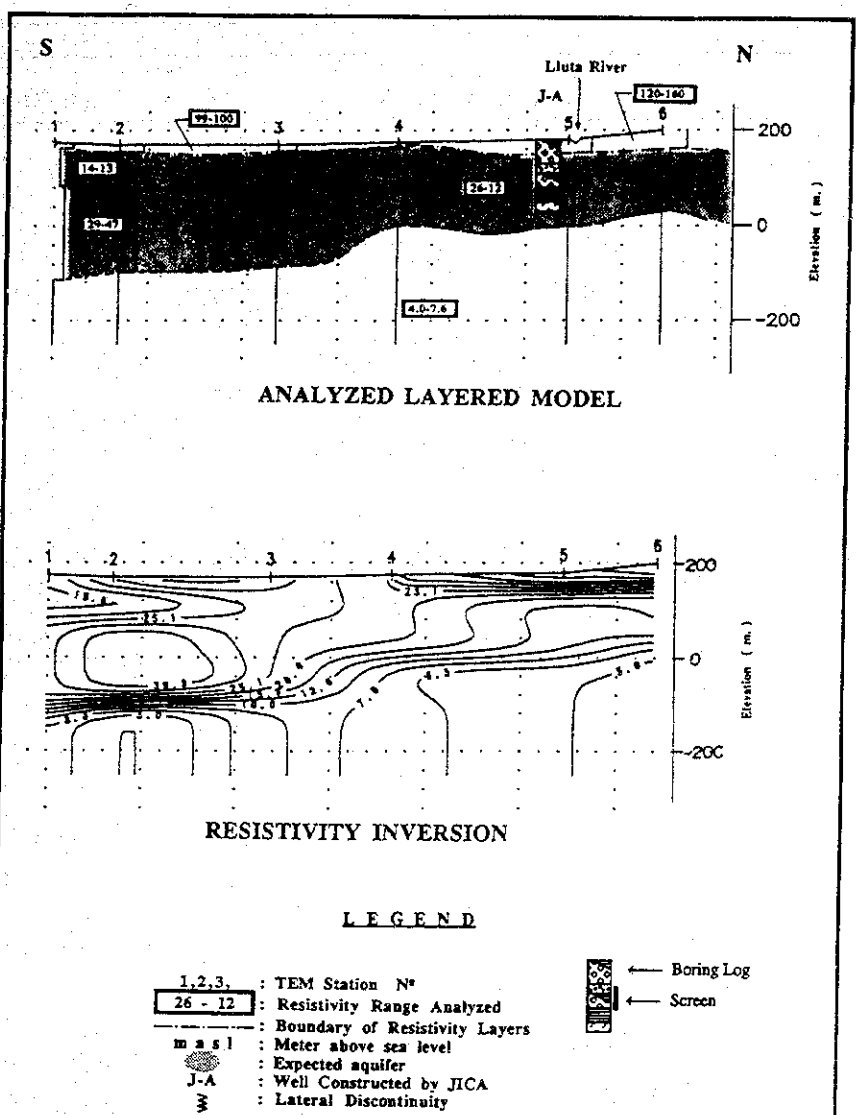

Fig. B-II, 2.7 Analized Resistivity Profile of RL-3 in Lluta River Area

< Perfil de Resistividad Analizado del RL-3 en el Area del Río Lluta>

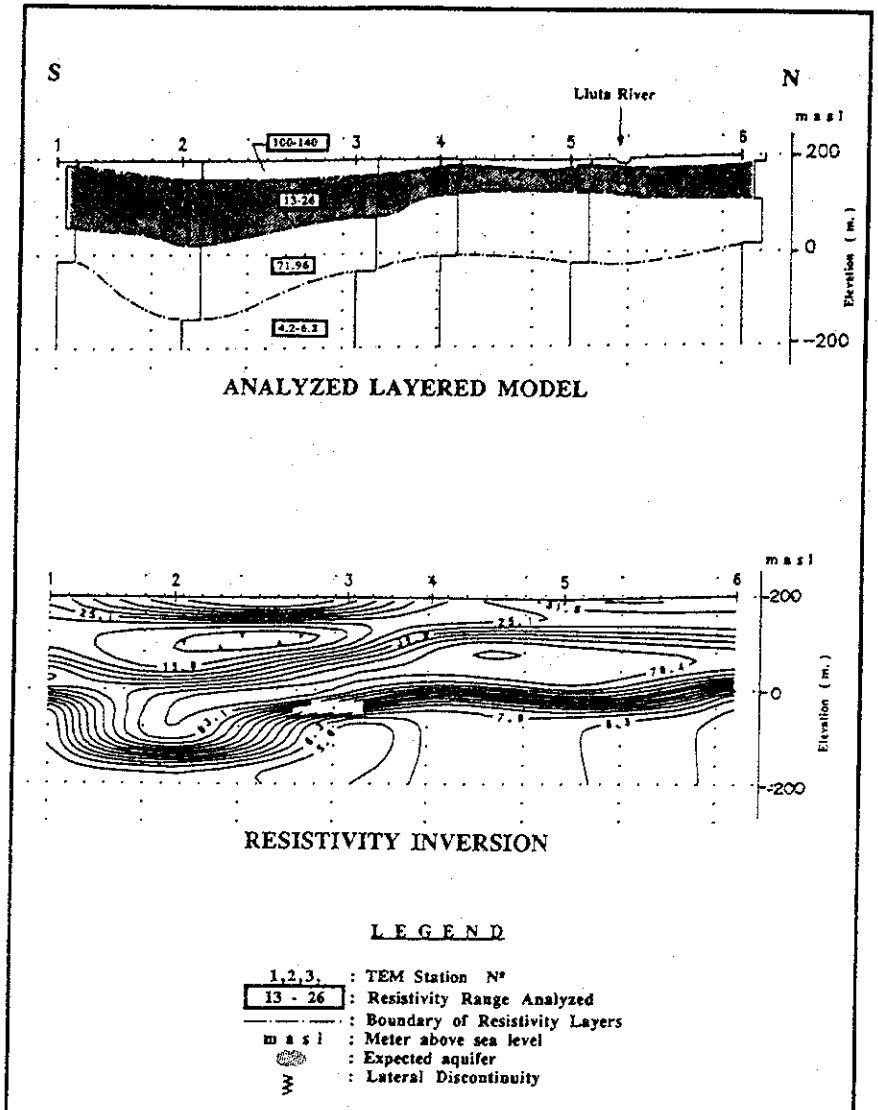

Fig. B-II, 2.8 Analized Resistivity Profile of RL-4 in Lluta River Area

< Perfil de Resistividad Analizado del RL-4 en el Area del Río Lluta>

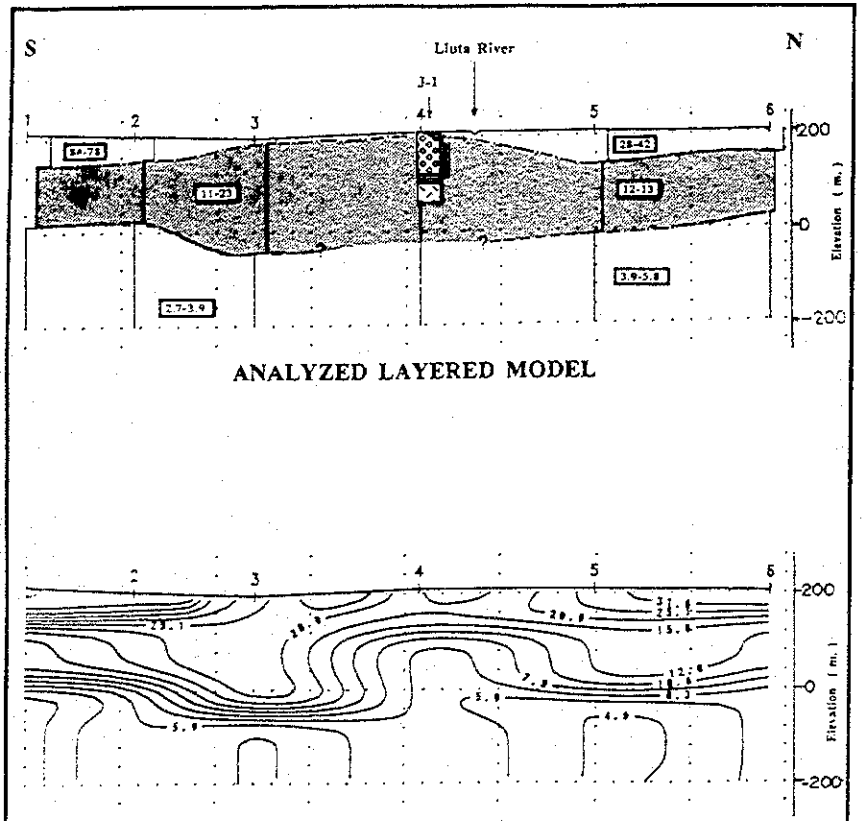

Fig. B-II, 2.9 Analized Resistivity Profile of RL-5 in Lluta River Area

< Perfil de Resistividad Analizado del RL-5 en el Area del Río Lluta>

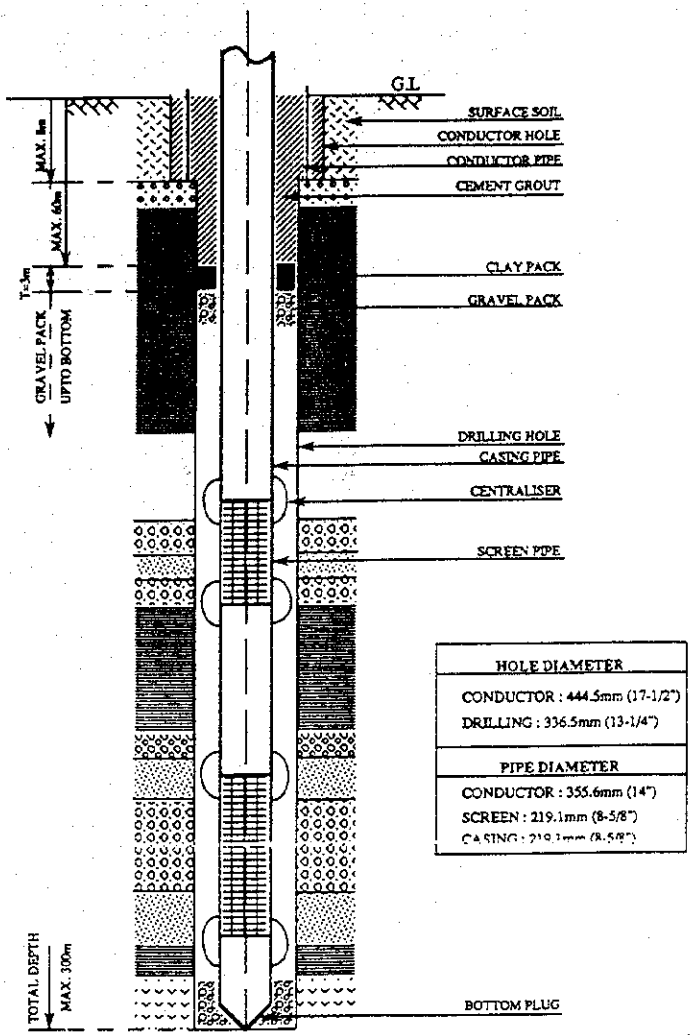

Fig. B-II, 2.10 Standard Design of Test Well
<Diseño Estándar de Pozo de Prueba>

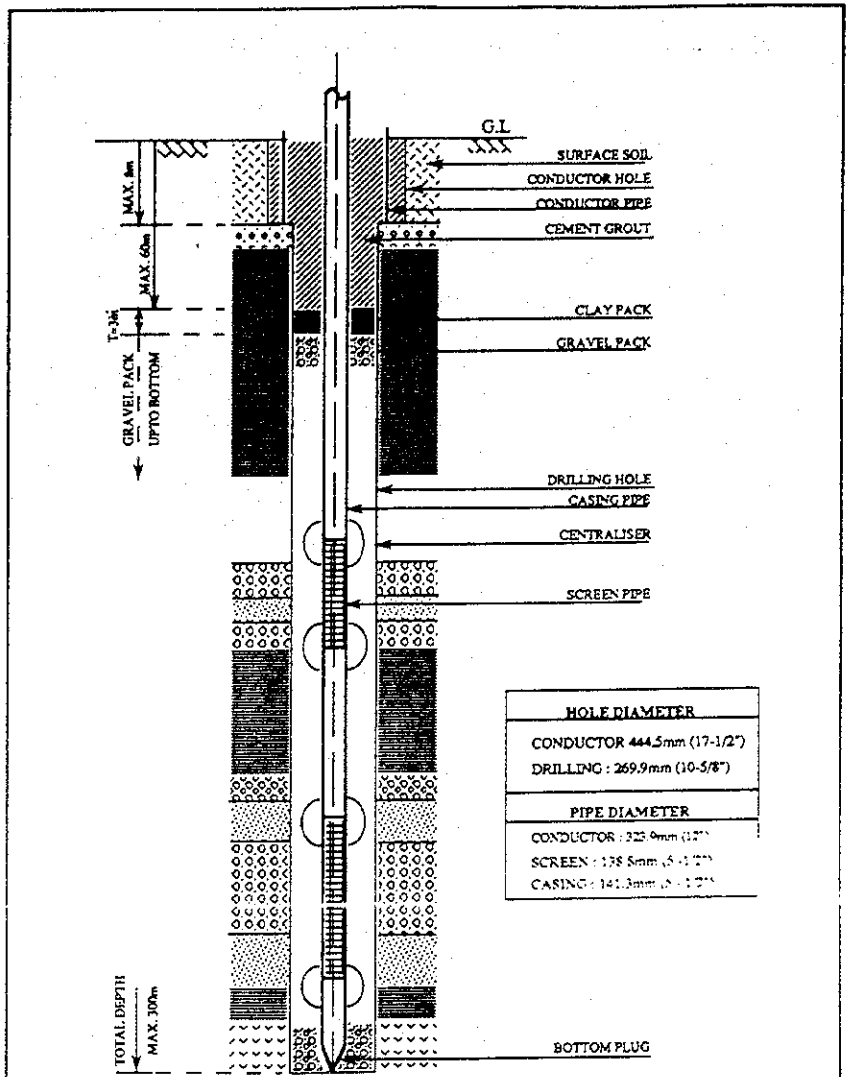

Fig. B-II, 2.11 Standrd Design of Observation Well
<Diseño Estándar de Pozo de Observación>

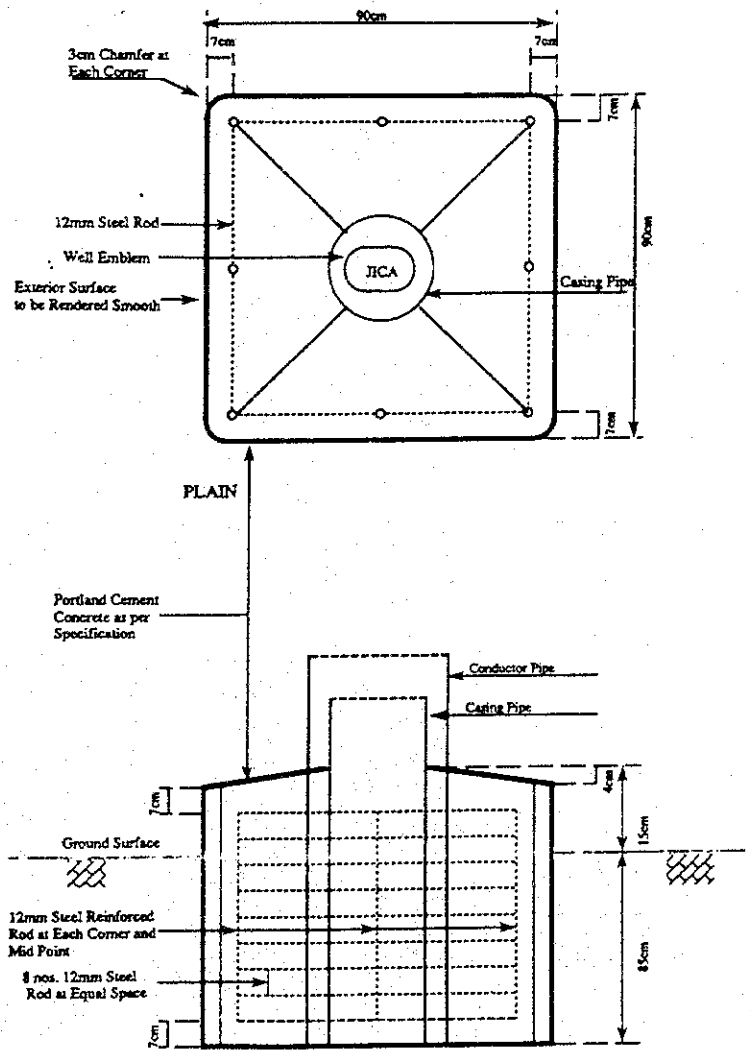

Fig. B-II, 2.12 Concrete Well Head Block for Test Well
<Bloque de Concreto de la Cabeza de Pozo para Pozos de Prueba>

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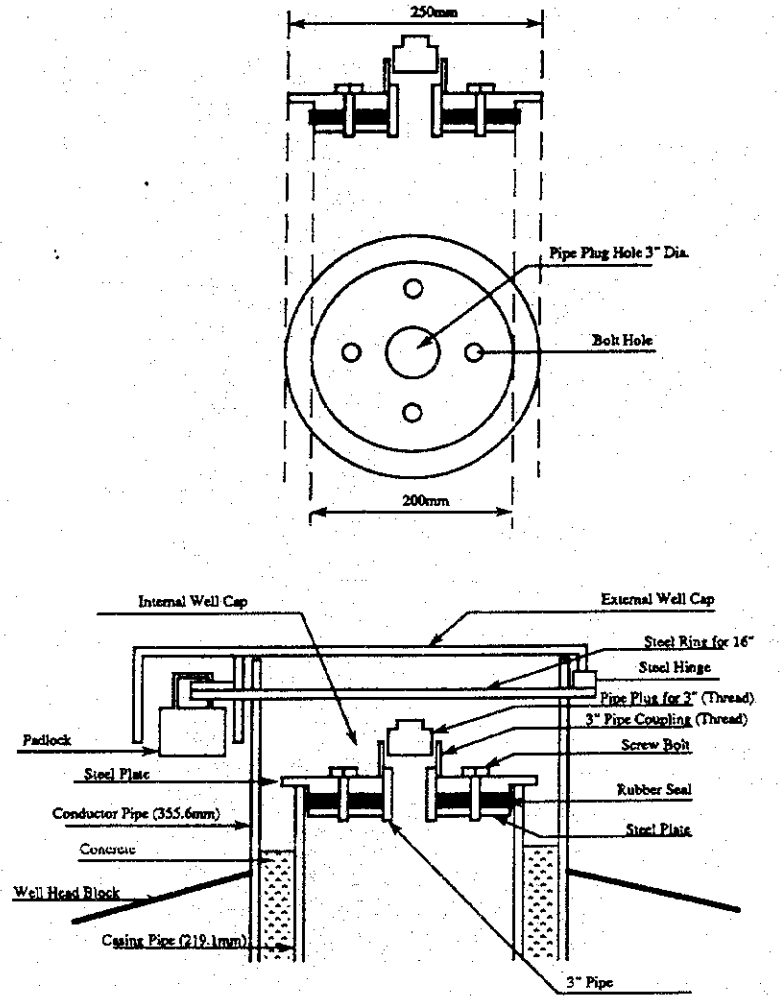

Fig. B-II, 2.13 Well Cap for Test Well
<Tapa para Pozo de Prueba>

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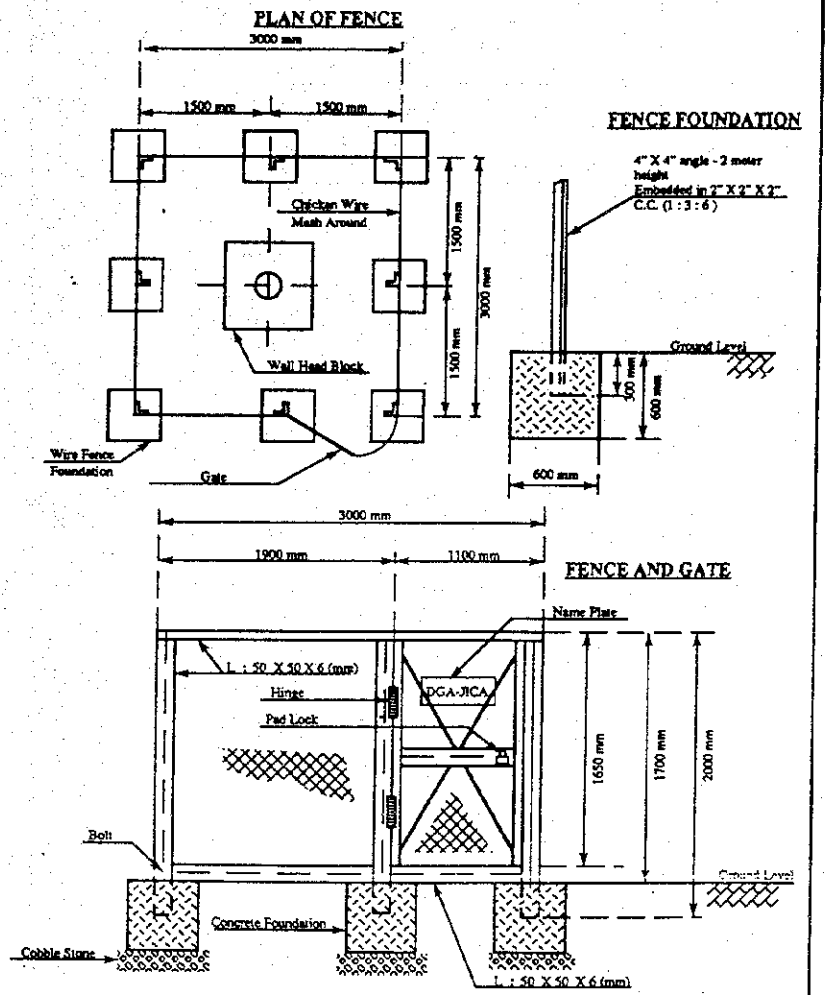

Fig. B-II, 2.14 Fence for Test and Observation Wells
<Cerco para Pozos de Prueba y Observación>

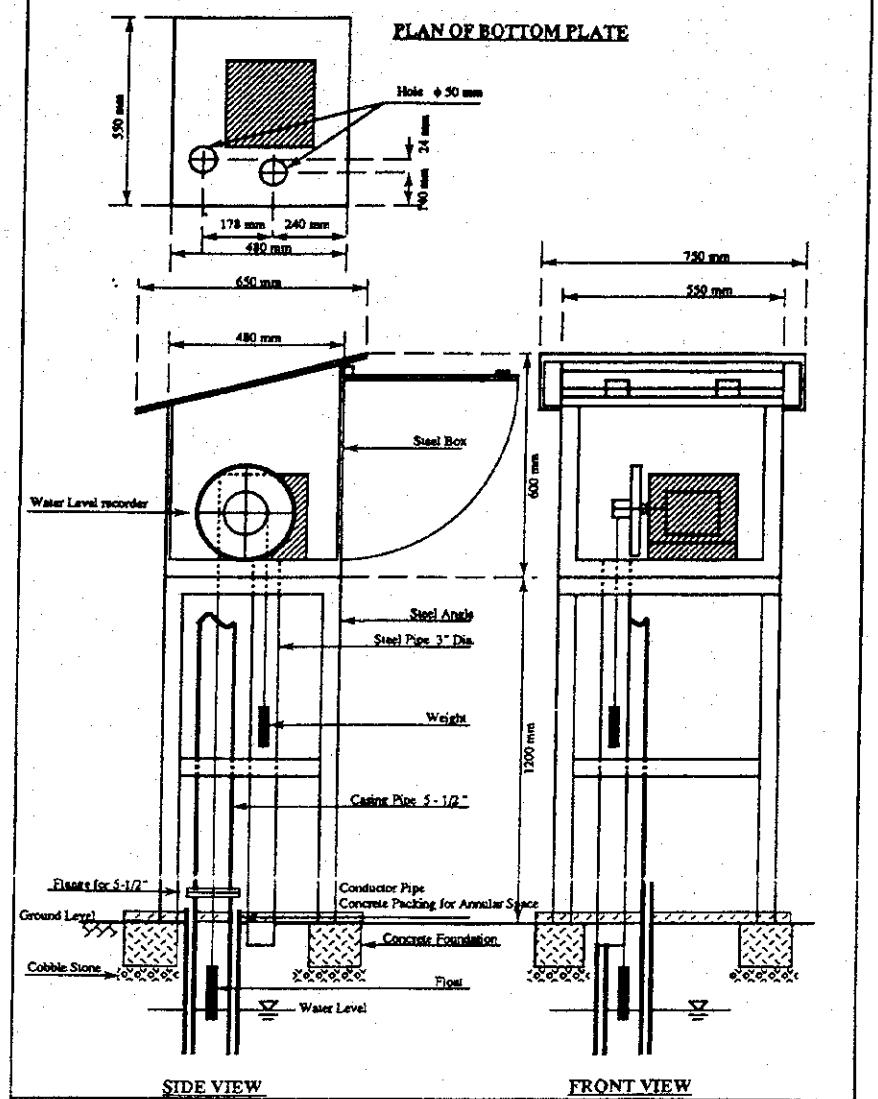

Fig. B-II, 2.15 **Water Level Recorder for Observation Well**
<Registrador de Nivel de Agua para Pozo de Observación>

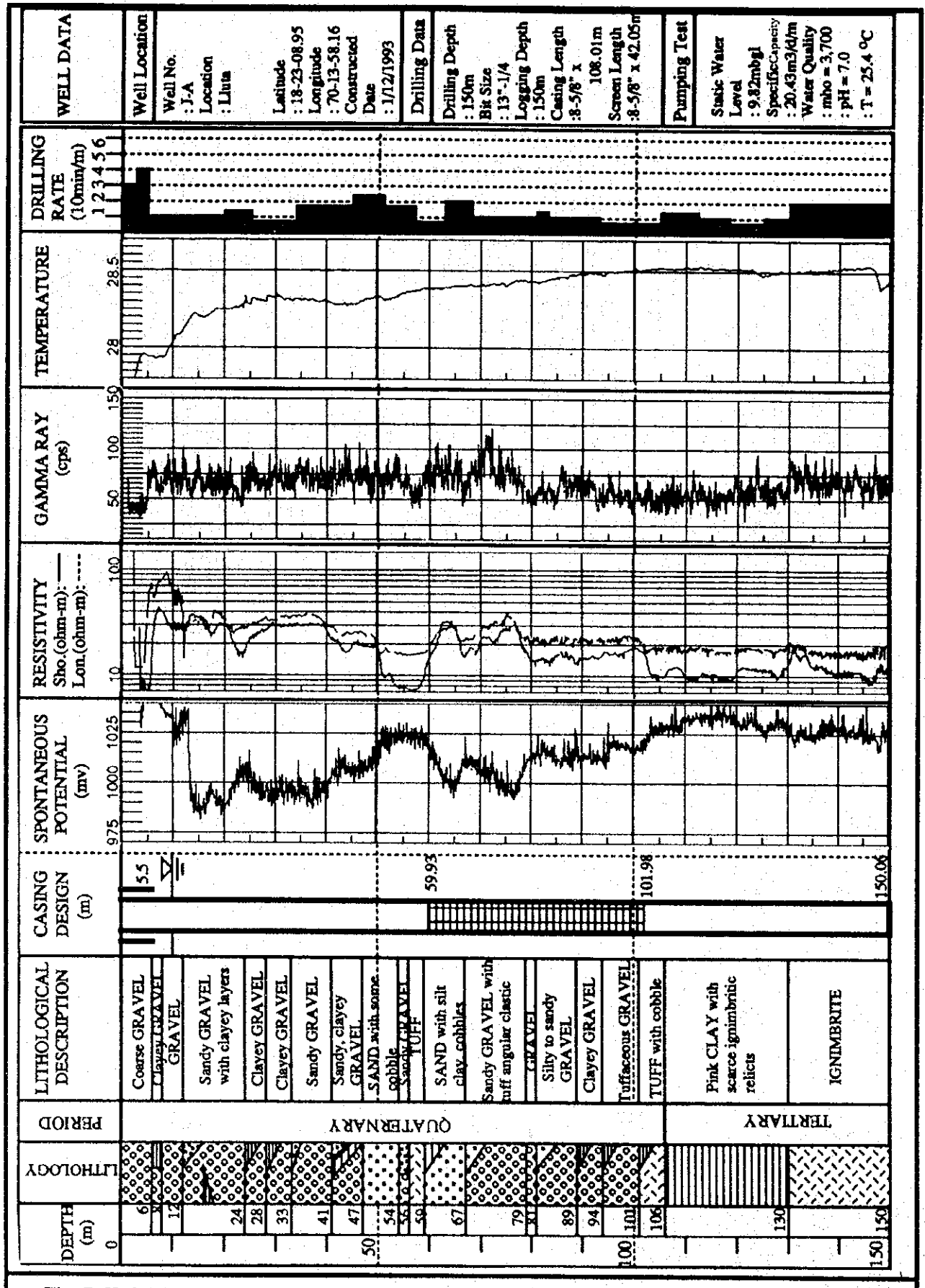

Fig. B-II, 2.16 Well Data for J-A

< Información del Pozo J-A >

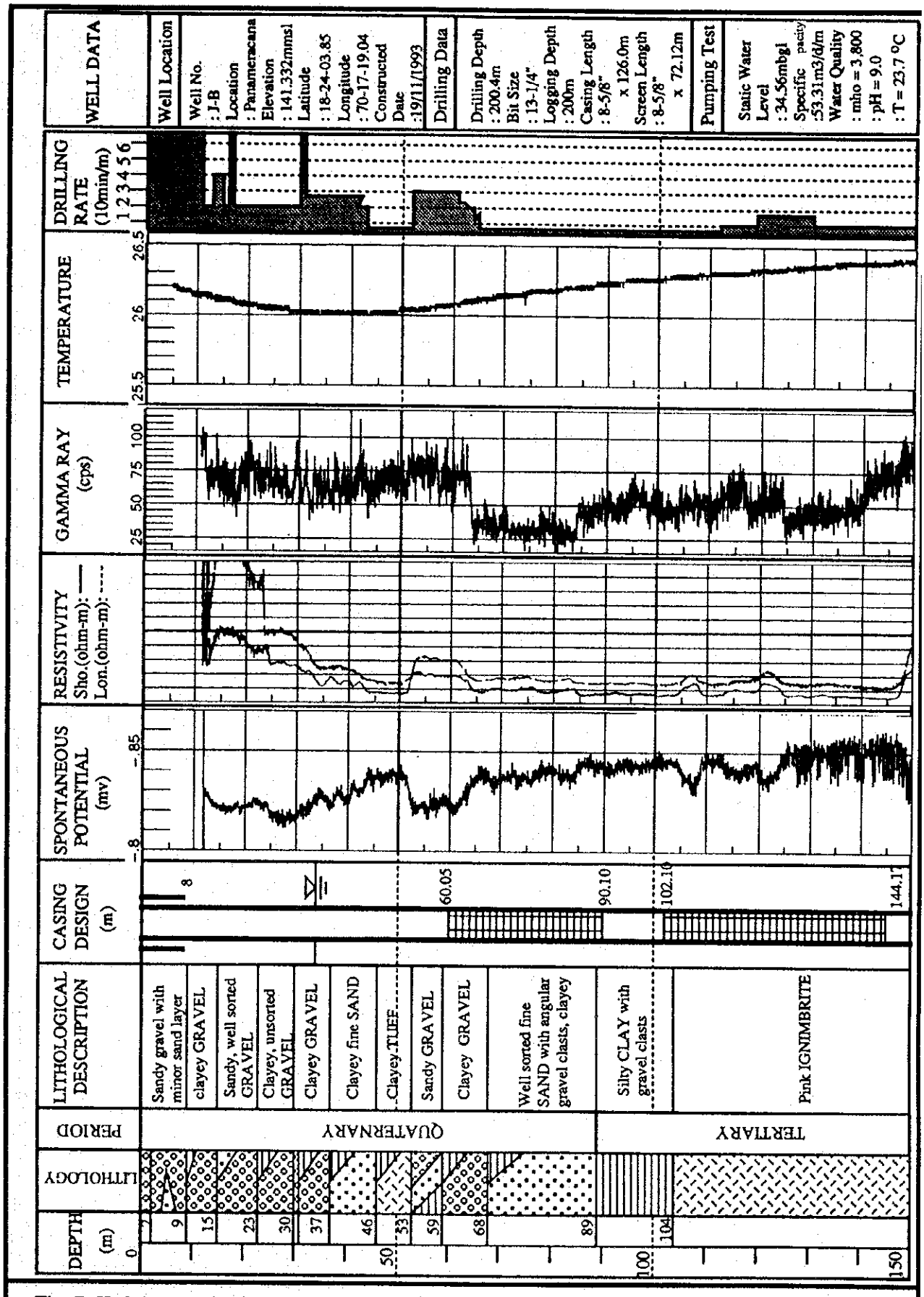

Fig. B-II, 2.17 Well Data for J-B (Sheet No.1)

< Información del Pozo J-B (Hoja Nº 1) >

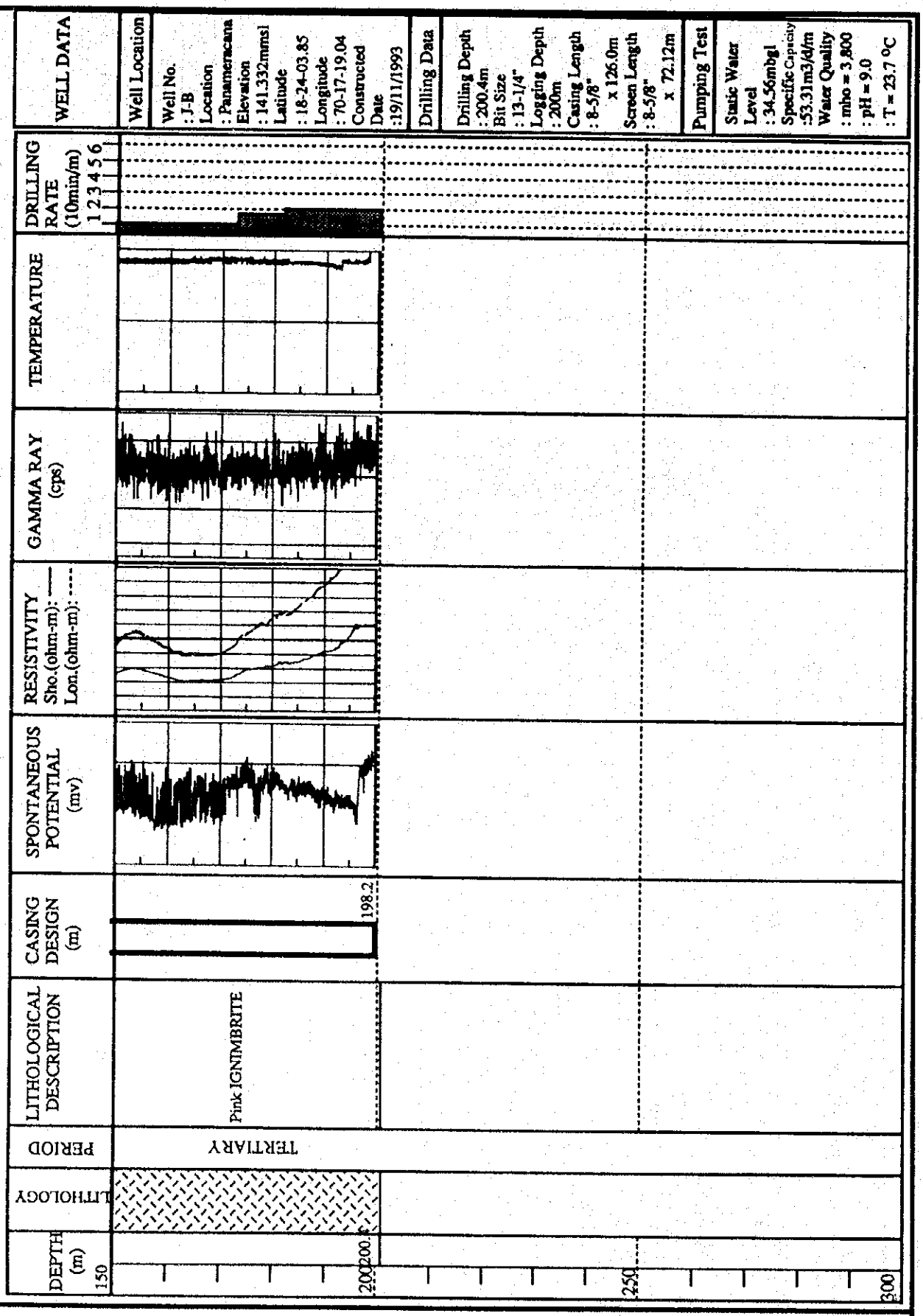

Fig. B-II, 2.17 Well Data for J-B (Sheet No. 2)

< Información del Pozo J-B (Hoja Nº 2) >

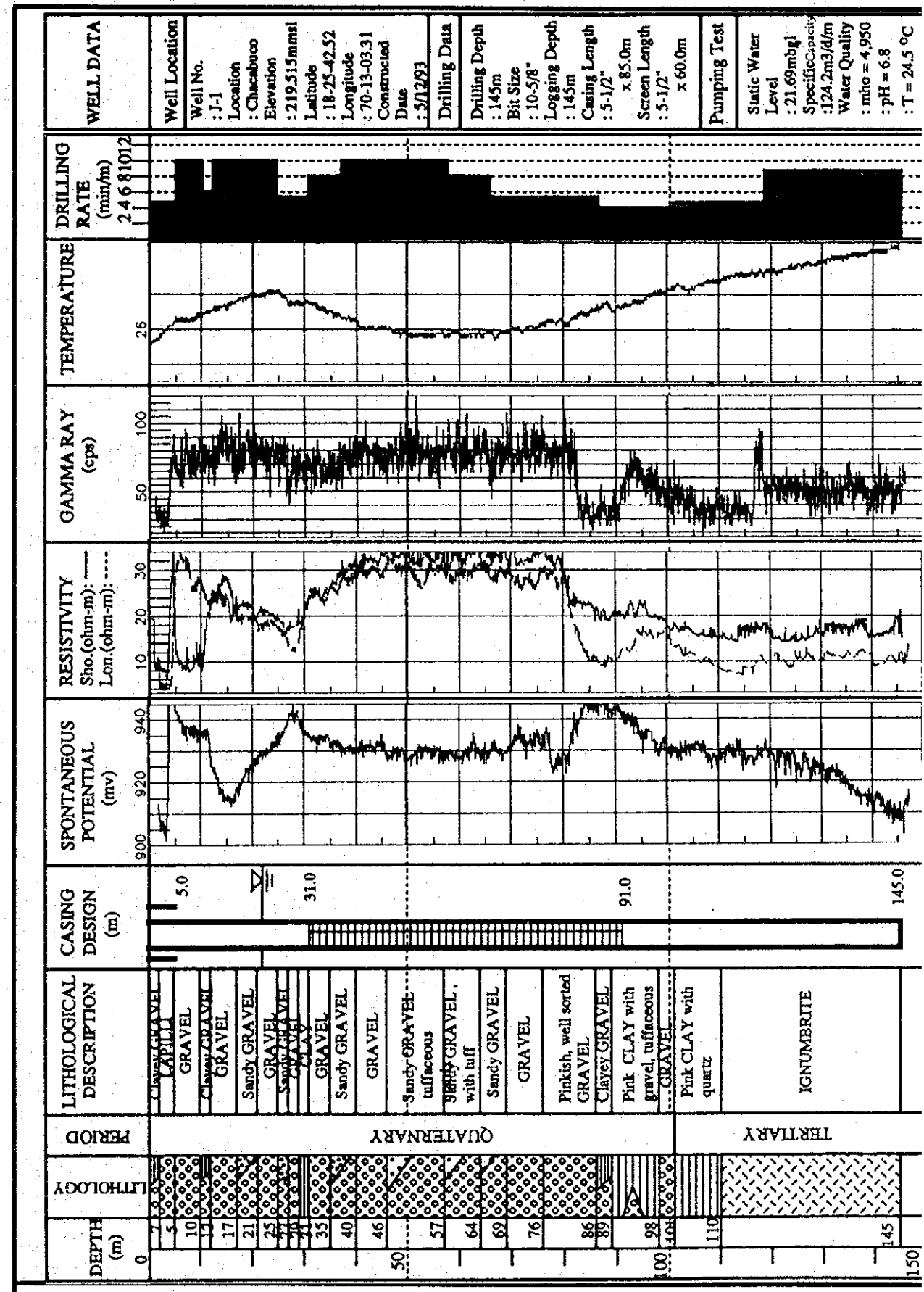

Fig. B-II, 2.18 Well Data for J-1

<Información del Pozo J-1>

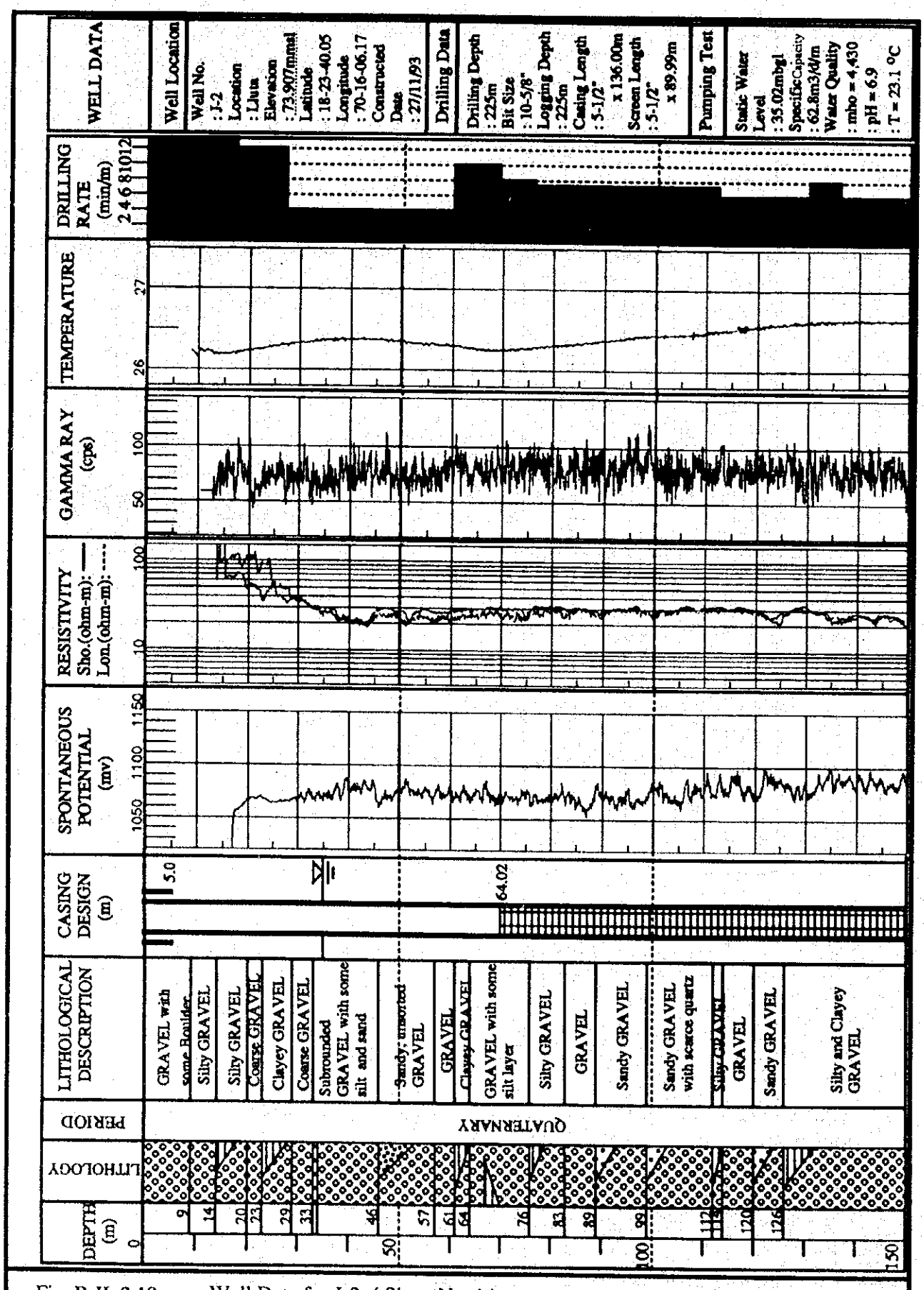

Fig. B-II, 2.19 Well Data for J-2 (Sheet No. 1)

< Información del Pozo J-2 (Hoja Nº 1) >

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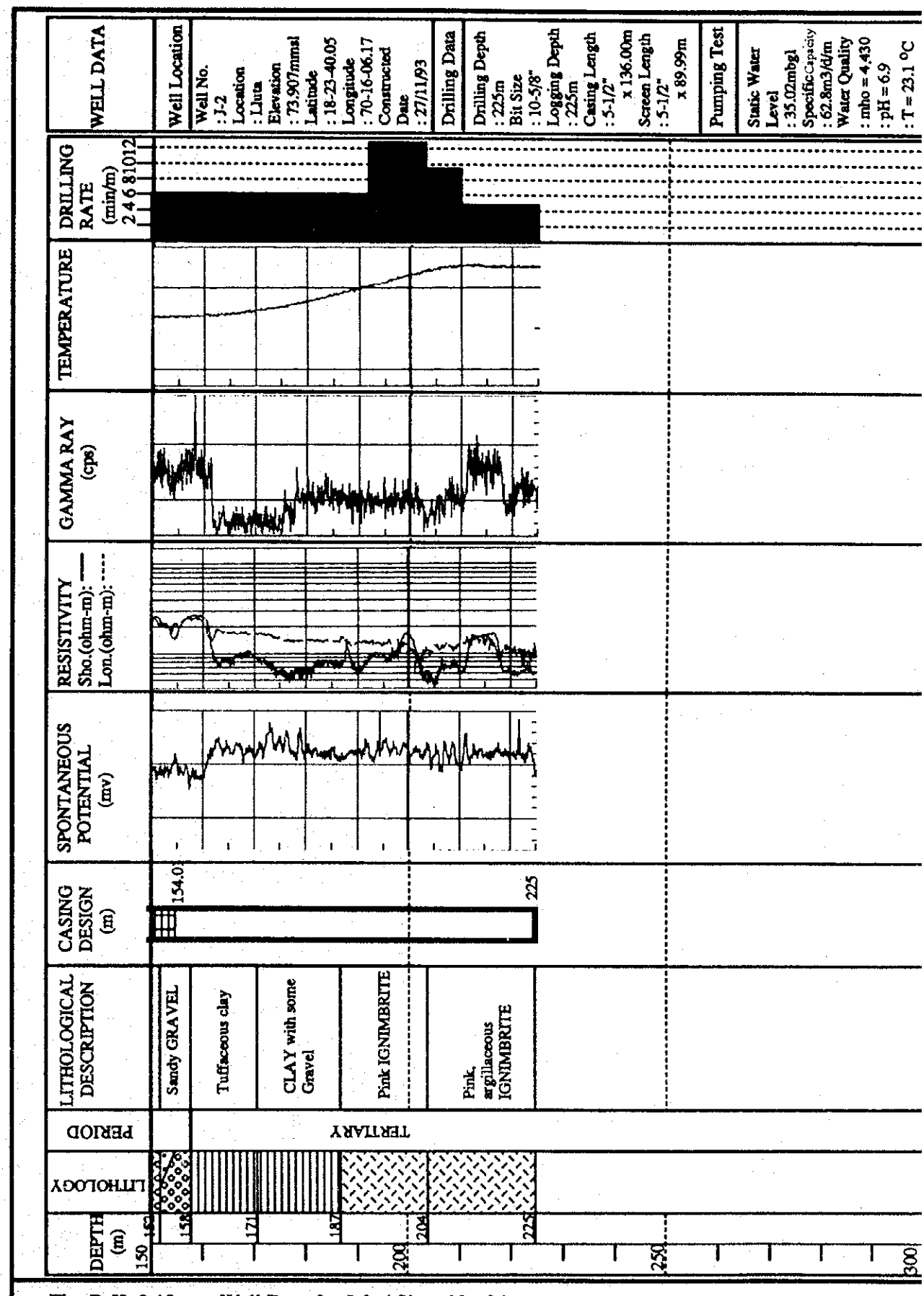

Fig. B-II, 2.19 Well Data for J-2 (Sheet No. 2)

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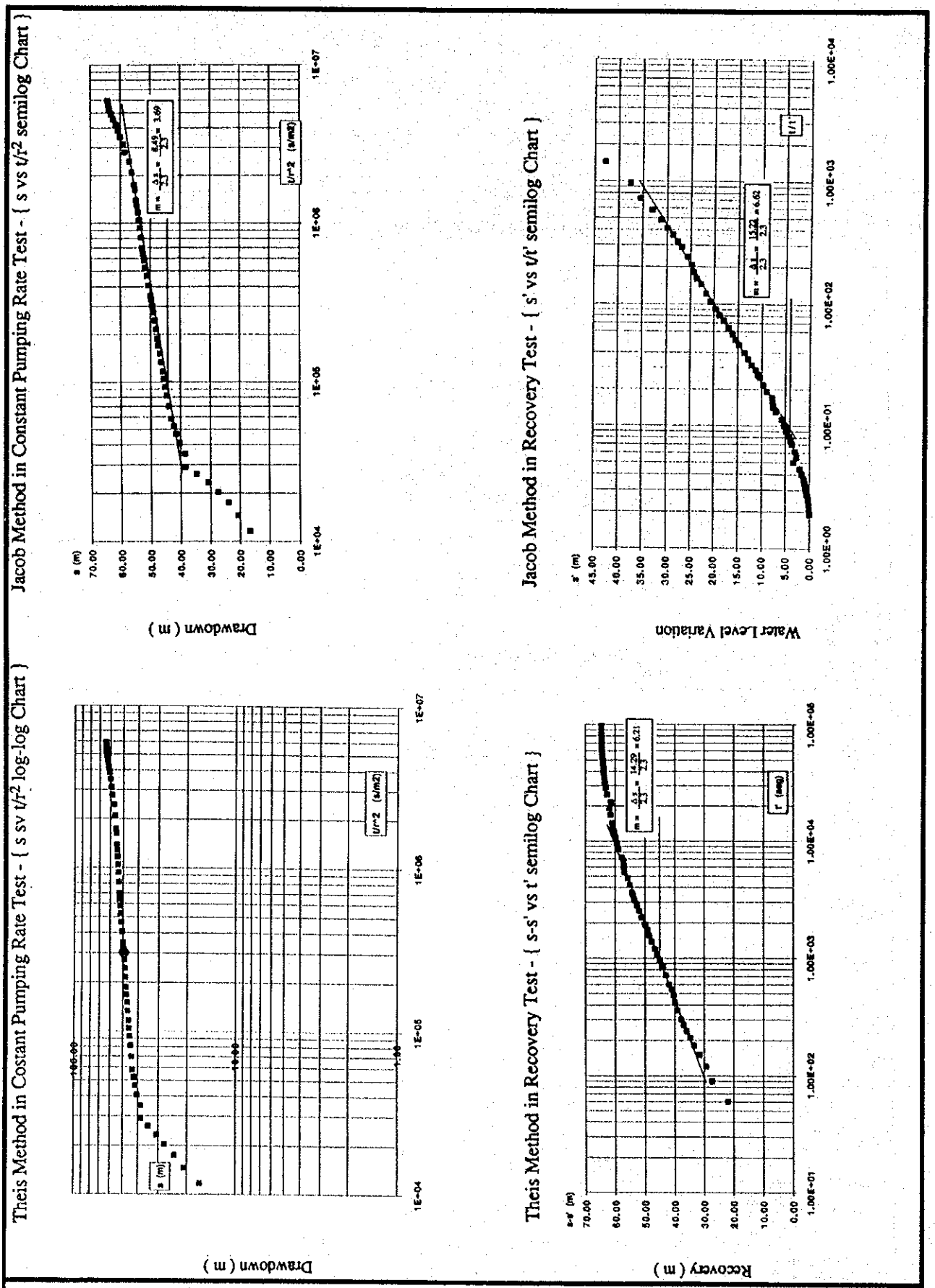


Fig. B-II, 2.20 Graphs for Theis and Jacob Method Analysis (Well No.J-A)

< Gráficos para los Métodos de Análisis Theis y Jacob (Pozo Nº J-A)>

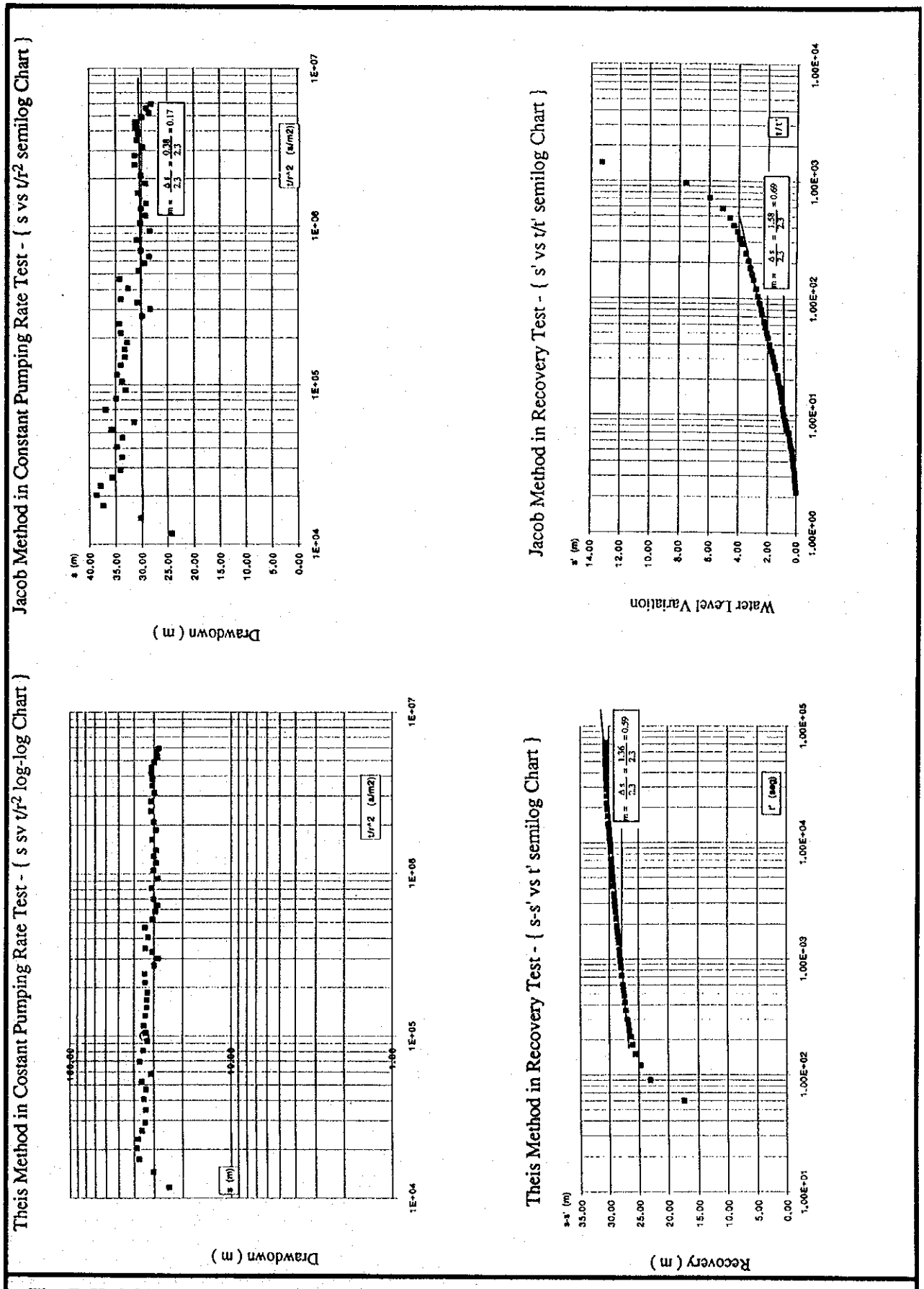


Fig. B-II, 2.21 Graphs for Theis and Jacob Method Analysis (Well No.J-B)

< Gráficos para los Métodos de Análisis Theis y Jacob (Pozo Nº J-B) >

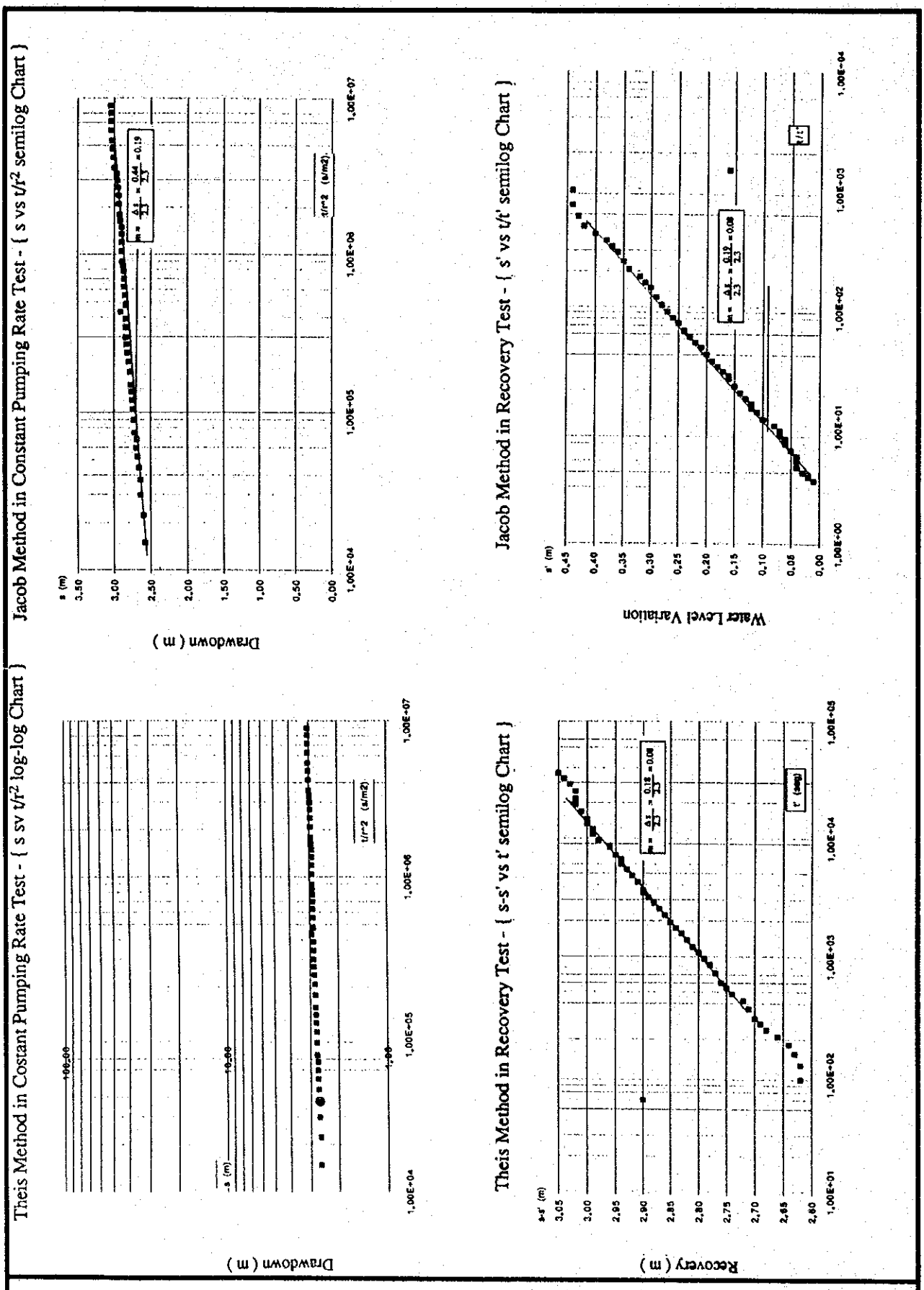


Fig. B-II, 2.22 Graphs for Theis and Jacob Method Analysis (Well No.J-1)

< Gráficos para los Métodos de Análisis Theis y Jacob (Pozo Nº J-1) >

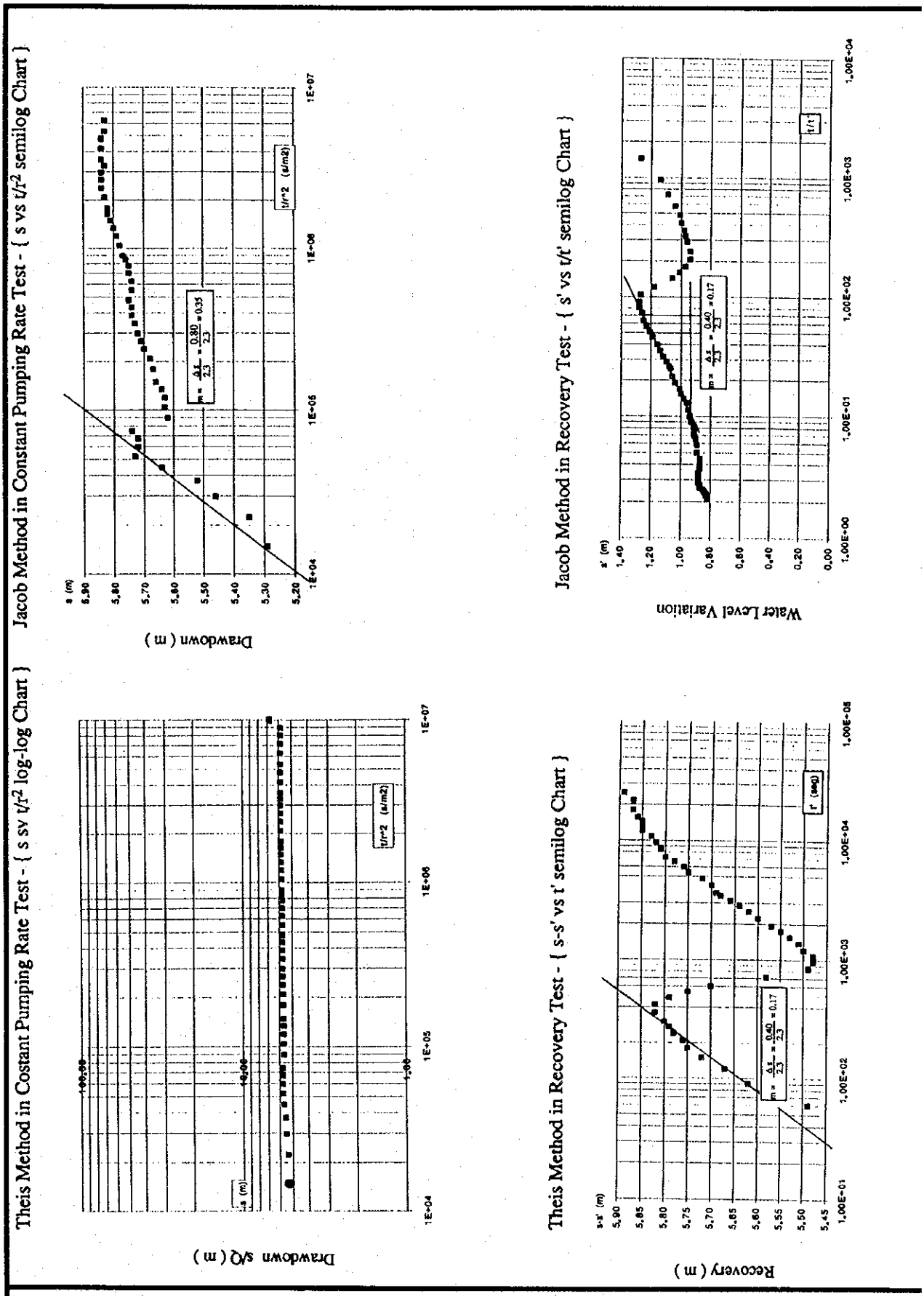
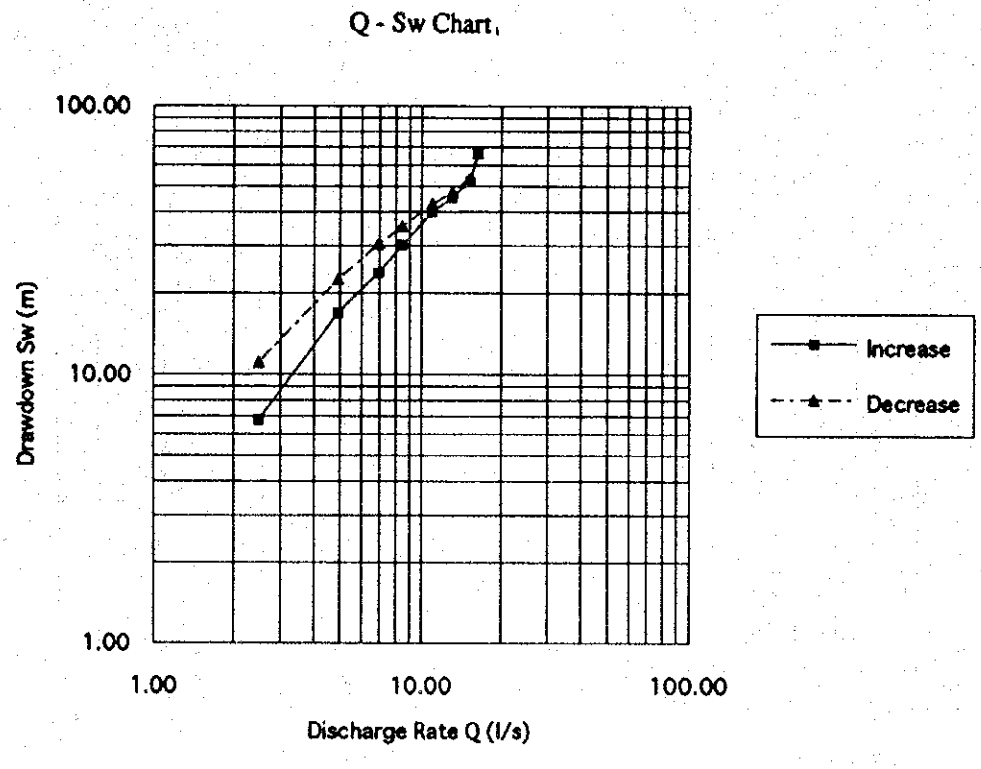


Fig. B-II, 2.23 Graphs for Theis and Jacob Method Analysis (Well No.J-2)

< Gráficos para los Métodos de Análisis Theis y Jacob (Pozo Nº J-2) >



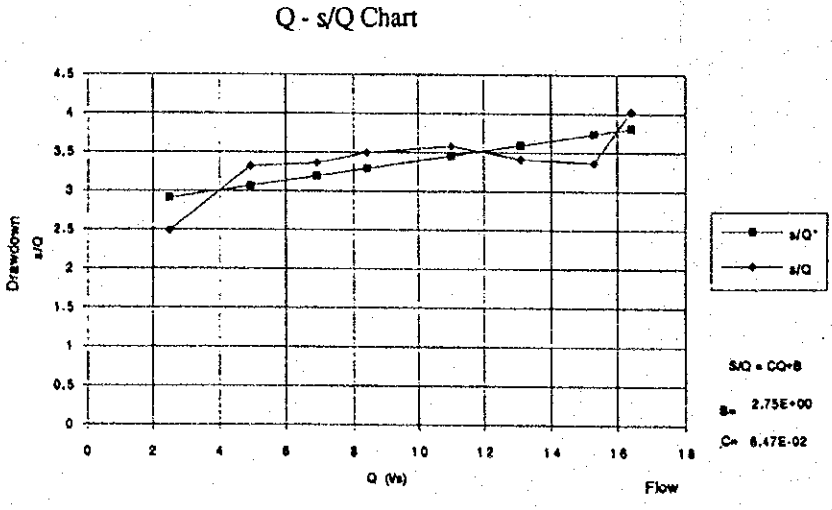
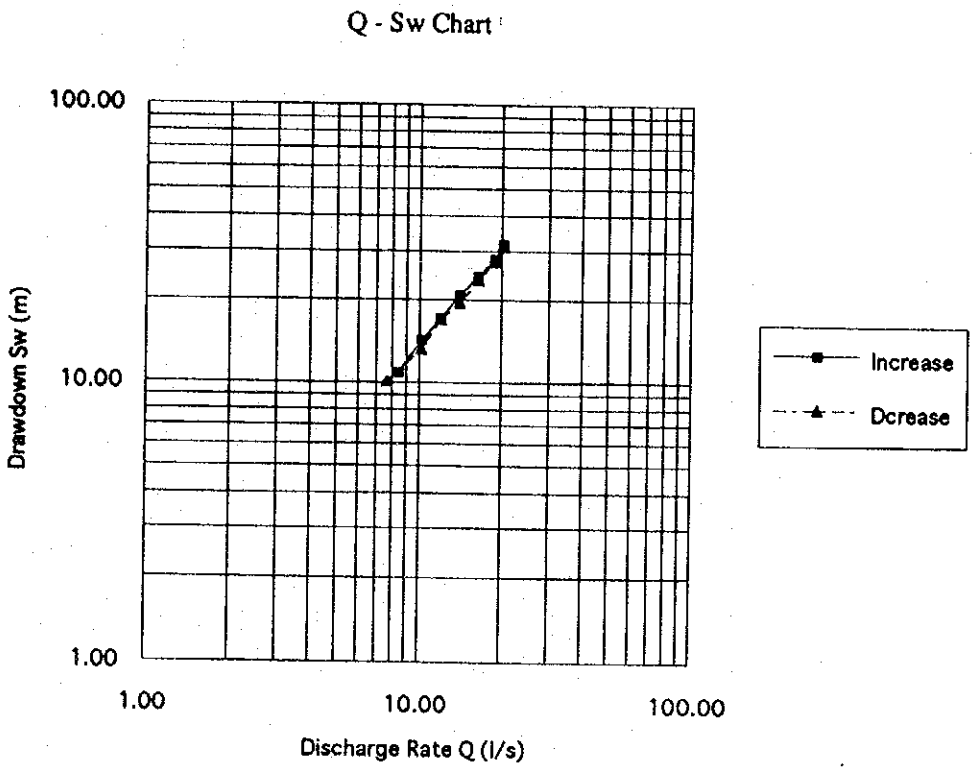


Fig. B-II, 2.24 Graphs for Step Drawdown Test (Well No.J-A)
<Gráficos para Prueba de Gasto Variable (Pozo No.-A)>



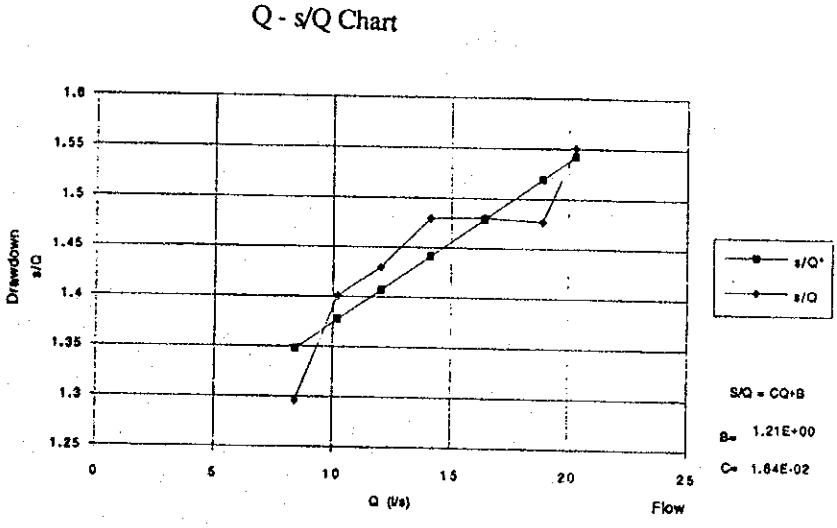
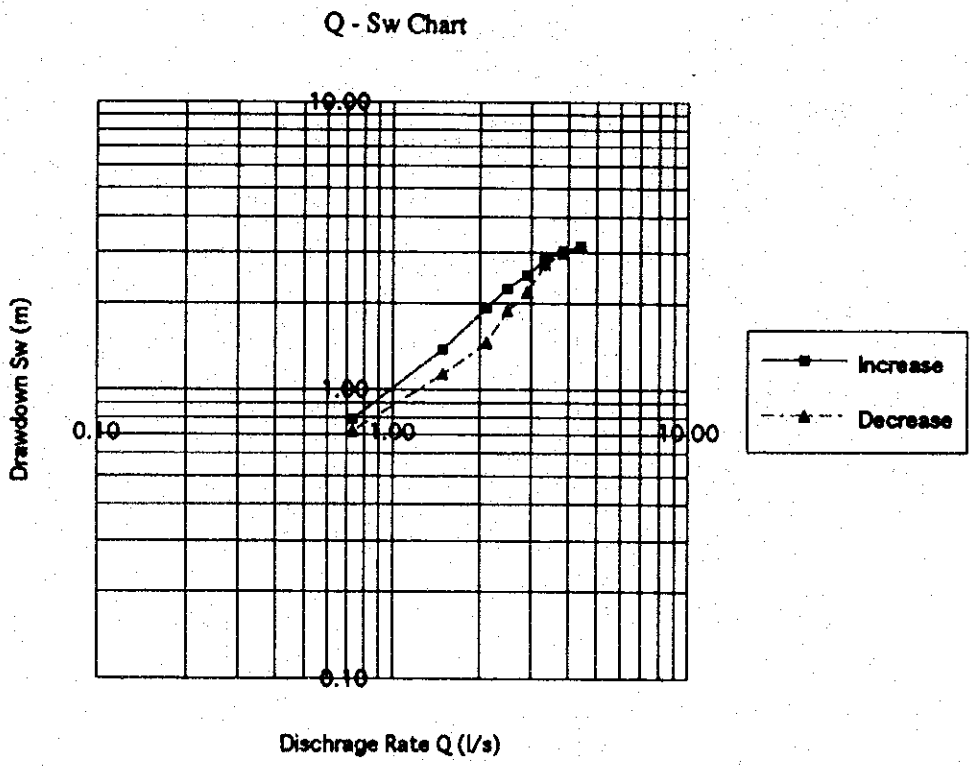


Fig. B-II, 2.25 Graphs for Step Drawdown Test (Well No.J-B)

<Gráficos para Prueba de Gasto Variable (Pozo No.-B>



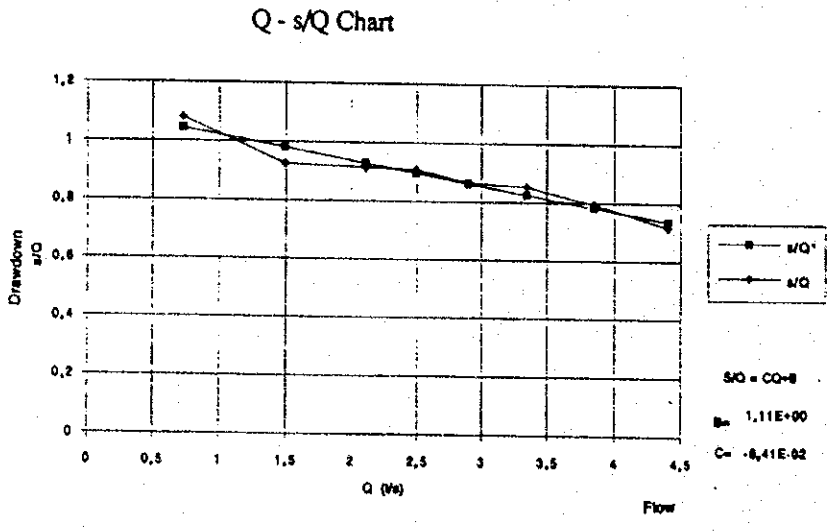


Fig. B-II, 2.26 Graphs for Step Drawdown Test (Well No.J-1)
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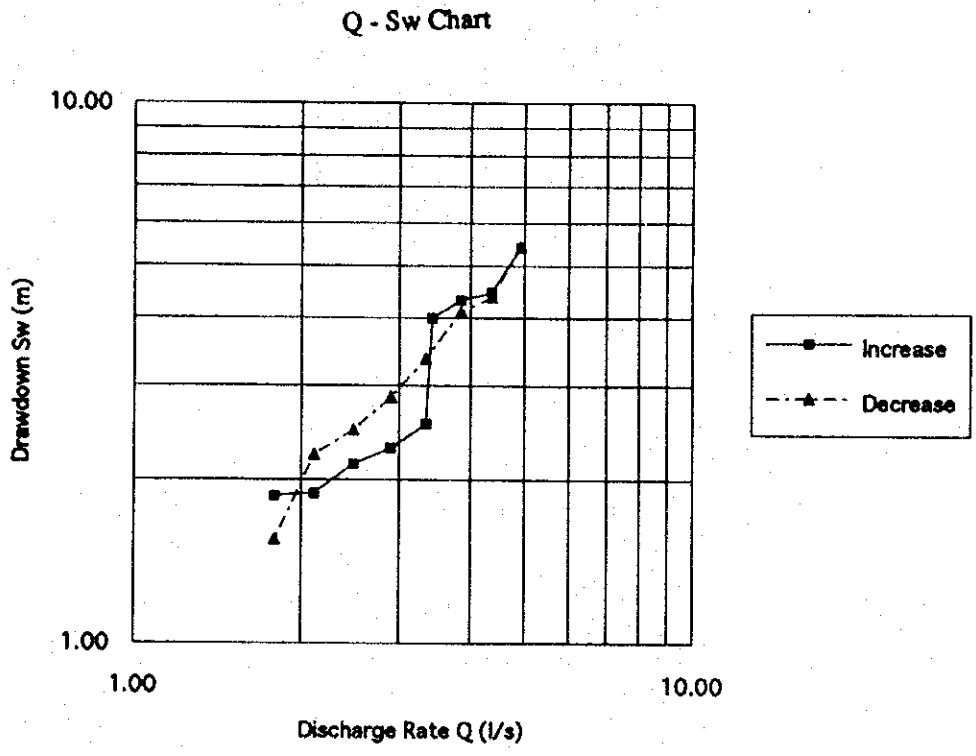

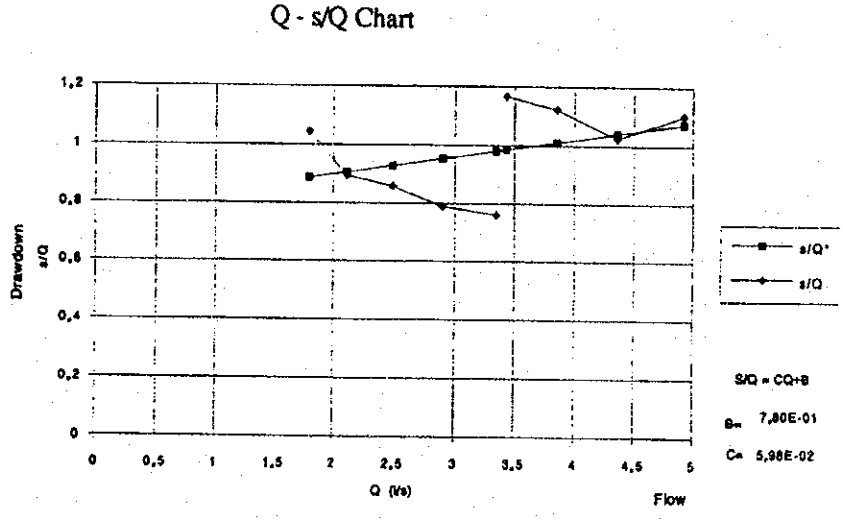

Fig. B-II, 2.27 Graphs for Step Drawdown Test (Well No.J-2)

<Gráficos para Prueba de Gasto Variable (Pozo No.J-2)>

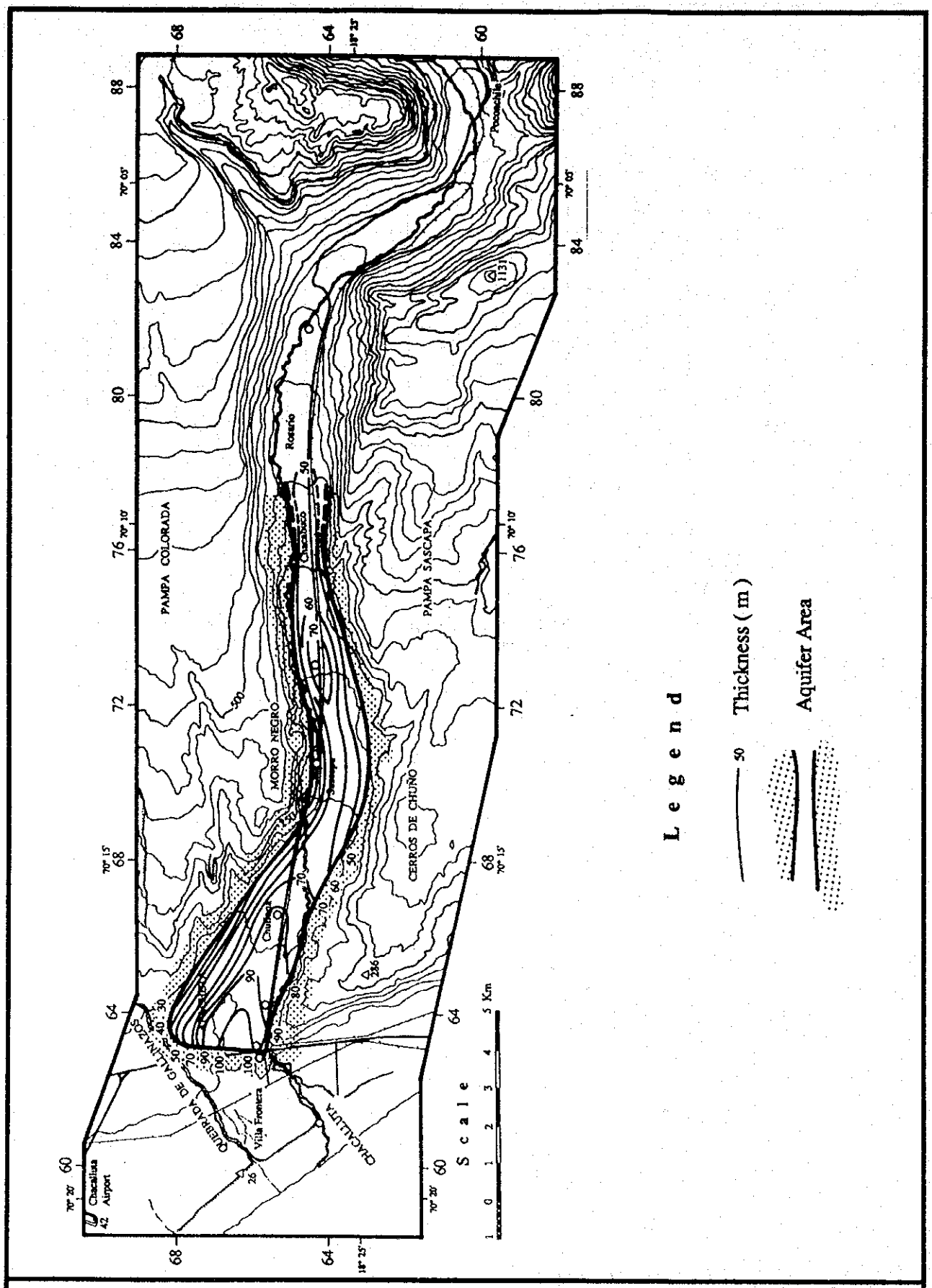

Fig. B-II, 2.28 Isopach Map of Deep Aquifer

< Mapa Isopaca de Acuifero Profundo >

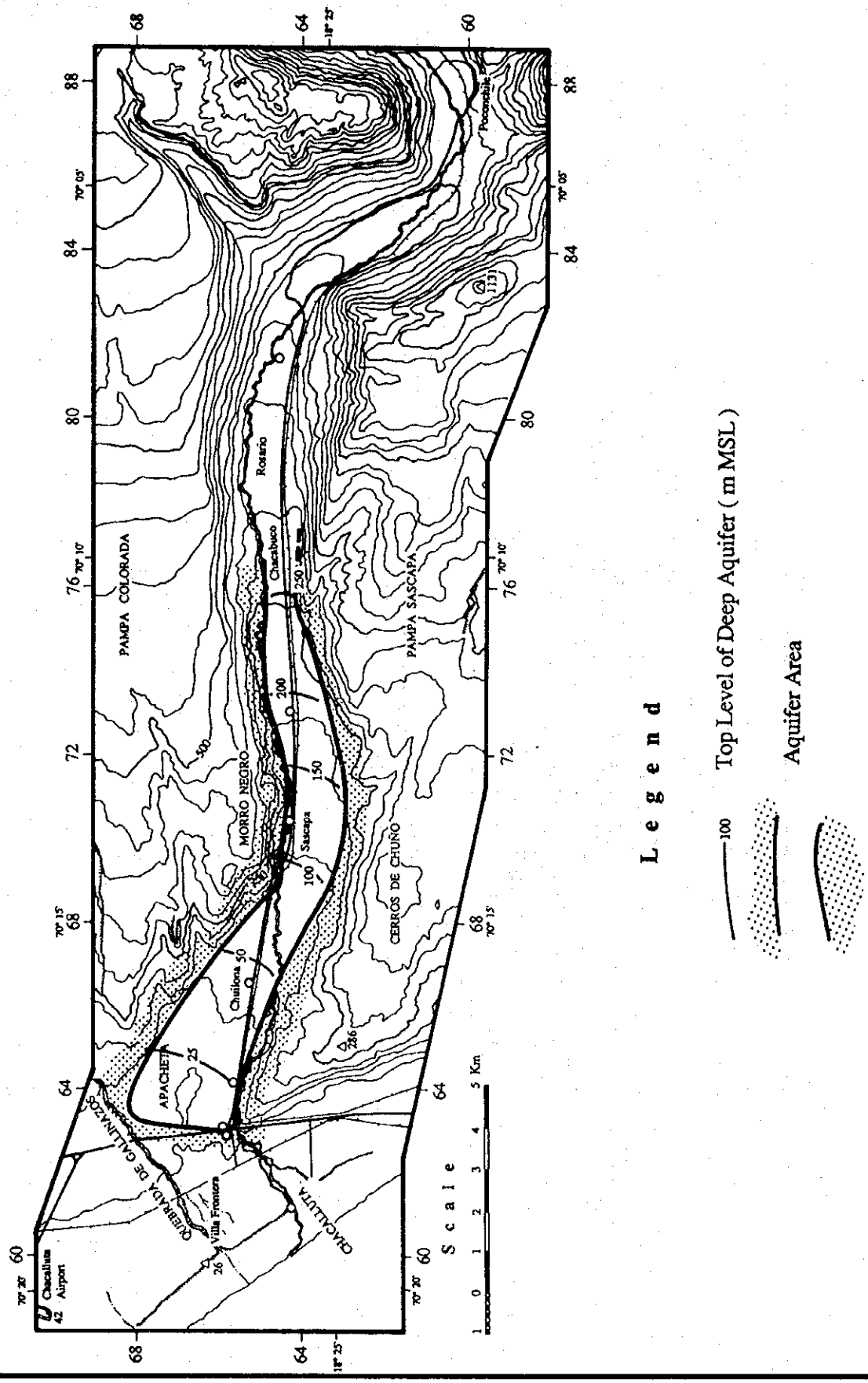

Fig. B-II, 2.29 Top of Deep Aquifer

< Superficie del Acuifero Bajo >

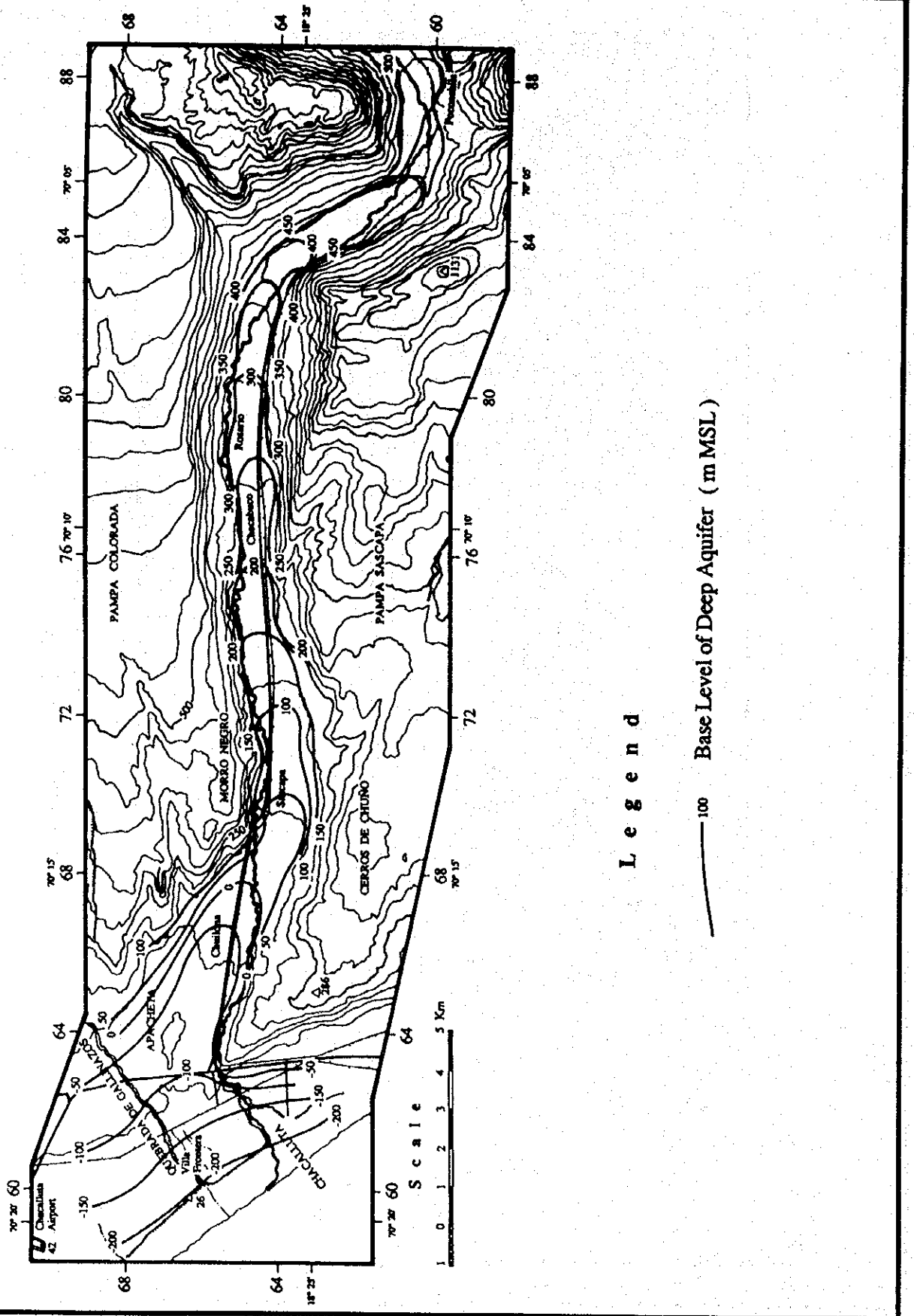

Fig. B-II, 2.30 Base of Deep Aquifer

< Fondo del Acuifero Bajo >

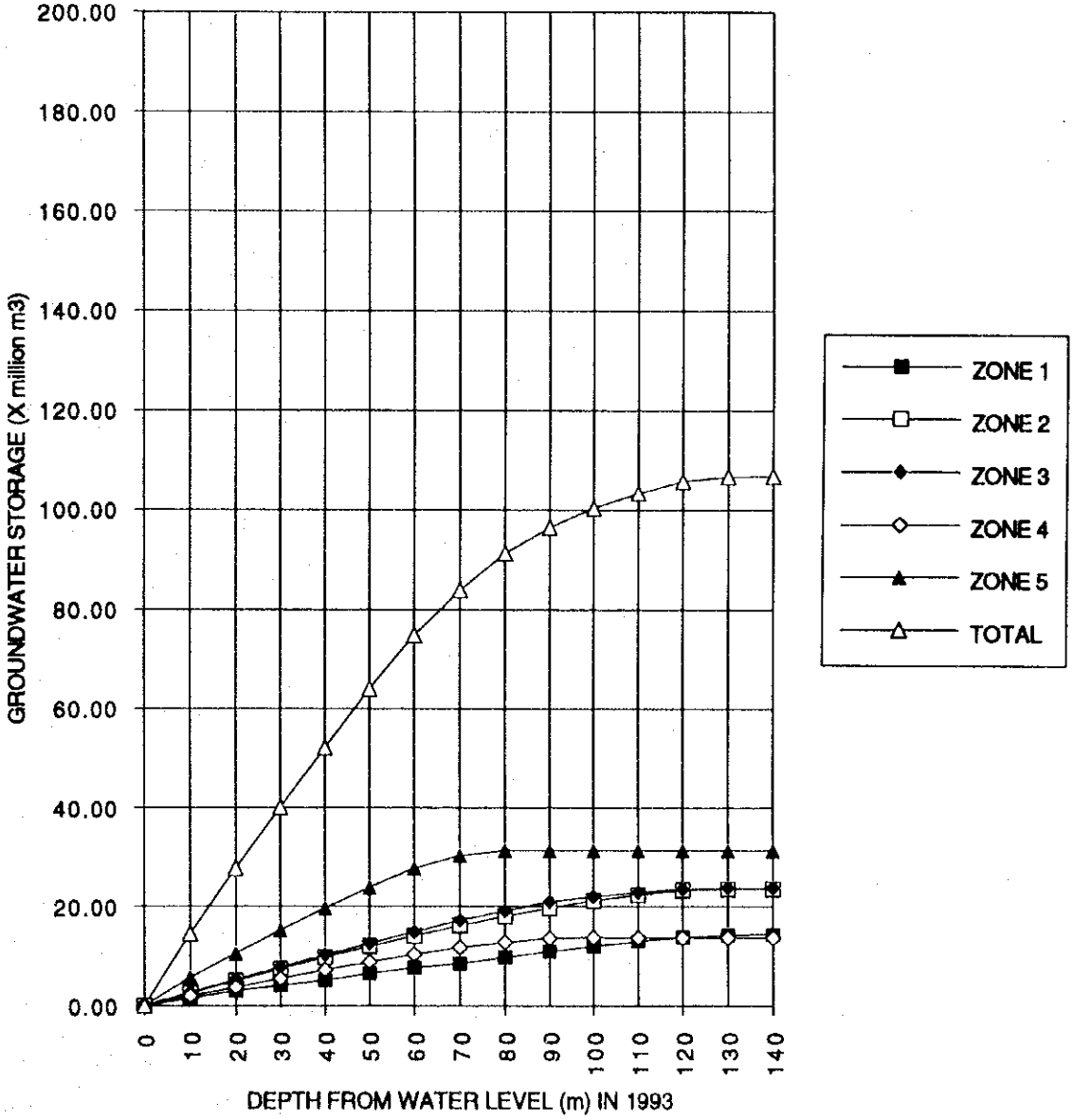

Fig. B-II, 2.31 Estimation of Groundwater Storage

<Estimación de Reservas de Agua Subterránea>

Chapter III. GROUNDWATER EXTRACTION

3.1 Existing Groundwater Extraction

Groundwater has been extracted from springs at Bocanegra and Poconchile, and from two (2) deep wells and dug wells at Villa Frontera area. The groundwater is used for the drinking water at Poconchile town, and for industries and irrigation at Villa Frontera, the lower reaches of the valley.

3.1.1 Deep Aquifer

The deep aquifer originally appears under the shallow aquifer and is mostly separated from it by the tuff layer. However, there is no tuff layer, boundary between two (2) aquifers, in the upstream of Chacabuco. For this reason, the aquifer distributed from Poconchile to Bocanegra (about 10 km northeast from Poconchile) is included in the deep aquifer for convenience.

1) Chuilona and Villa Frontera

Only two (2) wells, well No. 101 and 103 are extracting the groundwater from the deep aquifer near the Panamerican Road and the railway to Peru. The well, No.101 is operating for irrigation use at the Villa Frontera area. The well, No.103 is for private use. Extraction rate is not clear for both wells.

2) Poconchile

One (1) spring is located about 4 km east of Poconchile town. Water of the spring (No. V-2: refer to Table B-II, 2.1) is led to Poconchile town for potable water supply. The yield of the spring is seemed to be not small.

3) Bocanegra

There are one (1) well and one (1) spring at Bocanegra. The well was drilled for the groundwater study and is now abandoned. The spring supplies water to the Borax factory for the industrial use. However, extraction rate is unclear.

3.1.2 Shallow Aquifer

10 dug wells are extracting the groundwater from the shallow aquifer at the Villa Frontera area. Out of these, eight (8) dug wells are used for irrigation and industry.

Only one (1) data is available on the yield. According to the data, the dug well (No. V-2) is estimated to supply about 105,500 m^3/year of groundwater for industrial use. Extraction rate of other wells are unclear.

3.2 Groundwater Level

There are two (2) aquifers in the Lluta Valley as mentioned in Chapter 2; the shallow aquifer and the deep aquifer. DGA and the Study Team executed the groundwater level observation on 17th June 1993, since few data were available in the Lluta River Basin. In addition, the Study Team constructed two (2) test wells and two (2) observation wells during phase 2 study.

3.2.1 Water Level in Shallow Aquifer

The wells in the shallow aquifer are located only in the Villa Frontera area. However, no data is available on these wells. DGA and the Study Team observed water levels on 10 dug wells constructed in the shallow aquifer in Villa Frontera area. The result of the observation are shown below;

Well No.	Location	Elevation (m)	Static Water Level (m BGL)	(m MSL)
N-0	Villa Frontera	32	27.22	4.78
N-1	Villa Frontera	22	15.66	6.34
N-2	Villa Frontera	22	-	-
N-3	Villa Frontera	11	5.00	6.00
N-4	Villa Frontera	22	19.98	2.02
N-5	Villa Frontera	30	24.60	5.40
N-6	Villa Frontera	32	24.53	5.47
N-7	Villa Frontera	32	dried	
N-8	Villa Frontera	32	-	-
N-9	Villa Frontera	36	23.76	12.24

The depth to the water level ranges from 5 m to 27 m, averaging 20.1m. Static Water Level is generally low; 2 to 12 mMSL.

A contour map of water level (Fig. B-II, 3.1) is prepared based on the results of water level observation. The map presents the distribution of water level (MSL) in the Villa Frontera area. The water level ranges from 12.24 m (well No. N-9: refer Table B-II, 2.1) at Panamericana to 2.0 m (well No. N-4) at the southeast side of the Villa Frontera area (Fig. B-II, 3.1). Isopotential lines of the water level suggest groundwater flow from east and northeast. This means that groundwater of the

shallow aquifer is recharged from these directions i.e. the Lluta River. This is supported by the water quality analysis data (see 3.3 of Chapter 3).

Other contour maps were prepared by Alamos y Perelta and Ingendesa. These results are in well agreement with this Study.

3.2.2 Water Level in Deep Aquifer

There are four (4) existing wells and four JICA wells penetrated to the deep aquifer. Water levels of these wells are as follows;

Well No.	Location	Elevation (m)	Static Water Level (m BGL)	(m MSL)
100	Rosario	350	5.83	344.17
J-1	Chacabuco	220	21.69	197.83
J-A	Lluta	178	9.82	168.21
J-2	Lluta	107	34.56	72.81
J-B	Panamericana	74	73.77	38.75
101	Panamericana	60	36.10	23.90 *)
102	Panamericana	55	30.06	24.94
103	Panamericana	55	30.06	24.94

note: the mark *) means the water level not completely recovered after pumping.

Static water level in the deep aquifer is shown in Fig. B-II. 3.2. Static water level is about 450 mMSL near Poconchile, 300 to 350 mMSL at Rosario, 250 mMSL at Chacabuco, 50 mMSL at Chuilona and 25 mMSL at the entrance to Villa Frontera. Gradient of water level is 20/1000 which is larger than that of the Lluta River.

3.3 Groundwater Quality

No existing water quality data was available in the area. Therefore, DGA and the Study Team executed groundwater sampling and water quality analysis on the existing wells and JICA wells. The results of water quality analysis are shown in Table B-II, 3.1.

3.3.1 Water Quality of Shallow Aquifer

Results of the water quality analysis are as follows;

1) Temperature ranges from 21.8 to 25.2 °C. TDS values are in a range between 2,948 mg/l and 4,390 mg/l. All the TDS values exceed the standard of drinking water (WHO).

2) The health significance parameters other than NO_3 are generally within the standard (WHO). NO_3 is in a range between 5.66 mg/l and 18.73 mg/l, averaging 9.56 mg/l; i.e. all the wells exceed the standard. Contamination by NO_3 is possibly caused by agricultural chemicals.

3) Arsenic (As) contents are generally lower than the standard value; only the groundwater of well No. N-3 exceeds the standard.

4) Contents of boron (B) range from 13.92 to 29.00 mg/l. These values exceed the tentative standard of the Study, 5 mg/l.

5) Among the major ions, Na, Cl and SO_4 contents show the values much higher than the standard.

3.3.2 Groundwater Quality of Deep Aquifer

Groundwater Quality of the Deep aquifer is summarized in the following table.

Item	Standard (mg/l)	Range (mg/l)	Average (mg/l)	Number of well*
Temperature	-	21.4-26.8	23.7	-
pH	6.0-8.5	6.6-7.3	6.9	none
TDS	1000	2845-3945	3,289	all the wells
Mg	125	74-105	92	none
Na	200	437-613	529	all the wells
SO_4	250	625-1023	852	all the wells
Cl	250	791-1089	949	all the wells
NO_3	10.00	0.41-15.75	5.6	100-2
As	0.05	0.005-0.045	0.029	none
F	1.50	0.72-1.14	1.00	none
Cd	0.005	0.005-0.015	0.010	J-1, 2:J-A, B
Cr	0.05	0.01-0.03	0.021	none
Pb	0.05	0.015-0.08	0.04	J-1, J-2
B	5.00	11.87-27.30	21.87	all the wells
Fe	0.30	0.05-6.60	1.53	100-2, J-1, J-A
Mn	0.10	0.01-3.85	0.72	J-1,J-A
Zn	5.00	0.041-3.220	1.124	none
Cu	1.00	0.013-0.039	0.024	none
Al	0.20	0.10-0.30	0.20	none

note: * means number of wells which exceed the standard.
Fe contents of JICA wells No. J-1&J-A may be influenced by the riser pipes.

Characteristics of water quality are shown below;

1) TDS value is much higher than the standard.

2) B content is very high compared with the surface water.

3) As content is fairly low in comparison with the surface water.

4) NO_3 content is less than standard, although that of the shallow aquifer almost exceeds the standard. This fact suggests that groundwater in the deep aquifer is not influenced by the surface water in the Lower Lluta Valley.

5) All the JICA wells show higher contents of Cd and Fe. However, there is high possibility that Fe contents of J-1 and J-A are influenced by riser pipes used during the pumping tests, because the brand new pipes are used at the tests.

6) Other ion contents are generally lower than that of standards.

3.3.3 Major Ion Composition

Fig. B-II, 3.3 is a tri-linear diagram which shows the ion composition of the groundwater. All the wells are plotted in a small area concentrating near the boundary between the Non carbonate hardness type and the Non carbonate alkali type. This fact leads to following suggestions;

1) The groundwater originated from the same source i.e. the surface water of the Lluta River.

2) The groundwater are influenced by the waste water from mines or water originated from volcanoes. As a matter of fact, contamination sources are found in the upper reaches of the Lluta River (see, Supporting Report A).

3.3.4 Evaluation of Groundwater Quality

Groundwater quality in the aquifers is mentioned in 3.3.1 and 3.3.2 of this chapter. High content of NO_3 in the shallow aquifer shows the contamination by agricultural chemicals as mentioned above. Furthermore, if it is true, the shallow aquifer is possibly contaminated by other organic chemicals.

So far as concerned with the deep aquifer, the groundwater quality is not suitable for domestic water as it is, especially due to high TDS value and B contents. Some wells

exceed the standard of Cd, Pb, Fe and Mn. Therefore, the groundwater in the deep aquifer is also not suitable for the drinking water as it is. At treatment system should be considered if this water will be used for the drinking water source.

3.3.5 Future Change of Water Quality

Among the items of water quality, there are large differences in As and B contents of the surface water and the groundwater. B content is low in the surface water and increases its contents in the groundwater. In contrary to this, As contents is high in the surface water and low in the groundwater. These phenomena are caused by the infiltration of the surface water into the groundwater. Therefore, this phenomena will continue after the development of groundwater in the Lower Lluta Valley.

As for the other items, there is not so much difference between the surface water and the groundwater.

Considering these conditions, water quality of the groundwater will not change in the future even if the groundwater development will be made in the valley.

3.4 Evaluation of Groundwater Development Potential

Prospective aquifer area in the Lower Lluta Valley is shown in Fig. B-II, 3.5.

The aquifers in the Lower Lluta Valley are recharged by the surface water of the Lluta River. In the Lluta River Basin, the aquifers are saturated with groundwater because only a small quantity of groundwater is extracted through wells from the aquifers. The future groundwater extraction will cause a certain degree of water level depression. It will accerelate groundwater infiltration to the aquifers.

On the other hand, surface water is extracted for irrigation use based on the water rights. The groundwater development may cause obstacles to the existing extraction of the surface water for irrigation use; water rights (legally authorized water rights and customary rights (acciónes)). Accordingly, the groundwater development potential is studied on the following items.

- the potentail groundwater recharge rate from the Lluta River
- groundwater development potential considering water use
- limitation of number of well development

3.4.1 Calculation of Possible Groundwater Recharge

The surface water recharges the groundwater in the Lower Lluta Valley. However, data of infiltration rate from the surface water to the groundwater is not available in the area. Then, an assumption was made by using the data of the Azapa Valley. Average surface flow rate at Antes Bocatoma/Ausipar, Azapa Valley, is 1,101 l/sec and the average out flow rate to the sea is 149 l/sec. Azapa canal is taking the surface water at Bocatoma a total volume of 487 l/sec. Accordingly, the recharge rate to the groundwater from the surplus surface water at Bocatoma is calculated by the following equation;

$$R = (Q_A - Q_C - Q_O) \div (Q_A - Q_C)$$

where, R : Recharge rate in the Azapa Valley (l/sec)
Q_A: Average flow rate at Antes Bocatoma/Ausipar (l/sec)
Q_C : Extraction rate to Azapa Canal (l/sec)
Q_O: Average out flow rate to the sea (l/sec)

$$R = (1,101 - 487 - 149) \div (1,101 - 487) = 0.757$$

This result suggests that 75.7 % of surface water recharges the groundwater from the river bed in the Azapa Valley. The recharge is made through both the river bed and the farmlands in the valley. However, recharge by the flood water is made mainly through the river bed of the San José River.

The aquifers in the Lower Lluta Valley are seems to be recharged by the surface water through the river bed because the farmlands are drained the irrigation water. It shows that the soil of the farmland is of low permeability because of its clayey lithofacies.
The concept that the aquifers of both the Azapa valley and the Lower Lluta Valley are recharged by the surface water through the river beds in the flood period is supposed by the following facts.

Floods were occurred several times in both the San José and the Lluta Rivers in 1994. One of the flood was observed on 24th January, 1994 and continued several days. The conditions of flood are shown in Fig. B-II, 3.4 (1) as photographs. The flood water mainly flows only in the river bed through the river, from the upper reaches to the river mouth of the Azapa Valley. At the same time, a flood was also occurred in

the Lluta River which is shown in Fig. B-II, 3.4 (2). The conditions of the flood is same as that of the San José River.

The features mentioned above suggest that the groundwater is recharged by the flood water in the Lower Lluta Valley. Therefore, recharge rate in the Lower Lluta Valley is estimated following method comparing the lithofacies of both valleys.

Lithology of aquifers of the Azapa Valley and the Lluta Valley are both composed of sand and gravel. However, aquifers in the Lluta Valley are more muddy and tuffaceous than that of Azapa Valley. Effective porosity of aquifers in the Lluta Valley is estimated about 70 % of that in the Azapa Valley. Then, recharge rate to the groundwater in the Lluta Valley is estimated to be 53 % (=0.757 x 0.7) of the surface water at Kesler Headworks. Groundwater recharge in the Azapa Valley is made between Cabuza to the river mouth. Its distance is about 22 km. In case of the Lower Lluta Valley, recharge is made between Poconchile and Sascapa (near the JICA well No. J-1). The distance is 17 km. Considering this condition, groundwater recharge from the river bed of the Lluta River is estimated as follows;

$$R_L = (Q_T - C_R) \times 0.53 \times 17 \div 22$$
$$= (2{,}216 - 819) \times 0.53 \times 17 \div 22$$
$$= 572 \text{ (l/sec)}$$

where,

= Recharge rate to the groundwater from the river bed (l/sec)
= Flow rate at Tocontasi (l/sec)
= Real consumption in the valley (l/sec)

The results show that the potential of groundwater recharge is 572 l/sec. However, this volume of the groundwater development may unable the exraction of surface water for irrigation use because infiltration of surface water to the groundwater will be accerelate. It is difficult to develop the 572 l/sec of groundwater without any facilities for compensation works.

3.4.2 Consideration to Existing Agricultural Water Use

The surface water of the Lluta River recharges the aquifers of the Lluta Valley mainly in the reaches between Poconchile and Sascapa. The proposed groundwater development will lower the existing groundwater table, resulting in accerelation of river water infiltration into underground. It may infringe the existing river wter extraction for the irrigation use. Therefore, existing irrigation intakes located in the

downstream of Poconchile (irrigation sector III, IV and V) shall be integrated to one (1) headworks proposed at Kesler. All the irrigation water for the sector III, IV and V will be extracted from this headworks. For recycling use of extracted water, collection channels are also constructed along the river banks. The required irrigation intake volume, potential surplus river water and expected groundwater recharge are estimated for two (2) cases. Case 1 will satisfy the existing water rights including legally authorized ones and customary ones (acción) throughout the year. Case 2 will satisfy the actual water demand verying by month. These calculation were made by month. The results are shown in Table B-II, 3.2 to 3.5.

1) Case 1: Water Right and Acción

The surface water of the Lluta River is extracted for the irrigation use on the basis of the legally authorized water rights and customary rights, accións. In the development of groundwater in the Lower Lluta Valley, the development plan should be in harmony with these extraction. For this purpose, a irrigation canal was planned as well as the groundwater development plan. Proposed new irrigation system is shown in Fig. B-II, 3.6, 3.7 and 3.8.

An intake is located at the irrigation sector Kesler. The canal water is led to the Sector III, IV and V. Because the intake is located after Tocontasi, available surface water at the headworks is obtained by reducing the consumption in the irrigation sector I and II, and Comunidad Vilca Loredo. Groundwater is recharged mainly in the area between Poconchile and Sascapa, after the headworks. Therefore, groundwater development does not affect the extraction of the irrigation water.

Recycle use of extracted water was calculated by assuming that the real consumption is 50 % of water rights quantity for case 1.

The surface water consumption between Tocontasi and the proposed headwarks is estimated to be 551 l/sec; The legally authorized water right volume at Comunidad Vilca Loredo is 35.5 l/sec and the total number of acción is 687.2 which is equal to the 514.4 l/sec of water volume. For details of water rights, see, Supporting Report C. The surface flow rate at the headworks is calculated deducting this volume (551 l/sec) from the surface flow rate at Tocontasi by month.

Calculations of distribution to irrigation canal are made on the average surface flow rate and 80 % drought flow rate. The results are shown in following tables. For detailed calculations, refer Table B-II, 3.2.

(average flow)

	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining in River	Recharge
Jan.	2,887	275	2,612	819	819	1,793	753
Feb.	4,741	275	4,466	819	819	3,647	1,532
Mar.	4,222	275	3,947	819	819	3,128	1,314
Apr.	1,759	275	1,484	819	819	665	279
May.	1,809	275	1,534	819	819	715	300
Jun.	1,802	275	1,527	819	819	708	297
Jul.	1,937	275	1,662	819	819	843	354
Aug.	1,746	275	1,471	819	819	652	274
Sep.	1,542	275	1,267	819	819	448	188
Oct.	1,332	275	1,057	819	819	238	100
Nov.	1,307	275	1,032	819	819	213	89
Dec.	1,508	275	1,233	819	819	414	174
Ave.	2,216	275	1,941	819	819	1,122	471

In the year of average flow rate, the surface flow rate is larger than the required extraction rate for the satisfaction of the water rights through the year. The surplus surface flow rate (overflow rate at headworks) is in a range from 3,647 l/sec to 213 l/sec, averaging 1,122 l/sec. Grounwater is recharged from this surplus water flow a volume of 471 l/sec (1,122 l/sec x 0.42 = 471 l/sec).

(80 % drought flow)

	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining in River	Recharge
Jan.	1,614	275	1,339	819	819	520	218
Feb.	1,813	275	1,538	819	819	719	302
Mar.	1,830	275	1,555	819	819	736	309
Apr.	1,400	275	1,125	819	819	306	129
May.	1,444	275	1,169	819	819	350	147
Jun.	1,521	275	1,246	819	819	427	179
Jul.	1,589	275	1,314	819	819	495	208
Aug.	1,470	275	1,195	819	819	376	158
Sep.	1,302	275	1,027	819	819	208	87
Oct.	1,168	275	893	819	819	74	31
Nov.	1,089	275	814	819	814	0	0
Dec.	1,091	275	816	819	816	0	0
Ave.	1,444	275	1,169	819	819	351	147

In case of 80 % drought flow, the required extraction volume is within the remaining flow rate at the headworks except November and December. In these two (2) months, all the surface flow is extracted to irrigation canal so that the groundwater cannot receive the recharge from the surface water. In other months, the groundwater receives a recharge from the surface water in a range between 31 l/sec and 309 l/sec, averaging 147 l/sec.

Storage of the groundwater will be consumed in November and December. However, this deficit causes no affect to the irrigation water use because irrigation water is extracted from the intake before the recharge area from Poconchile to Sagasca. Consumption of groundwater in the drought year is compensated during the years other than drought year.

<Case 2: Existing Water Demand>

Existing real consumption of irrigation in sector I, II, and Comunidad Vilca Loredo is estimated to be from 114 l/sec to 4,741 l/sec, averaging 250 l/sec, by month, considering the cropping area and patterns. Water demand and real consumption in the sector III, IV and V are also estimated by same method. Irrigation water other than the volume of real consumption is drained to the canal again and is used for the next irrigation sector; the canal water is used repeatedly as the surface water of the Lluta River used for irrigation at present. Following water disribution is analyzed on the basis of these conditions. Detailed calculation is shown in Table B-II, 3.3 and 3.4.

(Average Flow)

Month	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining in River	Recharge
Jan.	2,887	448	2,439	433	433	2,006	843
Feb.	4,741	446	4,295	431	431	3,864	1,623
Mar.	4,222	393	3,829	1,212	1,212	2,617	1,099
Apr.	1,759	193	1,566	878	878	688	289
May.	1,809	150	1,660	709	709	951	399
Jun.	1,802	118	1,684	583	583	1,101	463
Jul.	1,937	114	1,823	156	156	1,667	700
Aug.	1,746	128	1,618	189	189	1,429	600
Sep.	1,542	164	1,378	859	859	519	218
Oct.	1,332	201	1,132	927	927	205	86
Nov.	1,307	236	1,071	1,056	1,056	15	6
Dec.	1,508	407	1,101	1,209	1,101	0	0
Ave.	2,216	250	1,966	720	711	1,255	527

In case of average flow, the surface flow rates are larger than the water demand except in December. Extraction rate to canal satisfies the required water demand from January to November. The surface flow rate at the headworks in December is 407 l/sec which is originally smaller than the actual water demand. Therefore, the extraction rate in December is limited to 1,101 l/sec which is the total flow rate at the headworks.

Average of surplus surface flow rate is 1,255 l/sec which recharges the groundwater a total volume of 527 l/sec .

(80% Drought flow)

Month	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining	Recharge
Jan.	1,614	448	1,166	433	433	733	308
Feb.	1,813	446	1,367	431	431	936	393
Mar.	1,830	393	1,437	1,212	1,212	225	95
Apr.	1,400	193	1,207	878	878	329	138
May.	1,444	150	1,295	709	709	586	246
Jun.	1,521	118	1,403	583	583	820	344
Jul.	1,589	114	1,475	156	156	1,319	554
Aug.	1,470	128	1,342	189	189	1,153	484
Sep.	1,302	164	1,138	859	859	279	117
Oct.	1,168	201	968	927	927	41	17
Nov.	1,089	236	853	1,056	853	0	0
Dec.	1,091	407	684	1,209	684	0	0
Ave.	1,444	250	1,194	720	659	535	225

In case of 80 % drought flow, flow rates are less than required flow rate, except in November and December. In these two (2) months, extraction rate to the irrigation canal is limited to the surplus water rate at the headworks. Averagd surplus flow rate is 535 l/sec which recharges the groundwater a total volume of 225 l/sec.

3.4.3 Restriction by Distribution of Aquifer

Groundwater development potential area is considered from Chuilona to Rosario. Distance between both sites is approximately 14 km. In this clause, the possible number of well construction is analyzed. Conditions of well construction are planned as follows;

Diameter of well	: 17-1/2" (444.5 mm)
Diameter of casing	: 12" (318.5 mm)
Production rate	: 25 l/sec

Allowable draw down : 40 m
Drilling depth : 120 - 150 m

Radius of Influence

The radius of influence is defined as "the radius of area where the draw down is 10 cm when pumping." Radius of influence is given by the following formula after Theis Equation;

$$0.001=\frac{Q}{4\pi T}W(u), \quad u=\frac{R^2S}{4tT}$$

$$\text{Then, } R=\sqrt{\frac{4tTu}{S}}$$

where,

Q : Production rate (m^3/sec)
R : Radius of influence area by pumping (m)
t : Time of pumping operation (sec)
T : Transmissibility (m^3/sec/m)
W(u) : Well function of Theis
S : Confined aquifer---Storage coefficient
: Unconfined aquifer---Effective porosity (assumed to be 0.2)

In the lower reaches of Chacabuco, the aquifer is considered to be a confined one. Radius of influence is rather large in this area. On the one hand, it is unconfined one in the upper reaches of Chacabuco. Accordingly, radiuses of influence are estimated by using storage coefficient for the confined aquifer and effective porosity for the unconfined aquifer. The deep aquifer will become unconfined after the water level withdraws up to the top of the aquifer bed. Therefore, the estimation of the radius of influence was made on the both cases. Estimated radiuses of influence are as follows;

Case 1 <confined aquifer: S= 10cm>

	R (m)	Q (m^3/s)	T (m^2/s)	t (s)	S
J-A	411	0.025	2.63E-04	86400	1.60E-03
J-B	2689	0.025	3.59E-03	86400	4.72E-04
J-1	2556	0.025	4.26E-03	86400	1.60E-03
J-2	12114	0.025	1.73E-03	86400	6.60E-06

Case 2-1 <unconfined aquifer: s= 1mm>

	R (m)	Q (m^3/s)	T (m^2/s)	t (s)	S
J-A	56	0.025	2.63E-04	86400	2.00E-01
J-B	169	0.025	3.59E-03	86400	2.00E-01
J-1	181	0.025	4.26E-03	86400	2.00E-01
J-2	125	0.025	1.73E-03	86400	2.00E-01

Case 2-2 <unconfined aquifer: s= 10cm>

	R (m)	Q (m^3/s)	T (m^2/s)	t (s)	S
J-A	37	0.025	2.63E-04	86400	2.00E-01
J-B	84	0.025	3.59E-03	86400	2.00E-01
J-1	78	0.025	2.63E-03	86400	2.00E-01
J-2	70	0.025	1.73E-03	86400	2.00E-01

Radius of influences are generally large in the confined aquifer, from 411 m to 12,114 m, averaging 4,443 m. They are generally small in the unconfined aquifer. The aquifer will become unconfined one as mentioned above. After becoming unconfined aquifer, the influence radius of the deep aquifer also become small, between 37 m and 84 m for 10cm of draw down, and between 56 m and 181 m for 1 mm of draw down. If pumping will be continued more than 24 hours without any rest, the radius of influence will become more wide. The spacing of production wells is, therefore, proposed to be 500 m considering the safety side.

Extent of potential groundwater development area is approximately 14 km as mentioned above. Then, the possible number of well construction is given below;

n=14,000 (m)÷500 (m)= 28 (wells)

The number of wells should be decided considering the peak demand and the spare wells. The number of emergency well (for peak demand) is 1.3 times of production wells for average demand and the ratio of spare well is 20 % of total well number (production well and emergency well). Thus, the numbers of well are calculated as follows, considering allowance;

- Production well : 17 wells
- Emergency well : 5 wells
- Spare well : 4 wells

Total : 26 wells

A total production rate for 17 wells comes to 425 l/sec (= 25 l/sec x 17).

3.4.4 Conclusion

The groundwater development potential in the Lower Lluta Valley is decided to be 425 l/sec considering the results of 3.4.1 to 3.4.3. For this volume of development, new irrigation system is necessary to construct as discussed in 3.4.2.

Table B-II, 3.1 Groundwater Quality

<Calidad de Agua Subterránea>

TYPE	WELL NO.		NAME		TEMP.	pH	TDS	Ca	Mg	Na	K	SO4	Cl	CO3	HCO3	HEALTH SIGNIFICANCE NO3	As	F	Cd	Cr	Pb	B	Fe	Mn	Zn	Cu	Al
					(C)			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
(STANDARD)						6.0-8.5	1000		125	200		250	250			10.00	0.050	1.50	0.005	0.050	0.050		0.30	0.10	5.000	1.000	0.20
SPRING		V-1	BOCANEGRA	Jul-93	20.7	6.1	1527	166	48	271	32.0	462	499	0	41	7.76	<0.005	0.47	0.002	0.040	0.020	182.54	0.01	0.03	0.018	0.024	0.30
				Oct-93	20.7	6.3	1585	159	50	276	34.0	489	529	0	42	6.27	0.044	0.57	0.004	0.010	0.010	32.10	0.04	0.01	0.030	0.033	0.50
				(Average)	20.7	6.2	1556	163	49	274	33.0	476	514	0	42	7.02	0.022	0.52	0.003	0.025	0.015	107.32	0.03	0.02	0.024	0.029	0.40
		V-2	POCONCHILE	Jul-93	22.1	7.5	1983	238	52	329	33.5	576	595	0	149	10.78	0.046	0.68	0.002	0.040	0.020	16.92	0.01	0.03	0.007	0.027	0.10
				Oct-93	21.5	7.6	1954	227	53	331	37.0	528	616	0	153	9.24	0.052	0.69	0.005	0.030	0.020	19.55	0.02	0.01	0.023	0.025	0.10
				(Average)	21.8	7.6	1968	232	52.5	330	35.3	552	605	0	151	10.01	0.049	0.69	0.004	0.035	0.020	18.24	0.02	0.02	0.015	0.026	0.10
	Average				21.3	6.9	1762	197	50.8	302	34.1	514	560	0	96	8.51	0.036	0.60	0.003	0.030	0.018	62.78	0.02	0.02	0.02	0.027	0.25
SHALLOW AQUIFER		N-0	Villa Frontera	Jul-93	23.4	7.4	3407	334	124	628	71.2	913	1241	0	87	9.68	0.006	0.57	0.003	0.050	0.020	18.05		0.51	0.186	0.051	0.30
				Oct-93	23.8	7.8	3510	389	137	580	68.0	941	1308	0	85	1.64	0.005	1.10	0.001	0.020	0.010	10.34	5.42	0.02	0.063	0.044	0.30
				(Average)	23.6	7.6	3458	361	131	604	69.6	927	1274	0	86	5.66	0.006	0.84	0.002	0.035	0.015	14.20	2.71	0.27	0.125	0.048	0.30
		N-1	Villa Frontera	Jul-93	24.1	7.0	2785	335	113	416	53.0	889	888	0	79	12.36	0.014	0.39	0.004	0.040	0.020	16.92	0.10	0.04	12.920	0.032	0.10
				Oct-93	23.2	7.2	2920	331	112	428	56.0	975	936	0	75	7.30	0.011	0.43	0.003	0.030	0.010	23.13	0.30	0.04	4.220	0.027	0.40
				(Average)	23.7	7.1	2852	333	112	422	54.5	932	912	0	77	9.83	0.013	0.41	0.004	0.035	0.015	20.03	0.20	0.04	8.570	0.030	0.25
		N-2	Villa Frontera	Jul-93	24.9	6.5	2628	329	107	378	51.2	845	841	0	69	8.08	0.016	0.42	0.003	0.400	0.010	17.95	0.04	0.03	0.010	0.031	0.10
				Oct-93	25.5	6.9	2715	321	105	386	53.0	884	898	0	61	6.80	0.019	0.45	0.004	0.020	0.020	19.03	0.02	0.01	0.026	0.027	0.40
				(Average)	25.2	6.7	2672	325	106	382	52.1	865	869	0	65	7.44	0.018	0.44	0.004	0.210	0.015	18.49	0.03	0.02	0.018	0.029	0.25
		N-3	Villa Frontera	Jul-93	21.5	6.5	3126	304	96	580	71.2	975	975	0	120	4.87	0.076	0.94	0.003	0.030	0.010	21.12	0.34	0.07	0.132	0.037	0.10
				Oct-93	22.1	6.8	2988	273	88	552	57.0	975	928	0	104	11.65	0.128	1.05	0.005	0.010	0.030	36.88	0.22	0.03	0.070	0.033	0.40
				(Average)	21.8	6.6	3057	289	92	566	64.1	975	952	0	112	8.26	0.102	1.00	0.004	0.020	0.020	29.00	0.26	0.05	0.101	0.035	0.25
		N-5	Villa Frontera	Jul-93	23.8	6.9	2657	201	93	476	58.0	821	902	0	92	15.04	0.037	0.83	0.003	0.030	0.010	17.03	0.04	0.05	0.024	0.031	0.10
				Oct-93	23.6	7.2	2800	287	92	469	58.0	865	928	0	93	7.90	0.041	0.76	0.002	0.010	0.010	20.31	0.11	0.02	0.409	0.032	0.20
				(Average)	23.7	7.0	2729	244	92	473	58.0	843	915	0	93	11.47	0.039	0.80	0.003	0.020	0.010	18.67	0.08	0.04	0.217	0.032	0.15
		N-6	Villa Frontera	Jul-93	23.5	6.9	2982	336	106	506	53.8	884	1022	0	68	7.01	0.028	0.66	0.002	0.030	0.020	18.05	0.21	0.10	0.036	0.036	0.10
				Oct-93	24.1	7.0	3075	338	106	511	56.0	922	1069	0	68	5.43	0.036	0.56	0.002	0.010	0.020	21.74	0.09	0.01	0.046	0.036	0.20
				(Average)	23.8	6.9	3028	337	106	508	54.9	903	1045	0	68	6.22	0.032	0.61	0.002	0.020	0.020	19.90	0.15	0.06	0.041	0.036	0.15
		N-8	Villa Frontera	Oct-93	24.1	7.0	3931	465	144	616	63.0	1013	1544	0	77	8.86	0.033	0.34	0.002	0.020	0.010	13.92	0.13	0.02	0.128	0.046	0.20
		N-9	Villa Frontera	Jul-93	24.5	6.7	3397	479	154	437	55.0	884	1316	0	49	23.06	0.023	0.34	0.003	0.040	0.020	16.31	0.82	0.25	0.736	0.037	0.70
				Oct-93	23.1	7.4	3553	490	154	469	59.0	903	1415	0	48	14.39	0.020	0.44	0.004	0.020	0.010	18.27	0.16	0.02	0.200	0.027	0.40
				(Average)	23.8	7.0	3475	485	154	453	57.0	893	1366	0	49	18.73	0.022	0.39	0.004	0.030	0.015	17.29	0.49	0.14	0.468	0.032	0.55
	Average				23.7	7.0	3150	355	117	503	59.2	919	1110	0	78	9.56	0.033	0.60	0.003	0.049	0.015	18.84	0.51	0.08	1.208	0.036	0.26
DEEP AQUIFER	012 11 100-2		ROSARIO	Jul-93	21.6	6.8	3211	314	97	610	73.5	961	1071	0	64	21.99	0.039	1.15	0.004	0.040	0.020	24.50	1.38	0.10	0.351	0.039	0.20
				Oct-93	21.1	6.8	3401	324	103	616	75.0	1085	1107	0	81	9.51	0.050	1.12	0.005	0.020	0.010	30.10	0.13	0.03	0.085	0.039	0.40
				(Average)	21.4	6.8	3306	319	100	613	74.3	1023	1089	0	73	15.75	0.045	1.14	0.005	0.030	0.015	27.30	0.76	0.07	0.218	0.039	0.30
	012 11 101-0		CARCEL DE ARICA	Oct-93	26.8	7.3	2982	258	85	437	49.0	845	791	0	79	4.58	0.035	0.72	0.005	0.010	0.020	11.87	0.03	0.01	0.041	0.028	0.30
	DGA-JICA	J-1	CHACABUCO	Feb-94	24.5	6.9	3075	338	105	612	65.5	875	1063	0	148	0.41	0.046		0.015	0.020	0.080	24.50	2.26	3.85	3.220	0.022	0.10
	DGA-JICA	J-A	LLUTA	Feb-94	25.4	7.1	3028	239	85	451	52.0	625	839	0	104	0.54	0.009		0.012	0.020	0.050	19.24	6.60	0.94	0.680	0.014	0.20
	DGA-JICA	J-2	LLUTA	Feb-94	23.1	6.6	3931	299	74	515	60.0	825	908	0	104	1.43	0.019		0.012	0.020	0.060	23.45	0.05	0.05	1.420	0.014	0.10
	DGA-JICA	J-B	PANAMERICANA	Feb-94	23.7	6.9	3397	296	93	460	51.0	750	868	0	78	0.74	0.005		0.014	0.020	0.040	19.45	0.28	0.03	2.070	0.013	0.10
	Average				23.7	6.9	3289	295	92	529	60.9	852	949	0.0	94	5.60	0.029	1.00	0.010	0.021	0.040	21.87	1.53	0.72	1.124	0.024	0.20

(Note) V: SPRING, N: DUG WELL (No. of spring and dug well are temporary.).
SAMPLED AND ANALYZED BY DGA AND JICA STUDY TEAM IN NOVEMBER 1993.
SAMPLES OF JICA WELLS WERE TAKEN AFTER PUMPING TEST. OTHERS WERE SAMPLED WITHOUT PUMPING (WELLS WERE NOT IN USE.).

Table B-II, 3.2 Water Distribution to Irrigation Canal (by Water Right)
<Distribución de Agua al Canal de Irrigación>

Acción between Tocontasi and Sector III =	687.2	Acc.	
x 0.75 =	515.4	l/sec	(a)
Water Right (Vilca-Loredo) =	35.5	l/sec	(b)
Total Demand (Tocontasi-Sector III) =	550.9	l/sec	(a)+(b)

		Acción	Acc. x 0.75 (l/sec)	Water Demand (l/sec)	Real Coms. (l/sec)	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(3)+(4) Canal(2) (l/sec)
Sector III	Kesler	4.70	3.53							
Right Bank	Pro-Chile	65.90	49.43							
	García	5.00	3.75							
	La Palma Uno	23.00	17.25							
	La Palma Dos	36.00	27.00	101.0	50.5	140.3	101.0	39.4	50.5	89.8
	Visconti	119.50	89.63	89.6	44.8	89.8	89.6	0.2	44.8	45.0
	Kesler Gil	60.00	45.00	45.0	22.5	45.0	45.0	0.0	22.5	22.5
	Sub-Total	314.10	235.58	235.6	117.8					
Left Bank	La Isla	22.40	16.80							
	Huanca	7.08	5.31							
	Linderos	23.90	17.93							
	Poconchile	83.80	62.85							
	Barranco Sta. Rosa	19.00	14.25							
	Mayorca	20.30	15.23							
	Huancarane	31.63	23.72							
Sector IV	Arellano Beyzan	18.70	14.03							
	Cora Beyzan	93.60	70.20	240.3	120.2	678.5	240.3	438.2	120.2	558.3
	El Muro	158.45	118.84							
	Alanoca	10.50	7.88	126.7	63.4	558.3	126.7	431.6	63.4	495.0
	Chacabuco (1)	155.00	116.25	116.3	58.1	495.0	116.3	378.7	58.1	436.9
	Chacabuco (2)	155.00	116.25							
	Dominguez	10.00	7.50	123.8	61.9	436.9	123.8	313.1	61.9	375.0
	Sascapa (1)	123.00	92.25	92.3	46.1	375.0	92.3	282.7	46.1	328.9
	Sascapa (2)	123.00	92.25	92.3	46.1	328.9	92.3	236.6	46.1	282.7
	Bravo Uno	18.75	14.06							
	Bravo Dos	11.26	8.45	22.5	11.3	282.7	22.5	260.2	11.3	271.5
	Sub-Total	1085.37	814.03	814.0	407.0					
Sector V	Valle Hermoso	249.00	249.00							
	Aica González	30.00	22.50	271.5	135.8	271.5	271.5	0.0	135.8	135.7
	M. Beovic	8.00	6.00							
	B'ba Pte.Chacali.	5.00	3.75							
	Ambrosio Flores	2.00	1.50	11.3	5.6	135.7	11.3	124.5	5.6	130.1
	Bellet	32.00	24.00							
	Beneficiencia	39.19	29.39							
	Santa Rosa	46.83	35.12	88.5	44.3	130.1	88.5	41.6	44.3	85.9
	Sub-Total	412.02	371.27							
	Total	1399.47	1049.60	1049.6	524.8					
			1049.60		524.8					

Table B-II, 3.3 (1) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

Jan.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			Consum
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.5	0.0	1.5	0.0	0.7	0.0	0.7
Right Bank	Pro-Chile	18.0	6.0	38.0	25.9	87.9	0.0	6.8	47.0	53.8	0.0	3.0	28.2	31.2
	García	3.2	0.7	1.4	1.3	6.7	0.0	0.8	1.8	2.5	0.0	0.3	1.1	1.4
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	0.0	2.3	3.7	6.0	0.0	1.0	2.2	3.2
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	0.0	4.5	0.6	5.1	0.0	2.0	0.4	2.4
	Visconti	100.8	8.7	10.5	39.3	159.3	0.0	9.8	13.0	22.8	0.0	4.4	7.8	12.2
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	0.0	9.2	21.0	30.2	0.0	4.1	12.6	16.7
	Sub-Total	212.4	30.8	70.4	105.3	418.9	0.0	34.7	87.1	121.8	0.0	15.6	52.3	67.9
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	27.4	9.0	0.0	36.4	11.0	4.1	0.0	15.0
	Huanca	4.6	1.0	2.0	1.9	9.4	6.9	1.1	2.5	10.5	2.8	0.5	1.5	4.7
	Linderos	16.0	7.9	8.0	0.0	31.9	24.4	8.9	9.9	43.2	9.7	4.0	5.9	19.7
	Poconchile	45.0	15.0	46.0	5.7	111.7	0.0	16.9	56.9	73.8	0.0	7.6	34.1	41.7
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	0.0	1.1	8.7	9.8	0.0	0.5	5.2	5.7
	Mayorca	13.1	2.7	5.8	5.4	27.1	0.0	3.1	7.1	10.2	0.0	1.4	4.3	5.7
	Huancarane	31.6	6.6	13.9	13.1	65.2	0.0	7.5	17.2	24.6	0.0	3.4	10.3	13.6
	Sub-Total	136.6	42.2	82.6	39.1	300.6	58.7	47.6	102.2	208.5	23.5	21.4	61.3	106.2
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	0.0	0.0	2.5	2.5	0.0	0.0	1.5	1.5
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	0.0	1.1	6.2	7.3	0.0	0.5	3.7	4.2
	El Muro	158.5	32.7	12.6	77.7	281.4	0.0	36.8	15.6	52.4	0.0	16.6	9.3	25.9
	Alanoca	10.5	1.0	1.0	23.0	35.5	0.0	1.1	1.2	2.4	0.0	0.5	0.7	1.2
	Chacabuco	310.0	30.0	10.0	106.8	456.8	0.0	33.8	12.4	46.2	0.0	15.2	7.4	22.6
	Dominguez	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sascapa	246.0	110.0	36.7	172.0	564.7	0.0	124.0	45.4	169.4	0.0	55.8	27.2	83.0
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	0.0	4.4	1.8	6.2	0.0	2.0	1.1	3.1
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	0.0	2.6	1.1	3.7	0.0	1.2	0.7	1.8
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	0.0	203.9	86.1	290.1	0.0	91.8	51.7	143.5
										620.4				
Sector V	Valle Hermoso	60.0	35.0	12.0	225.0	332.0	83.6	36.1	13.4	133.1	33.4	16.3	8.1	57.7
	Alca Gonzáles	24.0	8.0	1.0	7.0	40.0	33.4	8.3	1.1	42.8	13.4	3.7	0.7	17.8
	M. Beovic	0.0	0.0	8.0	2.7	10.7	0.0	0.0	9.0	9.0	0.0	0.0	5.4	5.4
	B'ba Pte. Chacall.	0.0	0.0	6.7	0.0	6.7	0.0	0.0	7.5	7.5	0.0	0.0	4.5	4.5
	Ambrosio Flores	0.0	0.0	2.0	0.7	2.7	0.0	0.0	2.2	2.2	0.0	0.0	1.3	1.3
	Bellet	0.0	2.7	0.0	40.0	42.7	0.0	2.8	0.0	2.8	0.0	1.3	0.0	1.3
	Beneficiencia	4.8	11.5	16.3	19.5	52.3	6.7	11.9	18.5	37.0	2.7	5.3	11.1	19.1
	Santa Rosa	12.0	10.0	8.0	32.4	62.4	16.7	10.3	9.0	36.0	6.7	4.6	5.4	16.7
	Total	100.8	67.2	54.2	327.3	549.5	140.4	69.4	60.6	270.4	56.2	31.2	36.4	123.8

Feb.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.5	0.0	1.5	0.0	0.7	0.0	0.7
Sector III	Pro-Chile	18.0	6.0	38.0	25.9	87.9	0.0	6.8	46.9	53.6	0.0	3.0	28.1	31.2
	García	3.2	0.7	1.4	1.3	6.7	0.0	0.8	1.8	2.5	0.0	0.3	1.1	1.4
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	0.0	2.3	3.7	5.9	0.0	1.0	2.2	3.2
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	0.0	4.5	0.6	5.1	0.0	2.0	0.4	2.4
	Visconti	100.8	8.7	10.5	39.3	159.3	0.0	9.8	12.9	22.7	0.0	4.4	7.8	12.2
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	0.0	9.1	21.0	30.1	0.0	4.1	12.6	16.7
	Sub-Total	212.4	30.8	70.4	105.3	418.9	0.0	34.7	86.9	121.5	0.0	15.6	52.1	67.7
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	27.3	9.0	0.0	36.3	10.9	4.1	0.0	15.0
	Huanca	4.6	1.0	2.0	1.9	9.4	6.9	1.1	2.5	10.5	2.8	0.5	1.5	4.7
	Linderos	16.0	7.9	8.0	0.0	31.9	24.3	8.9	9.9	43.1	9.7	4.0	5.9	19.6
	Poconchile	45.0	15.0	46.0	5.7	111.7	0.0	16.9	56.7	73.6	0.0	7.6	34.0	41.6
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	0.0	1.1	8.6	9.8	0.0	0.5	5.2	5.7
	Mayorca	13.1	2.7	5.8	5.4	27.1	0.0	3.1	7.1	10.2	0.0	1.4	4.3	5.7
	Huancarane	31.6	6.6	13.9	13.1	65.2	0.0	7.4	17.1	24.6	0.0	3.3	10.3	13.6
	Sub-Total	136.6	42.2	82.6	39.1	300.6	58.6	47.5	101.9	208.0	23.4	21.4	61.1	105.9
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	0.0	0.0	2.5	2.5	0.0	0.0	1.5	1.5
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	0.0	1.1	6.2	7.3	0.0	0.5	3.7	4.2
	El Muro	158.5	32.7	12.6	77.7	281.4	0.0	36.8	15.5	52.3	0.0	16.5	9.3	25.9
	Alanoca	10.5	1.0	1.0	23.0	35.5	0.0	1.1	1.2	2.4	0.0	0.5	0.7	1.2
	Chacabuco	310.0	30.0	10.0	106.8	456.8	0.0	33.8	12.3	46.1	0.0	15.2	7.4	22.6
	Dominguez	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sascapa	246.0	110.0	36.7	172.0	564.7	0.0	123.8	45.3	169.0	0.0	55.7	27.2	82.8
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	0.0	4.4	1.8	6.2	0.0	2.0	1.1	3.1
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	0.0	2.6	1.1	3.7	0.0	1.2	0.7	1.8
	Sub-Total	877.3	180.9	69.6	430.2	1558.0	0.0	203.5	85.9	289.4	0.0	91.6	51.5	143.1
										618.9				

Table B-II, 3.3 (2) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

Mar.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.3	0.0	1.3	0.0	0.6	0.0	0.6
Right Bank	Pro-Chile	18.0	6.0	38.0	25.9	87.9	24.2	6.0	41.1	71.3	9.7	2.7	24.6	37.0
	Garcia	3.2	0.7	1.4	1.3	6.7	4.4	0.7	1.5	6.6	1.7	0.3	0.9	3.0
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	21.5	2.0	3.2	26.8	8.6	0.9	1.9	11.5
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	47.8	4.0	0.5	52.3	19.1	1.8	0.3	21.2
	Visconti	100.8	8.7	10.5	39.3	159.3	135.6	8.7	11.3	155.6	54.2	3.9	6.8	64.9
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	52.2	8.1	18.4	78.7	20.9	3.6	11.0	35.6
	Sub-Total	212.4	30.8	70.4	105.3	418.5	285.7	30.7	76.1	392.5	114.3	13.8	45.7	173.8
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	24.2	8.0	0.0	32.2	9.7	3.6	0.0	13.3
	Huanca	4.6	1.0	2.0	1.9	9.4	6.1	1.0	2.2	9.2	2.5	0.4	1.3	4.2
	Linderos	16.0	7.9	8.0	0.0	31.9	21.5	7.9	8.6	38.0	8.6	3.5	5.2	17.3
	Poconchile	45.0	15.0	46.0	5.7	111.7	60.5	14.9	49.7	125.2	24.2	6.7	29.8	60.8
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	11.2	1.0	7.6	19.7	4.5	0.4	4.5	9.5
	Mayorca	13.1	2.7	5.8	5.4	27.1	17.7	2.7	6.2	26.7	7.1	1.2	3.7	12.0
	Huancarane	31.6	6.6	13.9	13.1	65.2	42.5	6.6	15.0	64.1	17.0	3.0	9.0	29.0
	Sub-Total	136.6	42.2	82.6	39.1	300.6	183.8	42.1	89.3	315.2	73.5	18.9	53.6	146.0
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	25.2	0.0	2.2	27.3	10.1	0.0	1.3	11.4
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	125.9	1.0	5.4	132.3	50.4	0.4	3.2	54.1
	El Muro	158.5	32.7	12.6	77.7	281.4	213.2	32.6	13.6	259.3	85.3	14.7	8.2	108.1
	Alanoca	10.5	1.0	1.0	23.0	35.5	14.1	1.0	1.1	16.2	5.6	0.4	0.6	6.7
	Chacabuco	310.0	30.0	10.0	106.8	456.8	417.0	29.9	10.8	457.7	166.8	13.5	6.5	186.7
	Dominguez	10.0	0.0	0.0	0.0	10.0	13.5	0.0	0.0	13.5	5.4	0.0	0.0	5.4
	Sascapa	246.0	110.0	36.7	172.0	564.7	330.9	109.6	39.7	480.2	132.4	49.3	23.8	205.5
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	25.2	3.9	1.6	30.7	10.1	1.7	1.0	12.8
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	15.1	2.3	1.0	18.4	6.1	1.0	0.6	7.7
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	1,180.1	180.2	75.3	1,435.6	472.0	81.1	45.2	598.3
										2143.3				

Apr.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.0	0.0	1.0	0.0	0.5	0.0	0.5
Sector III	Pro-Chile	18.0	6.0	38.0	25.9	87.9	19.1	4.7	30.9	54.7	7.6	2.1	18.6	28.3
	Garcia	3.2	0.7	1.4	1.3	6.7	3.4	0.5	1.2	5.1	1.4	0.2	0.7	2.3
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	16.9	1.6	2.4	21.0	6.8	0.7	1.5	8.9
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	37.6	3.1	0.4	41.1	15.0	1.4	0.2	16.7
	Visconti	100.8	8.7	10.5	39.3	159.3	106.8	6.8	8.5	122.1	42.7	3.1	5.1	50.9
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	41.1	6.4	13.9	61.3	16.4	2.9	8.3	27.6
	Sub-Total	212.4	30.8	70.4	105.3	418.9	224.9	24.2	57.3	306.4	90.0	10.9	34.4	135.2
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	6.3	0.0	6.3	0.0	2.8	0.0	2.8
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.7	1.6	2.4	0.0	0.3	1.0	1.3
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	6.2	6.5	12.7	0.0	2.8	3.9	6.7
	Poconchile	45.0	15.0	46.0	5.7	111.7	47.7	11.8	37.4	96.9	19.1	5.3	22.5	46.8
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	8.8	0.8	5.7	15.3	3.5	0.4	3.4	7.3
	Mayorca	13.1	2.7	5.8	5.4	27.1	13.9	2.2	4.7	20.8	5.6	1.0	2.8	9.4
	Huancarane	31.6	6.6	13.9	13.1	65.2	33.5	5.2	11.3	50.0	13.4	2.3	6.8	22.5
	Sub-Total	136.6	42.2	82.6	39.1	300.6	103.9	33.1	67.3	204.2	41.5	14.9	40.4	96.8
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	19.8	0.0	1.6	21.4	7.9	0.0	1.0	8.9
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	99.1	0.8	4.1	104.0	39.7	0.4	2.4	42.4
	El Muro	158.5	32.7	12.6	77.7	281.4	167.8	25.6	10.2	203.7	67.1	11.5	6.1	84.8
	Alanoca	10.5	1.0	1.0	23.0	35.5	11.1	0.8	0.8	12.7	4.4	0.4	0.5	5.3
	Chacabuco	310.0	30.0	10.0	106.8	456.8	328.3	23.5	8.1	360.0	131.3	10.6	4.9	146.8
	Dominguez	10.0	0.0	0.0	0.0	10.0	10.6	0.0	0.0	10.6	4.2	0.0	0.0	4.2
	Sascapa	246.0	110.0	36.7	172.0	564.7	260.5	86.3	29.9	376.7	104.2	38.8	17.9	161.0
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	19.9	3.0	1.2	24.1	7.9	1.4	0.7	10.0
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	11.9	1.8	0.7	14.5	4.8	0.8	0.4	6.0
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	929.1	141.9	56.7	1,127.6	371.6	63.8	34.0	469.5
										1638.3				

Table B-II, 3.3 (3) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

May

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	0.8	0.0	0.8	0.0	0.4	0.0	0.4
Right Bank	Pro-Chile	18.0	6.0	38.0	25.9	87.9	15.5	3.8	23.8	43.1	6.2	1.7	14.3	22.2
	García	3.2	0.7	1.4	1.3	6.7	2.8	0.4	0.9	4.1	1.1	0.2	0.5	1.8
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	13.8	1.3	1.9	16.9	5.5	0.6	1.1	7.2
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	30.5	2.5	0.3	33.4	12.2	1.1	0.2	13.5
	Visconti	100.8	8.7	10.5	39.3	159.3	86.7	5.5	6.6	98.8	34.7	2.5	3.9	41.1
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	33.4	5.2	10.6	49.2	13.4	2.3	6.4	22.1
	Sub-Total	212.4	30.8	70.4	105.3	418.9	182.7	19.6	44.1	246.4	73.1	8.8	26.4	108.3
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	5.1	0.0	5.1	0.0	2.3	0.0	2.3
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.6	1.3	1.9	0.0	0.3	0.8	1.0
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	5.0	5.0	10.0	0.0	2.3	3.0	5.3
	Poconchile	45.0	15.0	46.0	5.7	111.7	38.7	9.6	28.8	77.0	15.5	4.3	17.3	37.0
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	7.1	0.6	4.4	12.2	2.9	0.3	2.6	5.8
	Mayorca	13.1	2.7	5.8	5.4	27.1	11.3	1.8	3.6	16.7	4.5	0.8	2.2	7.5
	Huancarane	31.6	6.6	13.9	13.1	65.2	27.2	4.2	8.7	40.1	10.9	1.9	5.2	18.0
	Sub-Total	136.6	42.2	82.6	39.1	300.6	84.4	26.9	51.7	162.9	33.7	12.1	31.0	76.9
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	16.1	0.0	1.3	17.3	6.4	0.0	0.8	7.2
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	80.5	0.6	3.1	84.3	32.2	0.3	1.9	34.4
	El Muro	158.5	32.7	12.6	77.7	281.4	136.3	20.8	7.9	165.0	54.5	9.4	4.7	68.6
	Alanoca	10.5	1.0	1.0	23.0	35.5	9.0	0.6	0.6	10.3	3.6	0.3	0.4	4.3
	Chacabuco	310.0	30.0	10.0	106.8	456.8	266.7	19.1	6.3	292.0	106.7	8.6	3.8	119.0
	Dominguez	10.0	0.0	0.0	0.0	10.0	8.6	0.0	0.0	8.6	3.4	0.0	0.0	3.4
	Sascapa	246.0	110.0	36.7	172.0	564.7	211.6	70.1	23.0	304.7	84.6	31.5	13.8	130.0
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	16.1	2.5	0.9	19.5	6.5	1.1	0.6	8.1
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	9.7	1.5	0.6	11.7	3.9	0.7	0.3	4.9
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	754.6	115.3	43.6	913.5	301.9	51.9	26.1	379.9
										1322.8				

Jun.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	0.7	0.0	0.7	0.0	0.3	0.0	0.3
Sector III	Pro-Chile	18.0	6.0	38.0	25.9	87.9	12.8	3.2	18.5	34.5	5.1	1.4	11.1	17.7
	García	3.2	0.7	1.4	1.3	6.7	2.3	0.4	0.7	3.4	0.9	0.2	0.4	1.5
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	11.4	1.1	1.5	13.9	4.6	0.5	0.9	5.9
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	25.3	2.1	0.2	27.7	10.1	1.0	0.1	11.2
	Visconti	100.8	8.7	10.5	39.3	159.3	71.9	4.6	5.1	81.6	28.7	2.1	3.1	33.9
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	27.7	4.3	8.3	40.2	11.1	1.9	5.0	18.0
	Sub-Total	212.4	30.8	70.4	105.3	418.9	151.4	16.3	34.3	202.0	60.6	7.3	20.6	88.5
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	4.2	0.0	4.2	0.0	1.9	0.0	1.9
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.5	1.0	1.5	0.0	0.2	0.6	0.8
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	4.2	3.9	8.1	0.0	1.9	2.3	4.2
	Poconchile	45.0	15.0	46.0	5.7	111.7	32.1	7.9	22.4	62.4	12.8	3.6	13.4	29.8
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	5.9	0.5	3.4	9.9	2.4	0.2	2.0	4.7
	Mayorca	13.1	2.7	5.8	5.4	27.1	9.4	1.5	2.8	13.6	3.7	0.7	1.7	6.1
	Huancarane	31.6	6.6	13.9	13.1	65.2	22.5	3.5	6.8	32.8	9.0	1.6	4.1	14.6
	Sub-Total	136.6	42.2	82.6	39.1	300.6	69.9	22.3	40.3	132.5	28.0	10.0	24.2	62.2
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	13.3	0.0	1.0	14.3	5.3	0.0	0.6	5.9
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	66.7	0.5	2.4	69.7	26.7	0.2	1.5	28.4
	El Muro	158.5	32.7	12.6	77.7	281.4	113.0	17.3	6.1	136.4	45.2	7.8	3.7	56.6
	Alanoca	10.5	1.0	1.0	23.0	35.5	7.5	0.5	0.5	8.5	3.0	0.2	0.3	3.5
	Chacabuco	310.0	30.0	10.0	106.8	456.8	221.0	15.8	4.9	241.7	88.4	7.1	2.9	98.5
	Dominguez	10.0	0.0	0.0	0.0	10.0	7.1	0.0	0.0	7.1	2.9	0.0	0.0	2.9
	Sascapa	246.0	110.0	36.7	172.0	564.7	175.4	58.1	17.9	251.4	70.2	26.1	10.7	107.0
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	13.4	2.0	0.7	16.1	5.3	0.9	0.4	6.7
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	8.0	1.2	0.4	9.7	3.2	0.6	0.3	4.0
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	625.5	95.5	33.9	754.9	250.2	43.0	20.4	313.5
										1089.4				

Table B-II, 3.3 (4) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

Jul.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	0.7	0.0	0.7	0.0	0.3	0.0	0.3
Right Bank	Pro-Chile	18.0	6.0	38.0	25.9	87.9	0.0	3.1	17.9	21.0	0.0	1.4	10.8	12.2
	García	3.2	0.7	1.4	1.3	6.7	0.0	0.3	0.7	1.0	0.0	0.2	0.4	0.6
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	0.0	1.0	1.4	2.4	0.0	0.5	0.9	1.3
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	0.0	2.0	0.2	2.3	0.0	0.9	0.1	1.1
	Visconti	100.8	8.7	10.5	39.3	159.3	0.0	4.5	5.0	9.4	0.0	2.0	3.0	5.0
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	0.0	4.2	8.0	12.2	0.0	1.9	4.8	6.7
	Sub-Total	212.4	30.8	70.4	105.3	418.9	0.0	15.8	33.3	49.0	0.0	7.1	20.0	27.1
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	4.1	0.0	4.1	0.0	1.8	0.0	1.8
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.5	0.9	1.4	0.0	0.2	0.6	0.8
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	4.0	3.8	7.8	0.0	1.8	2.3	4.1
	Poconchile	45.0	15.0	46.0	5.7	111.7	0.0	7.7	21.7	29.4	0.0	3.5	13.0	16.5
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	0.0	0.5	3.3	3.8	0.0	0.2	2.0	2.2
	Mayorca	13.1	2.7	5.8	5.4	27.1	0.0	1.4	2.7	4.1	0.0	0.6	1.6	2.3
	Huancarane	31.6	6.6	13.9	13.1	65.2	0.0	3.4	6.6	9.9	0.0	1.5	3.9	5.5
	Sub-Total	136.6	42.2	82.6	39.1	300.6	0.0	21.6	39.0	60.6	0.0	9.7	23.4	33.1
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	0.0	0.0	0.9	0.9	0.0	0.0	0.6	0.6
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	0.0	0.5	2.4	2.9	0.0	0.2	1.4	1.6
	El Muro	158.5	32.7	12.6	77.7	281.4	0.0	16.7	5.9	22.7	0.0	7.5	3.6	11.1
	Alanoca	10.5	1.0	1.0	23.0	35.5	0.0	0.5	0.5	1.0	0.0	0.2	0.3	0.5
	Chacabuco	310.0	30.0	10.0	106.8	456.8	0.0	15.4	4.7	20.1	0.0	6.9	2.8	9.7
	Dominguez	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sascapa	246.0	110.0	36.7	172.0	564.7	0.0	56.3	17.3	73.6	0.0	25.3	10.4	35.7
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	0.0	2.0	0.7	2.7	0.0	0.9	0.4	1.3
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	0.0	1.2	0.4	1.6	0.0	0.5	0.3	0.8
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	0.0	92.6	32.9	125.5	0.0	41.7	19.7	61.4
										235.2				

Aug.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	0.7	0.0	0.7	0.0	0.3	0.0	0.3
Sector III	Pro-Chile	18.0	6.0	38.0	25.9	87.9	0.0	3.4	20.3	23.6	0.0	1.5	12.2	13.7
	García	3.2	0.7	1.4	1.3	6.7	0.0	0.4	0.8	1.1	0.0	0.2	0.5	0.6
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	0.0	1.1	1.6	2.7	0.0	0.5	1.0	1.5
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	0.0	2.3	0.3	2.5	0.0	1.0	0.2	1.2
	Visconti	100.8	8.7	10.5	39.3	159.3	0.0	4.9	5.6	10.5	0.0	2.2	3.4	5.6
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	0.0	4.6	9.1	13.6	0.0	2.1	5.4	7.5
	Sub-Total	212.4	30.8	70.4	105.3	418.9	0.0	17.4	37.6	54.9	0.0	7.8	22.5	30.3
Left Bank														
Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	4.5	0.0	4.5	0.0	2.0	0.0	2.0
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.5	1.1	1.6	0.0	0.2	0.6	0.9
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	4.5	4.3	8.7	0.0	2.0	2.6	4.6
	Poconchile	45.0	15.0	46.0	5.7	111.7	0.0	8.5	24.5	33.0	0.0	3.8	14.7	18.5
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	0.0	0.6	3.7	4.3	0.0	0.3	2.2	2.5
	Mayorca	13.1	2.7	5.8	5.4	27.1	0.0	1.5	3.1	4.6	0.0	0.7	1.8	2.5
	Huancarane	31.6	6.6	13.9	13.1	65.2	0.0	3.7	7.4	11.1	0.0	1.7	4.4	6.1
	Sub-Total	136.6	42.2	82.6	39.1	300.6	0.0	23.8	44.1	67.8	0.0	10.7	26.4	37.1
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	0.0	0.0	1.1	1.1	0.0	0.0	0.6	0.6
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	0.0	0.6	2.7	3.2	0.0	0.3	1.6	1.9
	El Muro	158.5	32.7	12.6	77.7	281.4	0.0	18.4	6.7	25.1	0.0	8.3	4.0	12.3
	Alanoca	10.5	1.0	1.0	23.0	35.5	0.0	0.6	0.5	1.1	0.0	0.3	0.3	0.6
	Chacabuco	310.0	30.0	10.0	106.8	456.8	0.0	16.9	5.3	22.2	0.0	7.6	3.2	10.8
	Dominguez	10.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sascapa	246.0	110.0	36.7	172.0	564.7	0.0	62.0	19.6	81.5	0.0	27.9	11.7	39.6
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	0.0	2.2	0.8	3.0	0.0	1.0	0.5	1.5
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	0.0	1.3	0.5	1.8	0.0	0.6	0.3	0.9
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	0.0	101.9	37.1	139.0	0.0	45.9	22.3	68.1
										261.8				

Table B-II, 3.3 (5) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

Sep.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	0.9	0.0	0.9	0.0	0.4	0.0	0.4
	Pro-Chile	18.0	6.0	38.0	25.9	87.9	17.2	4.3	26.1	47.3	6.9	1.9	15.6	24.4
	García	3.2	0.7	1.4	1.3	6.7	3.1	0.5	1.0	4.6	1.2	0.2	0.6	2.0
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	15.3	1.4	2.1	18.8	6.1	0.6	1.2	8.0
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	33.9	2.8	0.3	37.1	13.6	1.3	0.2	15.1
	Visconti	100.8	8.7	10.5	39.3	159.3	96.4	6.2	7.2	109.7	38.5	2.8	4.3	45.6
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	37.1	5.7	11.7	54.5	14.8	2.6	7.0	24.4
	Sub-Total	212.4	30.8	70.4	105.3	418.9	203.0	21.8	48.3	273.2	81.2	9.8	29.0	120.0
Left Bank Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	5.7	0.0	5.7	0.0	2.6	0.0	2.6
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.7	1.4	2.0	0.0	0.3	0.8	1.1
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	5.6	5.5	11.1	0.0	2.5	3.3	5.8
	Poconchile	45.0	15.0	46.0	5.7	111.7	43.0	10.6	31.6	85.2	17.2	4.8	18.9	40.9
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	7.9	0.7	4.8	13.4	3.2	0.3	2.9	6.4
	Mayorca	13.1	2.7	5.8	5.4	27.1	12.6	1.9	4.0	18.5	5.0	0.9	2.4	8.3
	Huancarane	31.6	6.6	13.9	13.1	65.2	30.2	4.7	9.5	44.4	12.1	2.1	5.7	19.9
	Sub-Total	136.6	42.2	82.6	39.1	300.6	93.8	29.9	56.7	180.4	37.5	13.5	34.0	85.0
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	17.9	0.0	1.4	19.2	7.2	0.0	0.8	8.0
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	89.5	0.7	3.4	93.6	35.8	0.3	2.1	38.2
	El Muro	158.5	32.7	12.6	77.7	281.4	151.5	23.1	8.6	183.3	60.6	10.4	5.2	76.2
	Alanoca	10.5	1.0	1.0	23.0	35.5	10.0	0.7	0.7	11.4	4.0	0.3	0.4	4.7
	Chacabuco	310.0	30.0	10.0	106.8	456.8	296.4	21.3	6.9	324.5	118.5	9.6	4.1	132.2
	Dominguez	10.0	0.0	0.0	0.0	10.0	9.6	0.0	0.0	9.6	3.8	0.0	0.0	3.8
	Sascapa	246.0	110.0	36.7	172.0	564.7	235.2	77.9	25.2	338.3	94.1	35.1	15.1	144.2
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	17.9	2.7	1.0	21.7	7.2	1.2	0.6	9.0
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	10.8	1.6	0.6	13.0	4.3	0.7	0.4	5.4
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	838.7	128.1	47.8	1,014.6	335.5	57.6	28.7	421.8
										1468.1				

Oct.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Sector III Right Bank	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.1	0.0	1.1	0.0	0.5	0.0	0.5
	Pro-Chile	18.0	6.0	38.0	25.9	87.9	20.2	5.0	32.0	57.1	8.1	2.2	19.2	29.5
	García	3.2	0.7	1.4	1.3	6.7	3.6	0.6	1.2	5.4	1.5	0.3	0.7	2.4
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	17.9	1.7	2.5	22.1	7.2	0.7	1.5	9.4
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	39.8	3.3	0.4	43.5	15.9	1.5	0.3	17.7
	Visconti	100.8	8.7	10.5	39.3	159.3	112.9	7.2	8.8	129.0	45.2	3.2	5.3	53.7
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	43.5	6.7	14.3	64.5	17.4	3.0	8.6	29.0
	Sub-Total	212.4	30.8	70.4	105.3	418.9	237.9	25.5	59.3	322.7	95.1	11.5	35.6	142.2
Left Bank Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	6.6	0.0	6.6	0.0	3.0	0.0	3.0
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.8	1.7	2.5	0.0	0.4	1.0	1.4
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	6.6	6.7	13.3	0.0	2.9	4.0	7.0
	Poconchile	45.0	15.0	46.0	5.7	111.7	50.4	12.4	38.7	101.6	20.2	5.6	23.2	49.0
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	9.3	0.8	5.9	16.0	3.7	0.4	3.5	7.6
	Mayorca	13.1	2.7	5.8	5.4	27.1	14.7	2.3	4.9	21.9	5.9	1.0	2.9	9.8
	Huancarane	31.6	6.6	13.9	13.1	65.2	35.4	5.5	11.7	52.6	14.2	2.5	7.0	23.6
	Sub-Total	136.6	42.2	82.6	39.1	300.6	109.8	35.0	69.6	214.4	43.9	15.8	41.7	101.4
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	20.9	0.0	1.7	22.6	8.4	0.0	1.0	9.4
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	104.8	0.8	4.2	109.9	41.9	0.4	2.5	44.8
	El Muro	158.5	32.7	12.6	77.7	281.4	177.5	27.1	10.6	215.2	71.0	12.2	6.4	89.5
	Alanoca	10.5	1.0	1.0	23.0	35.5	11.8	0.8	0.8	13.4	4.7	0.4	0.5	5.6
	Chacabuco	310.0	30.0	10.0	106.8	456.8	347.2	24.9	8.4	380.5	138.9	11.2	5.1	155.1
	Dominguez	10.0	0.0	0.0	0.0	10.0	11.2	0.0	0.0	11.2	4.5	0.0	0.0	4.5
	Sascapa	246.0	110.0	36.7	172.0	564.7	275.5	91.3	30.9	397.7	110.2	41.1	18.5	169.8
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	21.0	3.2	1.3	25.5	8.4	1.4	0.8	10.6
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	12.6	1.9	0.8	15.3	5.0	0.9	0.5	6.4
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	982.6	150.0	58.7	1,191.3	393.0	67.5	35.2	495.8
										1728.5				

Table B-II, 3.3 (6) Actual Water Demand and Real Consumption
<Demanda Actual de Agua y Consumo Real>

Nov.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
Right Bank Sector III	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.2	0.0	1.2	0.0	0.6	0.0	0.6
	Pro-Chile	18.0	6.0	38.0	25.9	87.9	22.9	5.6	37.9	66.4	9.1	2.5	22.8	34.4
	García	3.2	0.7	1.4	1.3	6.7	4.1	0.6	1.4	6.2	1.7	0.3	0.9	2.8
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	20.3	1.9	3.0	25.2	8.1	0.8	1.8	10.8
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	45.1	3.8	0.5	49.3	18.0	1.7	0.3	20.0
	Visconti	100.8	8.7	10.5	39.3	159.3	128.0	8.2	10.5	146.7	51.2	3.7	6.3	61.2
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	49.3	7.6	17.0	73.9	19.7	3.4	10.2	33.3
	Sub-Total	212.4	30.8	70.4	105.3	418.9	269.6	29.0	70.3	368.9	107.8	13.0	42.2	163.1
Left Bank Sector III	La Isla	18.0	8.0	0.0	4.0	30.0	0.0	7.5	0.0	7.5	0.0	3.4	0.0	3.4
	Huanca	4.6	1.0	2.0	1.9	9.4	0.0	0.9	2.0	2.9	0.0	0.4	1.2	1.6
	Linderos	16.0	7.9	8.0	0.0	31.9	0.0	7.4	8.0	15.4	0.0	3.3	4.8	8.1
	Poconchile	45.0	15.0	46.0	5.7	111.7	57.1	14.1	45.9	117.2	22.9	6.3	27.6	56.8
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	10.5	0.9	7.0	18.5	4.2	0.4	4.2	8.8
	Mayorca	13.1	2.7	5.8	5.4	27.1	16.7	2.6	5.8	25.0	6.7	1.2	3.5	11.3
	Huancarane	31.6	6.6	13.9	13.1	65.2	40.2	6.2	13.9	60.2	16.1	2.8	8.3	27.2
	Sub-Total	136.6	42.2	82.6	39.1	300.6	124.5	39.7	82.5	246.7	49.8	17.9	49.5	117.2
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	23.7	0.0	2.0	25.7	9.5	0.0	1.2	10.7
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	118.8	0.9	5.0	124.8	47.5	0.4	3.0	51.0
	El Muro	158.5	32.7	12.6	77.7	281.4	201.2	30.7	12.6	244.5	80.5	13.8	7.5	101.8
	Alanoca	10.5	1.0	1.0	23.0	35.5	13.3	0.9	1.0	15.3	5.3	0.4	0.6	6.4
	Chacabuco	310.0	30.0	10.0	106.8	456.8	393.6	28.2	10.0	431.8	157.4	12.7	6.0	176.1
	Dominguez	10.0	0.0	0.0	0.0	10.0	12.7	0.0	0.0	12.7	5.1	0.0	0.0	5.1
	Sascapa	246.0	110.0	36.7	172.0	564.7	312.3	103.5	36.6	452.4	124.9	46.6	22.0	193.5
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	23.8	3.6	1.5	28.9	9.5	1.6	0.9	12.1
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	14.3	2.2	0.9	17.4	5.7	1.0	0.5	7.2
	Sub-Total	877.3	180.9	69.6	430.2	1,558.0	1,113.8	170.1	69.6	1,353.5	445.5	76.6	41.7	563.8
										1,969.2				

Dec.

		Existing Irrigation Area (ha)					Water Demand (l/sec)				Real Consumption			
		Maize	Vegetable	Pasture	Fallow	Total	Maize	Vegetable	Pasture	Total	Maize	Vegetable	Pasture	Total
	Kesler	0.0	1.3	0.0	5.0	6.3	0.0	1.3	0.0	1.3	0.0	0.6	0.0	0.6
	Pro-Chile	18.0	6.0	38.0	25.9	87.9	25.1	6.2	42.5	73.8	10.0	2.8	25.5	38.3
Sector III Right Bank	García	3.2	0.7	1.4	1.3	6.7	4.5	0.7	1.6	6.8	1.8	0.3	1.0	3.1
	La Palma Uno	16.0	2.0	3.0	9.7	30.7	22.3	2.1	3.4	27.7	8.9	0.9	2.0	11.9
	La Palma Dos	35.5	4.0	0.5	8.0	48.0	49.5	4.1	0.6	54.1	19.8	1.9	0.3	22.0
	Visconti	100.8	8.7	10.5	39.3	159.3	140.4	9.0	11.7	161.1	56.2	4.0	7.0	67.3
	Kesler Gil	38.8	8.1	17.0	16.1	80.0	54.1	8.4	19.0	81.5	21.6	3.8	11.4	36.8
	Sub-Total	212.4	30.8	70.4	105.3	418.9	295.8	31.8	78.8	406.4	118.3	14.3	47.3	179.9
Left Bank	La Isla	18.0	8.0	0.0	4.0	30.0	25.1	8.3	0.0	33.3	10.0	3.7	0.0	13.7
	Huanca	4.6	1.0	2.0	1.9	9.4	6.4	1.0	2.8	10.1	2.5	0.4	1.7	4.7
	Linderos	16.0	7.9	8.0	0.0	31.9	22.3	8.2	11.1	41.6	8.9	3.7	6.7	19.3
	Poconchile	45.0	15.0	46.0	5.7	111.7	62.7	15.5	64.1	142.2	25.1	7.0	38.4	70.5
	Barranco Sta. Rosa	8.3	1.0	7.0	9.0	25.3	11.6	1.0	9.8	22.3	4.6	0.5	5.9	10.9
	Mayorca	13.1	2.7	5.8	5.4	27.1	18.3	2.8	8.0	29.2	7.3	1.3	4.8	13.4
	Huancarane	31.6	6.6	13.9	13.1	65.2	44.1	6.8	19.3	70.2	17.6	3.1	11.6	32.3
	Sub-Total	136.6	42.2	82.6	39.1	300.6	190.3	43.6	115.1	349.0	76.1	19.6	69.1	164.8
Sector IV	Arellano Beyzan	18.7	0.0	2.0	6.0	26.7	26.0	0.0	2.8	28.8	10.4	0.0	1.7	12.1
	Cora Beyzan	93.6	1.0	5.0	30.0	129.6	130.4	1.0	7.0	138.4	52.2	0.5	4.2	56.8
	El Muro	158.5	32.7	12.6	77.7	281.4	220.7	33.7	17.5	272.0	88.3	15.2	10.5	114.0
	Alanoca	10.5	1.0	1.0	23.0	35.5	14.6	1.0	1.4	17.1	5.9	0.5	0.8	7.2
	Chacabuco	310.0	30.0	10.0	106.8	456.8	431.8	31.0	13.9	476.7	172.7	13.9	8.4	195.0
	Dominguez	10.0	0.0	0.0	0.0	10.0	13.9	0.0	0.0	13.9	5.6	0.0	0.0	5.6
	Sascapa	246.0	110.0	36.7	172.0	564.7	342.7	113.5	51.1	507.3	137.1	51.1	30.7	218.8
	Bravo Uno	18.8	3.9	1.5	9.2	33.3	26.1	4.0	2.1	32.2	10.4	1.8	1.2	13.5
	Bravo Dos	11.3	2.3	0.9	5.5	20.0	15.7	2.4	1.2	19.3	6.3	1.1	0.7	8.1
	Sub-Total	877.3	180.9	69.7	430.2	1,558.0	1,222.0	186.6	97.0	1,505.7	488.8	84.0	58.2	631.0

Table B-II, 3.4 (1) Water Distribution to Irrigation Channel (by Demand)

<Distribución de Agua al Canal de Irrigación (por Demanda)>

Jan.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.5	0.7							
Right Bank	Pro-Chile	53.8	31.2							
	García	2.5	1.4							
	La Palma Uno	6.0	3.2							
	La Palma Dos	5.1	2.4	38.9	68.8	81	69	12	30	42
	Visconti	22.8	12.2	12.2	22.8	42	23	20	11	30
	Kesler Gil	30.2	16.7	16.7	30.2	30	30	0	13	13
	Sub-Total	121.8	67.9	67.9	121.8					
Left Bank	La Isla	36.4	15.0							
	Huanca	10.5	4.7							
	Linderos	43.2	19.7							
	Poconchile	73.8	41.7							
	Barranco Sta. Rosa	9.8	5.7							
	Mayorca	10.2	5.7							
	Huancarane	24.6	13.6							
Sector IV	Arellano Beyzan	2.5	1.5							
	Cora Beyzan	7.3	4.2	111.9	218.3	351	218	133	106	239
	El Muro	52.4	25.9							
	Alanoca	2.4	1.2	27.1	54.8	239	55	184	28	212
	Chacabuco (1)	23.1	11.3	11.3	23.1	212	23	189	12	201
	Chacabuco (2)	23.1	11.3							
	Dominguez	0.0	0.0	11.3	23.1	201	23	178	12	189
	Sascapa (1)	84.7	41.5	41.5	84.7	189	85	105	43	148
	Sascapa (2)	84.7	41.5	41.5	84.7	148	85	63	43	106
	Bravo Uno	6.2	3.1							
	Bravo Dos	3.7	1.8	4.9	9.9	106	10	96	5	101
Sector V	Valle Hermoso	54.3	26.7							
	Aica González	10.3	4.8	31.5	64.6	101	65	37	33	70
	M. Beovic	9.9	5.9							
	B'ba Pte.Chacall.	8.3	5.0							
	Ambrosio Flores	2.5	1.5	12.4	20.7	70	21	49	8	58
	Bellet	3.0	1.4							
	Beneficiencia	33.4	18.1							
	Santa Rosa	21.2	11.0	30.5	57.6	58	58	0	27	27
	Sub-Total	641	324	324	641					
	Total	763	392	392	763					

Feb.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.5	0.7							
Right Bank	Pro-Chile	53.6	31.2							
	García	2.5	1.4							
	La Palma Uno	5.9	3.2							
	La Palma Dos	5.1	2.4	38.8	68.6	81	69	13	30	42
	Visconti	22.7	12.2	12.2	22.7	42	23	20	11	30
	Kesler Gil	30.1	16.7	16.7	30.1	30	30	0	13	13
	Sub-Total	121.4	67.7	67.7	121.4					
Left Bank	La Isla	36.3	15.0							
	Huanca	10.5	4.7							
	Linderos	43.1	19.6							
	Poconchile	73.6	41.6							
	Barranco Sta. Rosa	9.8	5.7							
	Mayorca	10.2	5.7							
	Huancarane	24.6	13.6							
Sector IV	Arellano Beyzan	2.5	1.5							
	Cora Beyzan	7.3	4.2	111.6	217.9	350	218	132	106	238
	El Muro	52.3	25.9							
	Alanoca	2.4	1.2	27.1	54.7	238	55	184	28	211
	Chacabuco (1)	23.1	11.3	11.3	23.1	211	23	188	12	200
	Chacabuco (2)	23.1	11.3							
	Dominguez	0.0	0.0	11.3	23.1	200	23	177	12	189
	Sascapa (1)	84.5	41.4	41.4	84.5	189	85	104	43	147
	Sascapa (2)	84.5	41.4	41.4	84.5	147	85	63	43	106
	Bravo Uno	6.2	3.1							
	Bravo Dos	3.7	1.8	4.9	9.9	106	10	96	5	101
Sector V	Valle Hermoso	54.2	26.6							
	Aica González	10.2	4.8	31.4	64.4	101	64	37	33	70
	M. Beovic	9.9	5.9							
	B'ba Pte.Chacall.	8.3	5.0							
	Ambrosio Flores	2.5	1.5	12.4	20.6	70	21	49	8	57
	Bellet	3.0	1.4							
	Beneficiencia	33.3	18.0							
	Santa Rosa	21.1	11.0	30.4	57.4	57	57	0	27	27
	Sub-Total	640.1	323.1	323.1	640.1					
	Total	761.5	390.9	390.9	761.5		Total Extraction		431	

Table B-II, 3.4 (2) Water Distribution to Irrigation Channel (by Demand)
<Distribución de Agua al Canal de Irrigación (por Demanda)>

Mar.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.3	0.6							
Right Bank	Pro-Chile	71.3	37.0							
	García	6.6	3.0							
	La Palma Uno	26.8	11.5							
	La Palma Dos	52.3	21.2	73.3	158.2	229	158	71	85	156
	Visconti	155.6	64.9	64.9	155.6	156	156	0	91	91
	Kesler Gil	78.7	35.6	35.6	78.7	91	79	12	43	55
	Sub-Total	392.5	173.8	173.8	392.5					
Left Bank	La Isla	32.2	13.3							
	Huanca	9.2	4.2							
	Linderos	38.0	17.3							
	Poconchile	125.2	60.8							
	Barranco Sta. Rosa	19.7	9.5							
	Mayorca	26.7	12.0							
	Huancarane	64.1	29.0							
Sector IV	Arellano Beyzan	27.3	11.4							
	Cora Beyzan	132.3	54.1	211.5	474.7	983	475	508	263	772
	El Muro	259.3	108.1							
	Alanoca	16.2	6.7	114.8	275.5	772	276	496	161	657
	Chacabuco (1)	228.9	93.4	93.4	228.9	657	229	428	136	563
	Chacabuco (2)	228.9	93.4							
	Dominguez	13.5	5.4	98.7	242.4	563	242	321	144	465
	Sascapa (1)	240.1	102.8	102.8	240.1	465	240	225	137	362
	Sascapa (2)	240.1	102.8	102.8	240.1	362	240	122	137	259
	Bravo Uno	30.7	12.8							
	Bravo Dos	18.4	7.7	20.5	49.1	259	49	210	29	239
Sector V	Valle Hermoso	173.8	75.9							
	Aica González	64.8	27.5	103.4	238.7	239	239	0	135	135
	M. Beovic	9.9	5.9							
	B'ba Pte.Chacall.	8.3	5.0							
	Ambrosio Flores	2.5	1.5	12.4	20.7	135	21	115	8	123
	Bellet	0.0	0.0							
	Beneficiencia	33.1	17.6							
	Santa Rosa	41.7	19.3	36.9	74.8	123	75	48	38	86
	Sub-Total	2,084.9	897.1	897.1	2,084.9					
	Total	2,477.4	1,070.9	1,070.9	2,477.4		Total Extraction		1,212	

Apr.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.0	0.5							
Right Bank	Pro-Chile	54.7	28.3							
	García	5.1	2.3							
	La Palma Uno	21.0	8.9							
	La Palma Dos	41.1	16.7	56.7	123.0	179	123	56	66	122
	Visconti	122.1	50.9	50.9	122.1	122	122	0	71	71
	Kesler Gil	61.3	27.6	27.6	61.3	71	61	10	34	44
	Sub-Total	306.4	135.2	135.2	306.4					
Left Bank	La Isla	6.3	2.8							
	Huanca	2.4	1.3							
	Linderos	12.7	6.7							
	Poconchile	96.9	46.8							
	Barranco Sta. Rosa	15.3	7.3							
	Mayorca	20.8	9.4							
	Huancarane	50.0	22.5							
Sector IV	Arellano Beyzan	21.4	8.9							
	Cora Beyzan	104.0	42.4	148.1	329.7	700	330	370	182	552
	El Muro	203.7	84.8							
	Alanoca	12.7	5.3	90.1	216.4	552	216	335	126	462
	Chacabuco (1)	180.0	73.4	73.4	180.0	462	180	282	107	388
	Chacabuco (2)	180.0	73.4							
	Dominguez	10.6	4.2	77.6	190.6	388	191	198	113	311
	Sascapa (1)	188.4	80.5	80.5	188.4	311	188	122	108	230
	Sascapa (2)	188.4	80.5	80.5	188.4	230	188	42	108	150
	Bravo Uno	24.1	10.0							
	Bravo Dos	14.5	6.0	16.1	38.6	150	39	111	23	134
Sector V	Valle Hermoso	100.7	43.6							
	Aica González	32.5	13.5	57.1	133.3	134	133	0	76	77
	M. Beovic	6.5	3.9							
	B'ba Pte.Chacall.	5.5	3.3							
	Ambrosio Flores	1.6	1.0	8.2	13.6	77	14	63	5	68
	Bellet	2.1	1.0							
	Beneficiencia	27.5	14.1							
	Santa Rosa	27.1	12.5	27.6	56.7	68	57	12	29	41
	Sub-Total	1,535.5	659.2	659.2	1,535.5					
	Total	1,841.9	794.4	794.4	1,841.9		Total Extraction		879	

Table B-II, 3.4 (3) Water Distribution to Irrigation Channel(by Demand)
<Distribución de Agua al Canal de Irrigación (por Demanda)>

May

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III Right Bank	Kesler	0.8	0.4							
	Pro-Chile	43.1	22.2							
	García	4.1	1.8							
	La Palma Uno	16.9	7.2							
	La Palma Dos	33.4	13.5	45.1	98.3	144	98	46	53	99
	Visconti	98.8	41.1	41.1	98.8	99	99	0	58	58
	Kesler Gil	49.2	22.1	22.1	49.2	58	49	9	27	36
	Sub-Total	246.4	108.3	108.3	246.4					
Left Bank	La Isla	5.1	2.3							
	Huanca	1.9	1.0							
	Linderos	10.0	5.3							
	Poconchile	77.0	37.0							
	Barranco Sta. Rosa	12.2	5.8							
	Mayorca	16.7	7.5							
	Huancarane	40.1	18.0							
Sector IV	Arellano Beyzan	17.3	7.2							
	Cora Beyzan	84.3	34.4	118.4	264.6	565	265	300	146	447
	El Muro	165.0	68.6							
	Alanoca	10.3	4.3	72.9	175.3	447	175	271	102	374
	Chacabuco (1)	146.0	59.5	59.5	146.0	374	146	228	87	314
	Chacabuco (2)	146.0	59.5							
	Dominguez	8.6	3.4	62.9	154.6	314	155	160	92	251
	Sascapa (1)	152.4	65.0	65.0	152.4	251	152	99	87	186
	Sascapa (2)	152.4	65.0	65.0	152.4	186	152	34	87	121
	Bravo Uno	19.5	8.1							
	Bravo Dos	11.7	4.9	13.0	31.2	121	31	90	18	108
Sector V	Valle Hermoso	81.4	35.2							
	Aica González	26.4	10.9	46.1	107.8	108	108	0	62	62
	M. Beovic	5.0	3.0							
	B'ba Pte.Chacall.	4.2	2.5							
	Ambrosio Flores	1.3	0.8	6.3	10.4	62	10	52	4	56
	Bellet	1.7	0.8							
	Beneficiencia	21.8	11.1							
	Santa Rosa	21.7	10.0	21.9	45.2	56	45	11	23	34
	Sub-Total	1,239.7	531.0	531.0	1,239.7					
	Total	1,486.1	639.3	639.3	1,486.1		Total Extraction		709	

Jun.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III Right Bank	Kesler	0.7	0.3							
	Pro-Chile	34.5	17.7							
	García	3.4	1.5							
	La Palma Uno	13.9	5.9							
	La Palma Dos	27.7	11.2	36.6	80.2	118	80	38	44	82
	Visconti	81.6	33.9	33.9	81.6	82	82	0	48	48
	Kesler Gil	40.2	18.0	18.0	40.2	48	40	7	22	30
	Sub-Total	202.0	88.5	88.5	202.0					
Left Bank	La Isla	4.2	1.9							
	Huanca	1.5	0.8							
	Linderos	8.1	4.2							
	Poconchile	62.4	29.8							
	Barranco Sta. Rosa	9.9	4.7							
	Mayorca	13.6	6.1							
	Huancarane	32.8	14.6							
Sector IV	Arellano Beyzan	14.3	5.9							
	Cora Beyzan	69.7	28.4	96.4	216.5	465	217	248	120	369
	El Muro	136.4	56.6							
	Alanoca	8.5	3.5	60.2	144.9	369	145	224	85	308
	Chacabuco (1)	120.9	49.3	49.3	120.9	308	121	188	72	259
	Chacabuco (2)	120.9	49.3							
	Dominguez	7.1	2.9	52.1	128.0	259	128	131	76	207
	Sascapa (1)	125.7	53.5	53.5	125.7	207	126	81	72	154
	Sascapa (2)	125.7	53.5	53.5	125.7	154	126	28	72	100
	Bravo Uno	16.1	6.7							
	Bravo Dos	9.7	4.0	10.7	25.8	100	26	74	15	89
Sector V	Valle Hermoso	67.1	28.9							
	Aica González	21.8	9.0	38.0	88.9	89	89	0	51	51
	M. Beovic	3.9	2.3							
	B'ba Pte.Chacall.	3.3	2.0							
	Ambrosio Flores	1.0	0.6	4.9	8.1	51	8	43	3	46
	Bellet	1.4	0.6							
	Beneficiencia	17.5	8.9							
	Santa Rosa	17.7	8.1	17.7	36.7	46	37	10	19	29
	Sub-Total	1,021.1	436.2	436.2	1,021.1					
	Total	1,223.1	524.7	524.7	1,223.1		Total Extraction		583	

Table B-II, 3.4 (4) Water Distribution to Irrigation Channel(by Demand)
<Distribución de Agua al Canal de Irrigación (por Demanda)

Jul.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	0.7	0.3							
Right Bank	Pro-Chile	21.0	12.2							
	García	1.0	0.6							
	La Palma Uno	2.4	1.3							
	La Palma Dos	2.3	1.1	15.4	27.4	33	27	5	12	17
	Visconti	9.4	5.0	5.0	9.4	17	9	8	4	12
	Kesler Gil	12.2	6.7	6.7	12.2	12	12	0	6	6
	Sub-Total	49.0	27.1	27.1	49.0					
Left Bank	La Isla	4.1	1.8							
	Huanca	1.4	0.8							
	Linderos	7.8	4.1							
	Poconchile	29.4	16.5							
	Barranco Sta. Rosa	3.8	2.2							
	Mayorca	4.1	2.3							
	Huancarane	9.9	5.5							
Sector IV	Arellano Beyzan	0.9	0.6							
	Cora Beyzan	2.9	1.6	35.3	64.4	124	64	60	29	89
	El Muro	0.0	0.0							
	Alanoca	1.0	0.5	0.5	1.0	89	1	88	0	88
	Chacabuco (1)	10.1	4.9	4.9	10.1	88	10	78	5	83
	Chacabuco (2)	10.1	4.9							
	Dominguez	0.0	0.0	4.9	10.1	83	10	73	5	78
	Sascapa (1)	36.8	17.9	17.9	36.8	78	37	42	19	61
	Sascapa (2)	36.8	17.9	17.9	36.8	61	37	24	19	43
	Bravo Uno	0.0	0.0							
	Bravo Dos	0.0	0.0	0.0	0.0	43	0	43	0	43
Sector V	Valle Hermoso	23.6	11.5							
	Aica González	4.6	2.1	13.6	28.2	43	28	15	15	29
	M. Beovic	3.8	2.3							
	B'ba Pte.Chacall.	3.2	1.9							
	Ambrosio Flores	0.9	0.6	4.7	7.9	29	8	21	3	24
	Bellet	1.4	0.6							
	Beneficiencia	13.7	7.3							
	Santa Rosa	8.9	4.6	12.5	24.0	24	24	0	11	12
	Sub-Total	219.1	112.1	112.1	219.1					
	Total	268.1	139.1	139.1	268.1		Total Extraction		157	

Aug.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	0.7	0.3							
Right Bank	Pro-Chile	23.6	13.7							
	García	1.1	0.6							
	La Palma Uno	2.7	1.5							
	La Palma Dos	2.5	1.2	17.3	30.8	37	31	6	13	19
	Visconti	10.5	5.6	5.6	10.5	19	10	9	5	14
	Kesler Gil	13.6	7.5	7.5	13.6	14	14	0	6	6
	Sub-Total	54.9	30.3	30.3	54.9					
Left Bank	La Isla	4.5	2.0							
	Huanca	1.6	0.9							
	Linderos	8.7	4.6							
	Poconchile	33.0	18.5							
	Barranco Sta. Rosa	4.3	2.5							
	Mayorca	4.6	2.5							
	Huancarane	11.1	6.1							
Sector IV	Arellano Beyzan	1.1	0.6							
	Cora Beyzan	3.2	1.9	39.7	72.1	152	72	80	32	112
	El Muro	25.1	12.3							
	Alanoca	1.1	0.6	12.9	26.2	112	26	86	13	99
	Chacabuco (1)	11.1	5.4	5.4	11.1	99	11	88	6	94
	Chacabuco (2)	11.1	5.4							
	Dominguez	0.0	0.0	5.4	11.1	94	11	83	6	89
	Sascapa (1)	40.8	19.8	19.8	40.8	89	41	48	21	69
	Sascapa (2)	40.8	19.8	19.8	40.8	69	41	28	21	49
	Bravo Uno	3.0	1.5							
	Bravo Dos	1.8	0.9	2.4	4.8	49	5	44	2	47
Sector V	Valle Hermoso	26.1	12.7							
	Aica González	5.0	2.3	15.1	31.1	47	31	16	16	32
	M. Beovic	4.3	2.6							
	B'ba Pte.Chacall.	3.6	2.1							
	Ambrosio Flores	1.1	0.6	5.3	8.9	32	9	23	4	26
	Bellet	1.5	0.7							
	Beneficiencia	15.3	8.2							
	Santa Rosa	9.9	5.1	14.0	26.7	26	27	0	13	12
	Sub-Total	273.6	139.7	139.7	273.6					
	Total	328.5	170.0	170.0	328.5		Total Extraction		189	

Table B-II, 3.4 (5) Water Distribution to Irrigation Channel (by Demand)
<Distribución de Agua al Canal de Irrigación (por Demanda)>

Sep.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III Right Bank	Kesler	0.9	0.4							
	Pro-Chile	47.5	24.4							
	García	4.6	2.0							
	La Palma Uno	18.8	8.0							
	La Palma Dos	37.1	15.1	49.9	108.9	160	109	51	59	110
	Visconti	109.7	45.6	45.6	109.7	110	110	0	64	64
	Kesler Gil	54.5	24.4	24.4	54.5	64	55	10	30	40
	Sub-Total	273.2	120.0	120.0	273.2					
Left Bank	La Isla	5.7	2.6							
	Huanca	2.0	1.1							
	Linderos	11.1	5.8							
	Poconchile	85.2	40.9							
	Barranco Sta. Rosa	13.4	6.4							
	Mayorca	18.5	8.3							
	Huancarane	44.4	19.9							
Sector IV	Arellano Beyzan	19.2	8.0							
	Cora Beyzan	93.6	38.2	131.1	293.2	699	293	406	162	568
	El Muro	183.3	76.2							
	Alanoca	11.4	4.7	80.9	194.7	568	195	373	114	487
	Chacabuco (1)	162.2	66.1	66.1	162.2	487	162	325	96	421
	Chacabuco (2)	162.2	66.1							
	Dominguez	9.6	3.8	70.0	171.8	421	172	249	102	351
	Sascapa (1)	169.2	72.1	72.1	169.2	351	169	182	97	279
	Sascapa (2)	169.2	72.1	72.1	169.2	279	169	110	97	207
	Bravo Uno	21.7	9.0							
	Bravo Dos	13.0	5.4	14.4	34.7	207	35	172	20	192
Sector V	Valle Hermoso	145.6	63.2							
	Alca González	46.8	19.4	82.6	192.4	192	192	0	110	110
	M. Beovic	9.9	5.9							
	B'ba Pte.Chacall.	8.3	5.0							
	Ambrosio Flores	2.5	1.5	12.4	20.7	110	21	89	8	97
	Bellet	3.0	1.4							
	Beneficiencia	40.7	21.0							
	Santa Rosa	39.4	18.3	40.7	83.2	97	83	14	42	57
	Sub-Total	1,491.2	642.5	642.5	1,491.2					
	Total	1,764.4	762.5	762.5	1,764.4		Total Extraction		859	

Oct.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III Right Bank	Kesler	1.1	0.5							
	Pro-Chile	57.1	29.5							
	García	5.4	2.4							
	La Palma Uno	22.1	9.4							
	La Palma Dos	43.5	17.7	59.5	129.2	189	129	59	70	129
	Visconti	129.0	53.7	53.7	129.0	129	129	0	75	75
	Kesler Gil	64.5	29.0	29.0	64.5	75	65	11	36	46
	Sub-Total	322.7	142.2	142.2	322.7					
Left Bank	La Isla	6.6	3.0							
	Huanca	2.5	1.4							
	Linderos	13.3	7.0							
	Poconchile	101.6	49.0							
	Barranco Sta. Rosa	16.0	7.6							
	Mayorca	21.9	9.8							
	Huancarane	52.6	23.6							
Sector IV	Arellano Beyzan	22.6	9.4							
	Cora Beyzan	109.9	44.8	155.7	347.0	738	347	391	191	582
	El Muro	215.2	89.5							
	Alanoca	13.4	5.6	95.1	228.6	582	229	354	133	487
	Chacabuco (1)	190.3	77.6	77.6	190.3	487	190	297	113	410
	Chacabuco (2)	190.3	77.6							
	Dominguez	11.2	4.5	82.0	201.5	410	201	208	119	328
	Sascapa (1)	198.9	84.9	84.9	198.9	328	199	129	114	243
	Sascapa (2)	198.9	84.9	84.9	198.9	243	199	44	114	158
	Bravo Uno	25.5	10.6							
	Bravo Dos	15.3	6.4	17.0	40.8	158	41	117	24	141
Sector V	Valle Hermoso	106.4	46.0							
	Alca González	34.4	14.2	60.3	140.7	141	141	0	80	81
	M. Beovic	6.7	4.0							
	B'ba Pte.Chacall.	5.6	3.4							
	Ambrosio Flores	1.7	1.0	8.4	14.1	81	14	66	6	72
	Bellet	2.2	1.0							
	Beneficiencia	28.8	14.8							
	Santa Rosa	28.5	13.2	28.9	59.5	72	60	13	31	43
	Sub-Total	1,620.1	694.8	694.8	1,620.1					
	Total	1,942.8	837.1	837.1	1,942.8		Total Extraction		927	

Table B-II, 3.4 (6) Water Distribution to Irrigation Channel(by Demand)
<Distribución de Agua al Canal de Irrigación (por Demanda,

Nov.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.2	0.6							
Right Bank	Pro-Chile	66.4	34.4							
	García	6.2	2.8							
	La Palma Uno	25.2	10.8							
	La Palma Dos	49.3	20.0	68.6	148.4	215	148	67	80	147
	Visconti	146.7	61.2	61.2	146.7	147	147	0	85	85
	Kesler Gil	73.9	33.3	33.3	73.9	85	74	12	41	52
	Sub-Total	368.9	163.1	163.1	368.9					
Left Bank	La Isla	7.5	3.4							
	Huanca	2.9	1.6							
	Linderos	15.4	8.1							
	Poconchile	117.2	56.8							
	Barranco Sta. Rosa	18.5	8.8							
	Mayorca	25.0	11.3							
	Huancarane	60.2	27.2							
Sector IV	Arellano Beyzan	25.7	10.7							
	Cora Beyzan	124.8	51.0	178.8	397.2	841	397	444	218	662
	El Muro	244.5	101.8							
	Alanoca	15.3	6.4	108.2	259.7	662	260	402	152	554
	Chacabuco (1)	215.9	88.1	88.1	215.9	554	216	338	128	466
	Chacabuco (2)	215.9	88.1							
	Dominguez	12.7	5.1	93.1	228.6	466	229	237	135	373
	Sascapa (1)	226.2	96.8	96.8	226.2	373	226	147	129	276
	Sascapa (2)	226.2	96.8	96.8	226.2	276	226	50	129	179
	Bravo Uno	28.9	12.1							
	Bravo Dos	17.4	7.2	19.3	46.3	179	46	133	27	160
Sector V	Valle Hermoso	121.1	52.5							
	Aica González	39.0	16.2	68.7	160.1	160	160	0	91	91
	M. Beovic	8.0	4.8							
	B'ba Pte.Chacall.	6.7	4.0							
	Ambrosio Flores	2.0	1.2	10.0	16.7	91	17	75	7	81
	Bellet	2.5	1.1							
	Beneficiencia	33.4	17.2							
	Santa Rosa	32.6	15.1	33.5	68.6	81	69	13	35	48
	Sub-Total	1,845.5	793.1	793.1	1,845.5					
	Total	2,214.4	956.2	956.2	2,214.4		Total Extraction		1,056	

Dec.

		Water Demand (l/sec)	Real Coms. (l/sec)	Consum.	Demand	(1) Intake/Canal (l/sec)	(2) Distribution (l/sec)	(3) Remaining (l/sec)	(4) Return (l/sec)	(5) (3)+(4) (l/sec)
Sector III	Kesler	1.3	0.6							
Right Bank	Pro-Chile	73.8	38.3							
	García	6.8	3.1							
	La Palma Uno	27.7	11.9							
	La Palma Dos	54.1	22.0	75.8	163.8	237	164	73	88	161
	Visconti	161.1	67.3	67.3	161.1	161	161	0	94	94
	Kesler Gil	81.5	36.8	36.8	81.5	94	81	12	45	57
	Sub-Total	406.4	179.9	179.9	406.4					
Left Bank	La Isla	33.3	13.7							
	Huanca	10.1	4.7							
	Linderos	41.6	19.3							
	Poconchile	142.2	70.5							
	Barranco Sta. Rosa	22.3	10.9							
	Mayorca	29.2	13.4							
	Huancarane	70.2	32.3							
Sector IV	Arellano Beyzan	28.8	12.1							
	Cora Beyzan	138.4	56.8	233.7	516.2	972	516	455	283	738
	El Muro	272.0	114.0							
	Alanoca	17.1	7.2	121.1	289.0	738	289	449	168	617
	Chacabuco (1)	238.4	97.5	97.5	238.4	617	238	378	141	519
	Chacabuco (2)	238.4	97.5							
	Dominguez	13.9	5.6	103.1	252.3	519	252	267	149	416
	Sascapa (1)	253.7	109.4	109.4	253.7	416	254	162	144	307
	Sascapa (2)	253.7	109.4	109.4	253.7	307	254	53	144	197
	Bravo Uno	32.2	13.5							
	Bravo Dos	19.3	8.1	21.6	51.5	197	52	146	30	176
Sector V	Valle Hermoso	133.1	57.7							
	Aica González	42.8	17.8	75.5	175.9	176	176	0	100	100
	M. Beovic	9.0	5.4							
	B'ba Pte.Chacall.	7.5	4.5							
	Ambrosio Flores	2.2	1.3	11.2	18.7	100	19	82	7	89
	Bellet	2.8	1.3							
	Beneficiencia	37.0	19.1							
	Santa Rosa	36.0	16.7	37.0	75.8	89	76	13	39	52
	Sub-Total	2,125.1	919.5	919.5	2,125.1					
	Total	2,531.5	1,099.5	1,099.5	2,531.5		Total Extraction		1,209	

Table B-II, 3.5 Monthly Average Groundwater Recharge Potential

<Potencialidad Medio Mensual de Recarga de Agua Subterránea>

(Case 1) : Water Right

(Unit: l/s)

	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining in River	Recharge
Jan	2,887	275	2,612	819	819	1,793	735
Feb	4,741	275	4,466	819	819	3,647	1,495
Mar	4,222	275	3,947	819	819	3,128	1,282
Apr	1,759	275	1,484	819	819	665	273
May	1,809	275	1,534	819	819	715	293
Jun	1,802	275	1,527	819	819	708	290
Jul	1,937	275	1,662	819	819	843	346
Aug	1,746	275	1,471	819	819	652	267
Sep	1,542	275	1,267	819	819	448	184
Oct	1,332	275	1,057	819	819	238	98
Nov	1,307	275	1,032	819	819	213	87
Dec	1,508	275	1,233	819	819	414	170
Ave.	2,216	275	1,941	819	819	1,122	460

(Case 2) : Water Demand

(Unit: l/s)

	Tocontasi	Consum. (Upstr.)	Intake Point	Required Extraction	Actual Extraction	Remaining in River	Recharge
Jan	2,887	448	2,439	433	433	2,006	822
Feb	4,741	446	4,295	431	431	3,864	1,584
Mar	4,222	393	3,829	1,212	1,212	2,617	1,073
Apr	1,759	193	1,566	878	878	688	282
May	1,809	150	1,660	709	709	951	390
Jun	1,802	118	1,684	583	583	1,101	451
Jul	1,937	114	1,823	156	156	1,667	683
Aug	1,746	128	1,618	189	189	1,429	586
Sep	1,542	164	1,378	859	859	519	213
Oct	1,332	201	1,132	927	927	205	84
Nov	1,307	236	1,071	1,056	1,056	15	6
Dec	1,508	407	1,101	1,209	1,101	0	0
Ave.	2,216	250	1,966	720	711	1,255	515

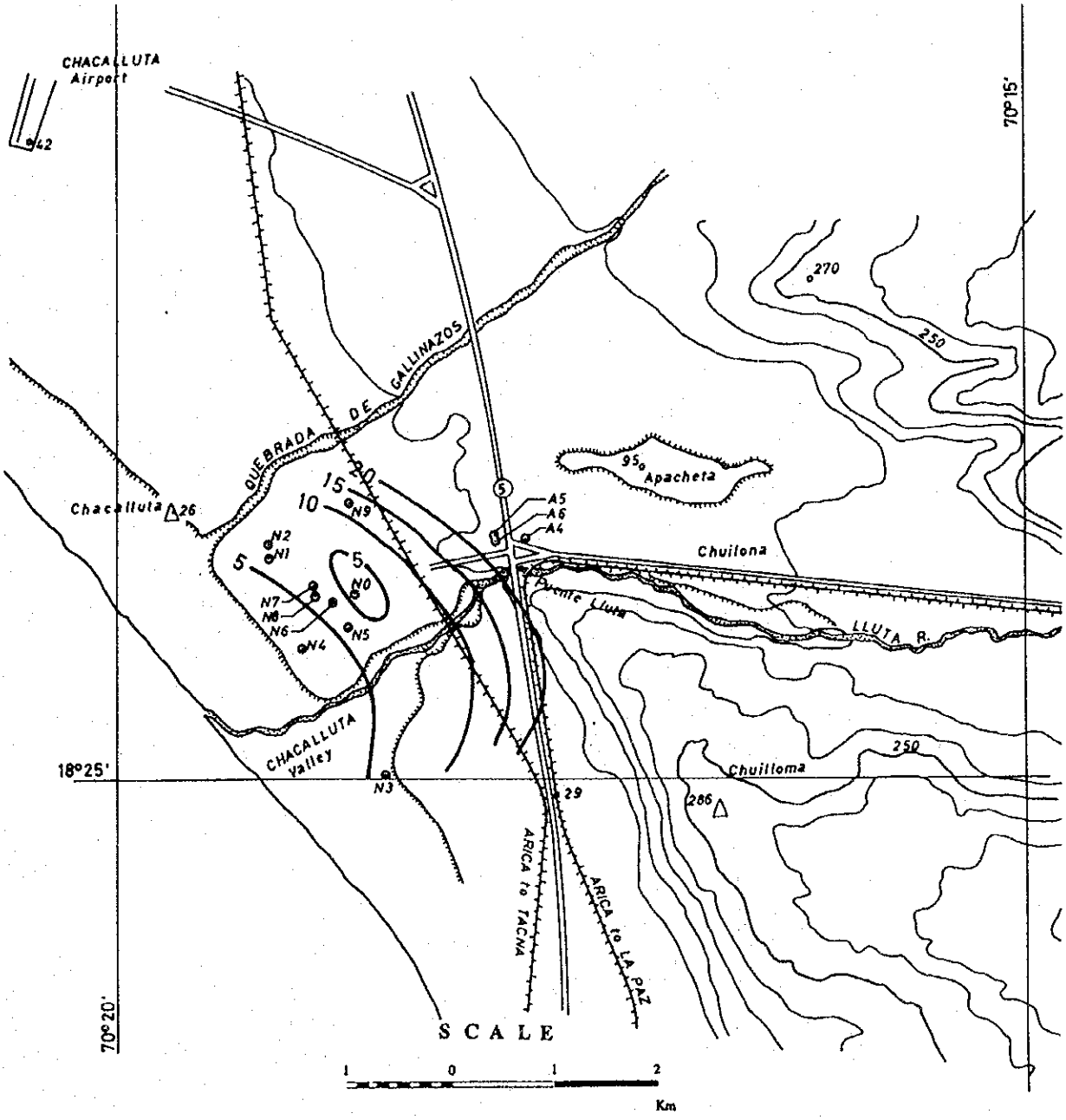

Fig. B-II, 3.1 Static Water Level of Shallow Aquifer

<Nivel Estático de Acuífero Poco Profundo>

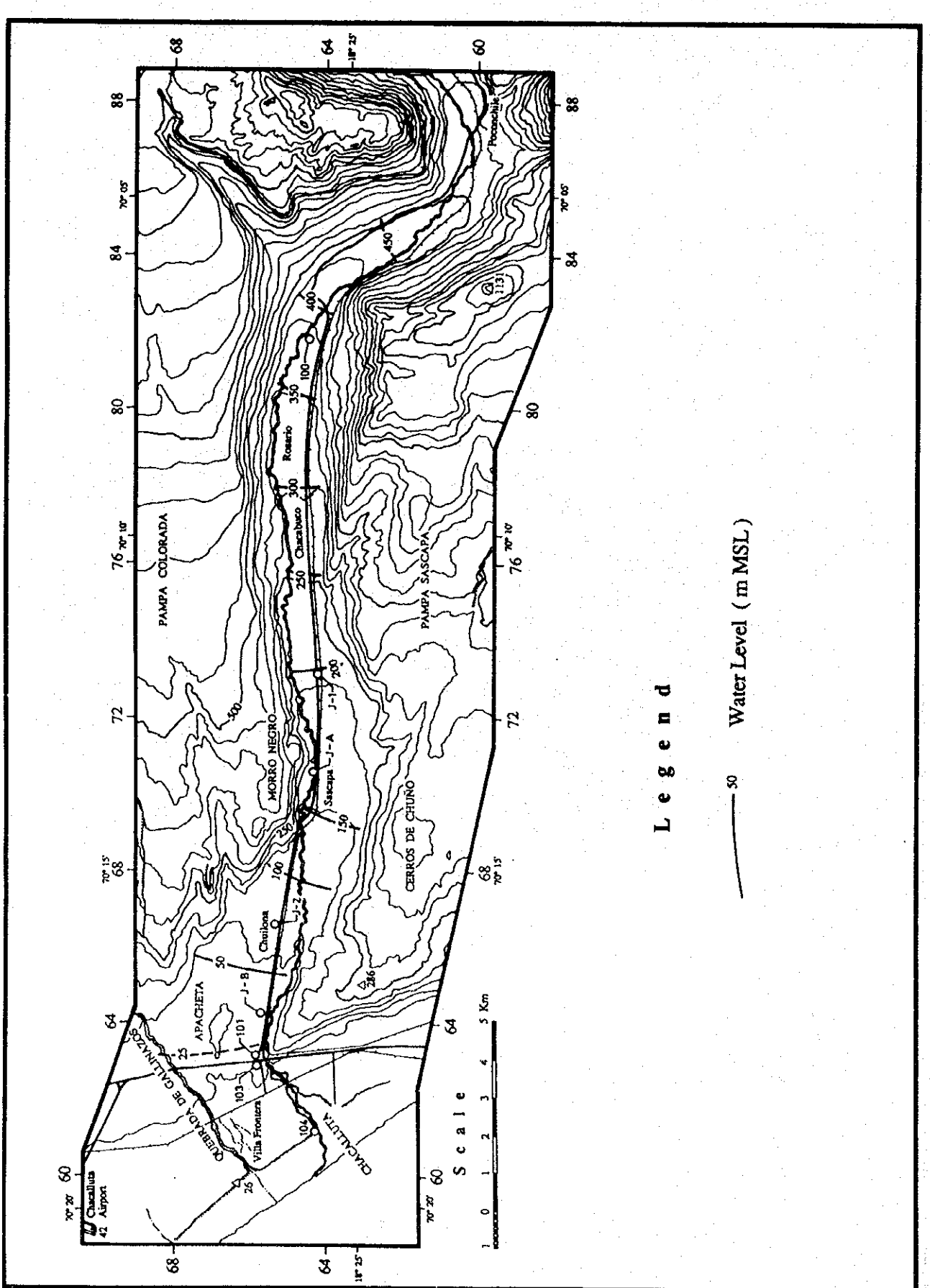

Fig. B-II, 3.2 Static Water Level of Deep Aquifer

<Nivel Estático de Acuífero Profundo>

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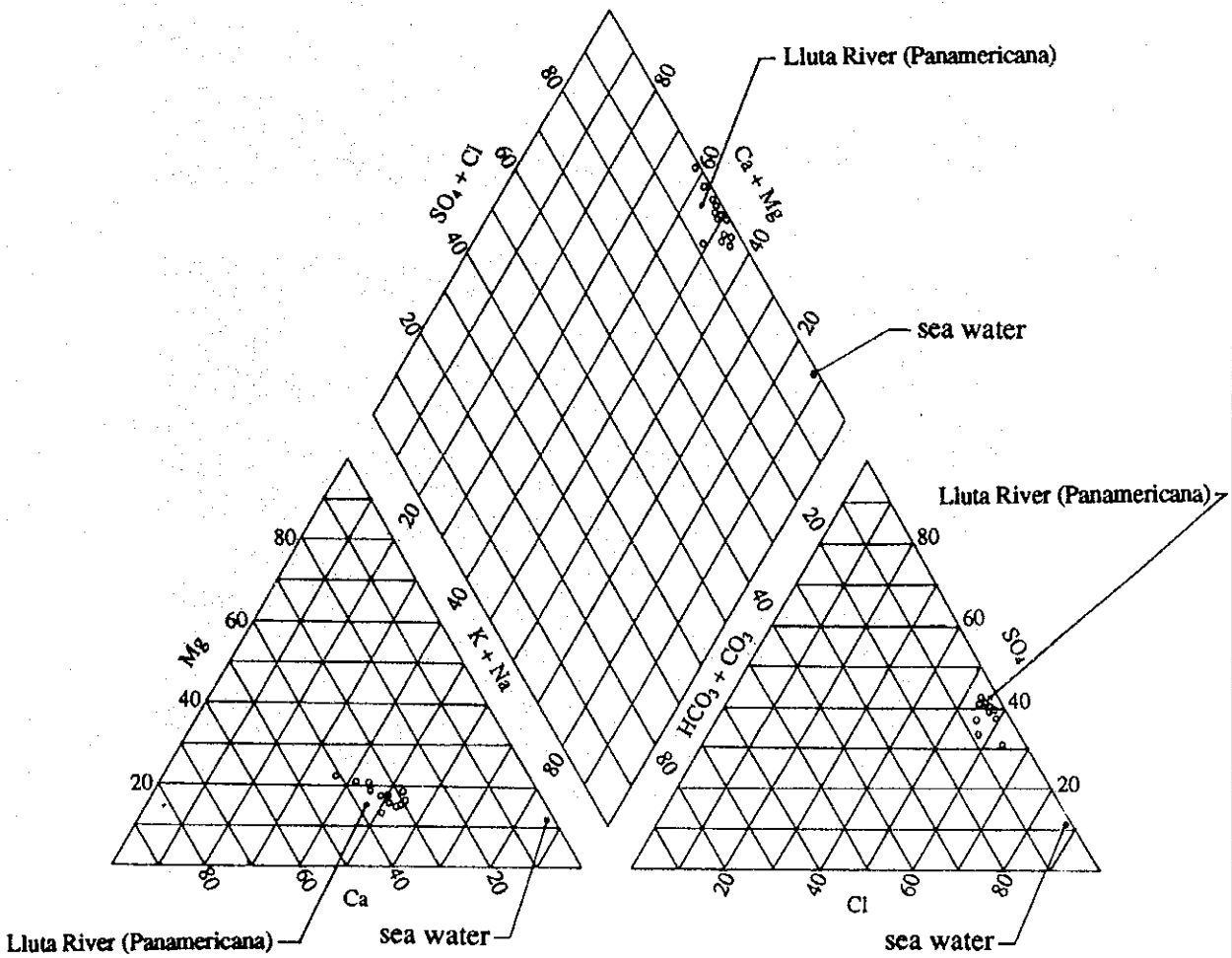
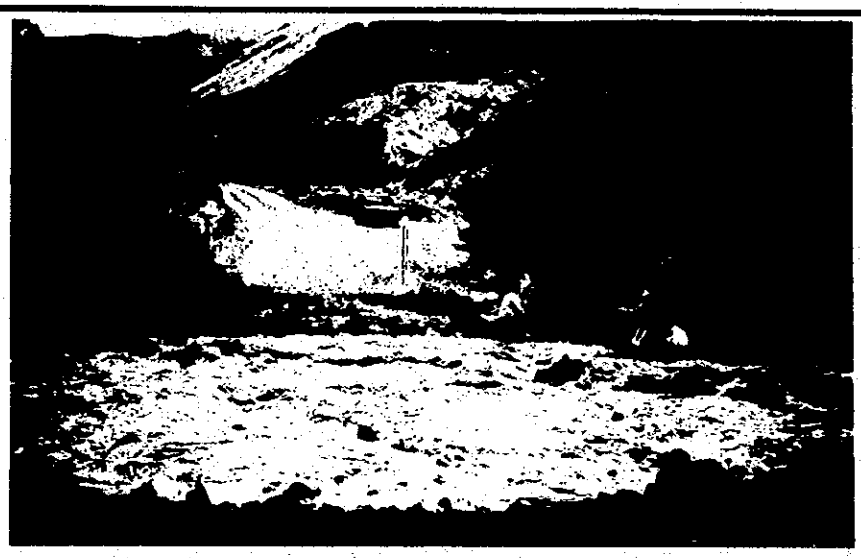
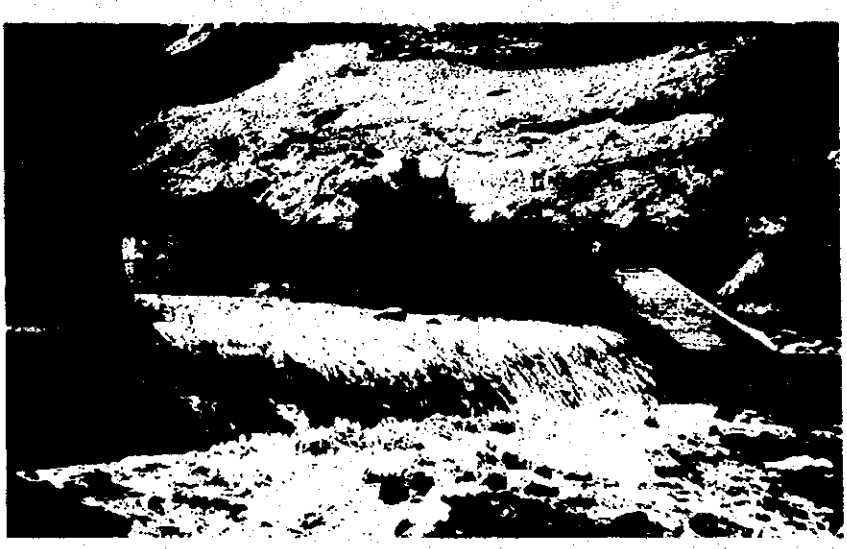


Fig. B-II, 3.3 Tri-linear Diagram of Major Iones

< Diagrama Tri-Lineal de Iones Mayores



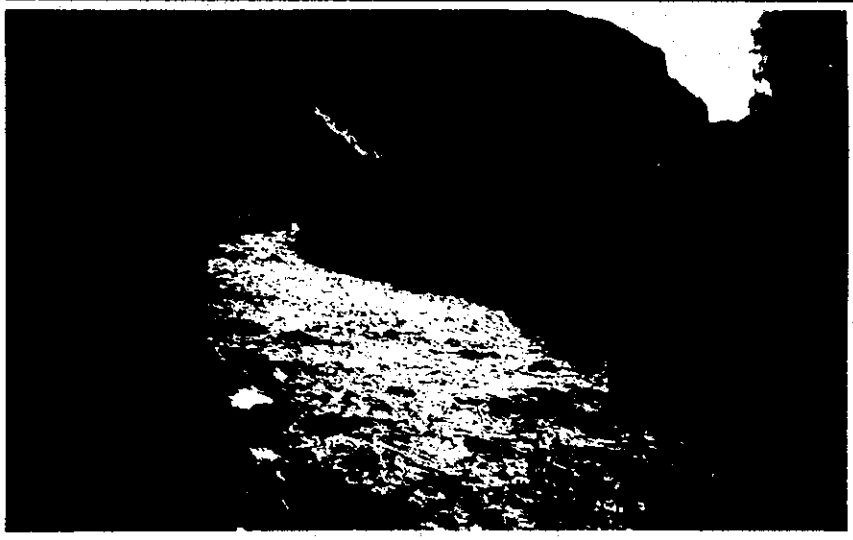
Near Casa Grande



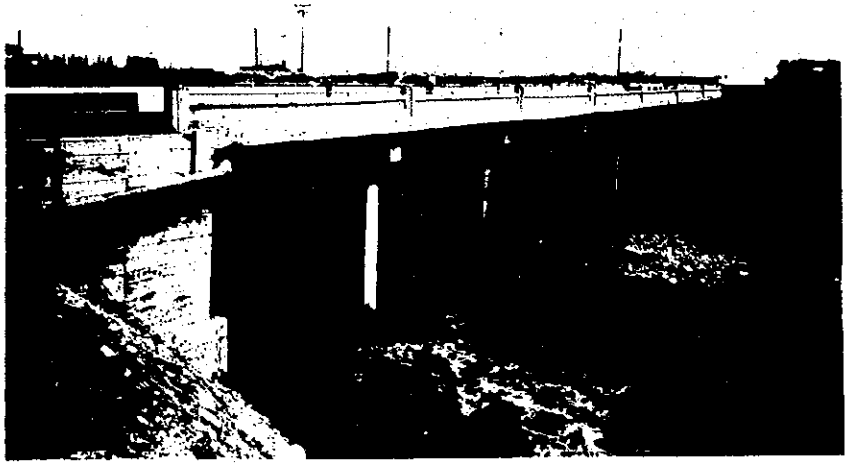
At the Azapa Intake

River Mouth of the San José River

Fig. B-II, 3.4 (1) Flood in San José River (24 Nov., 1994)
<Avenidas en RíoSan José(24 Nov., 1994)>



Near the Santa Rosa Bridge



At the Chacalluta Bridge

At the Chacalluta Bridge

Fig. B-II, 3.4 (2) Flood in Lluta River (24 Nov., 1994)

<Avenidas en Río Lluta (24 Nov., 1994)>

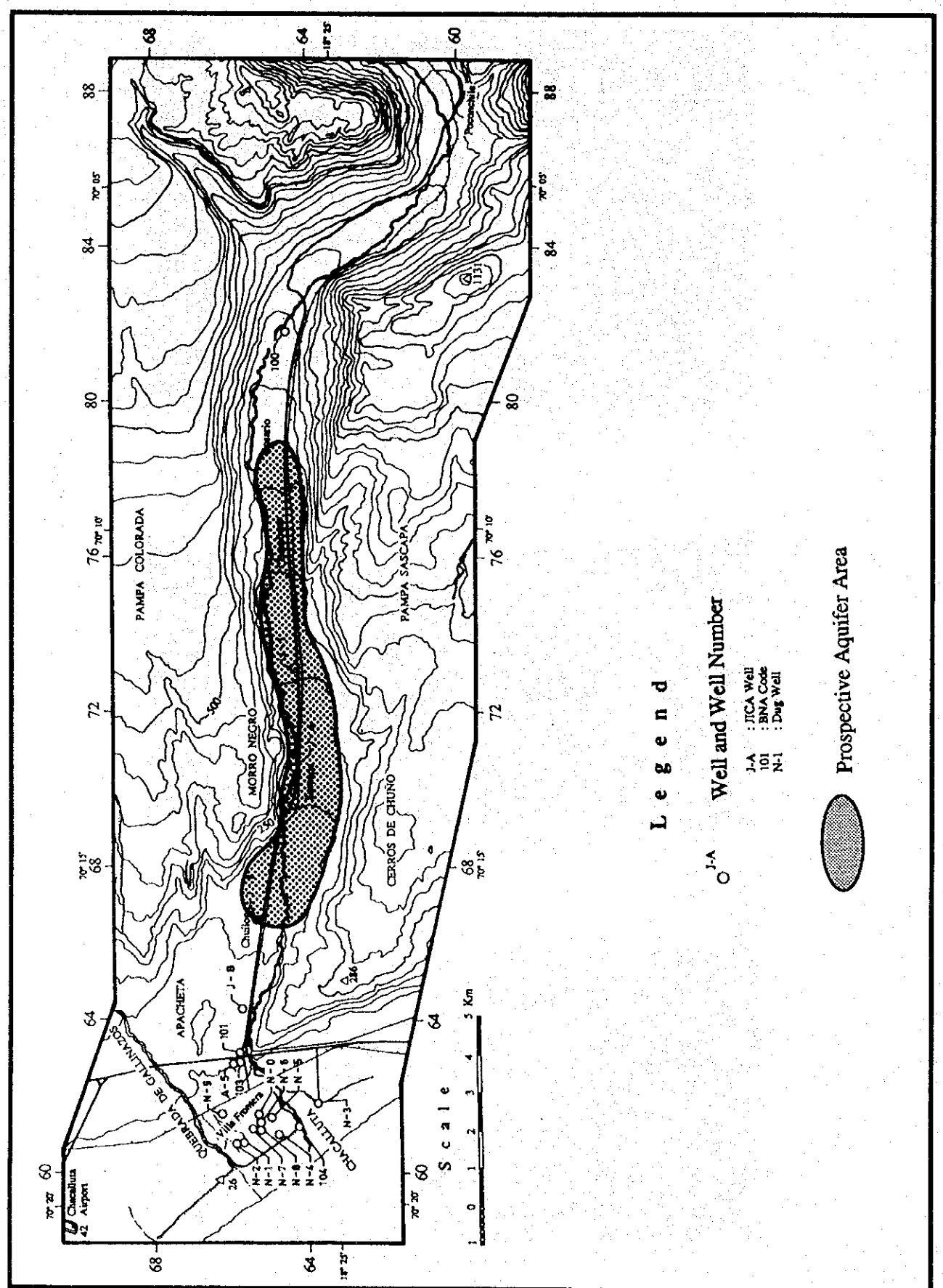
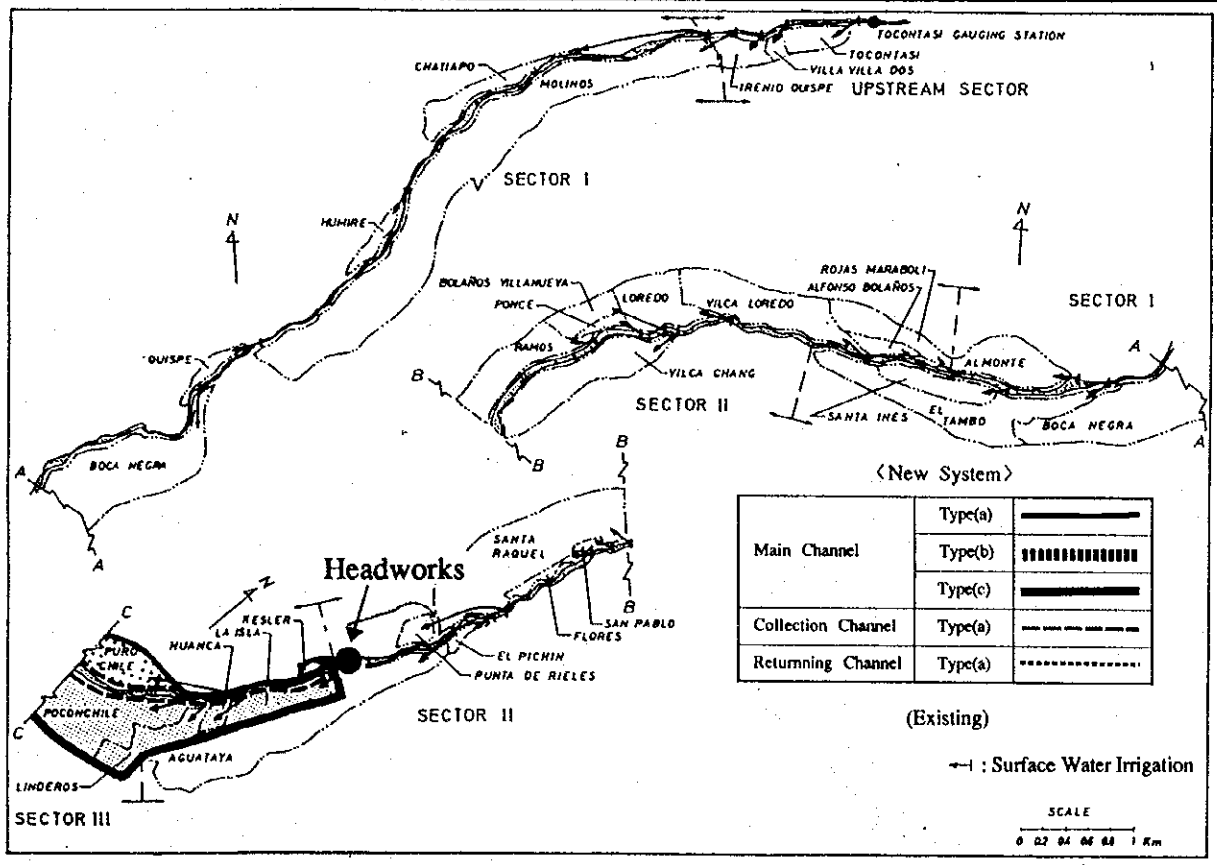


Fig. B-II, 3.5 Prospective Aquifer Area

< Area de Acuíferos Probable >



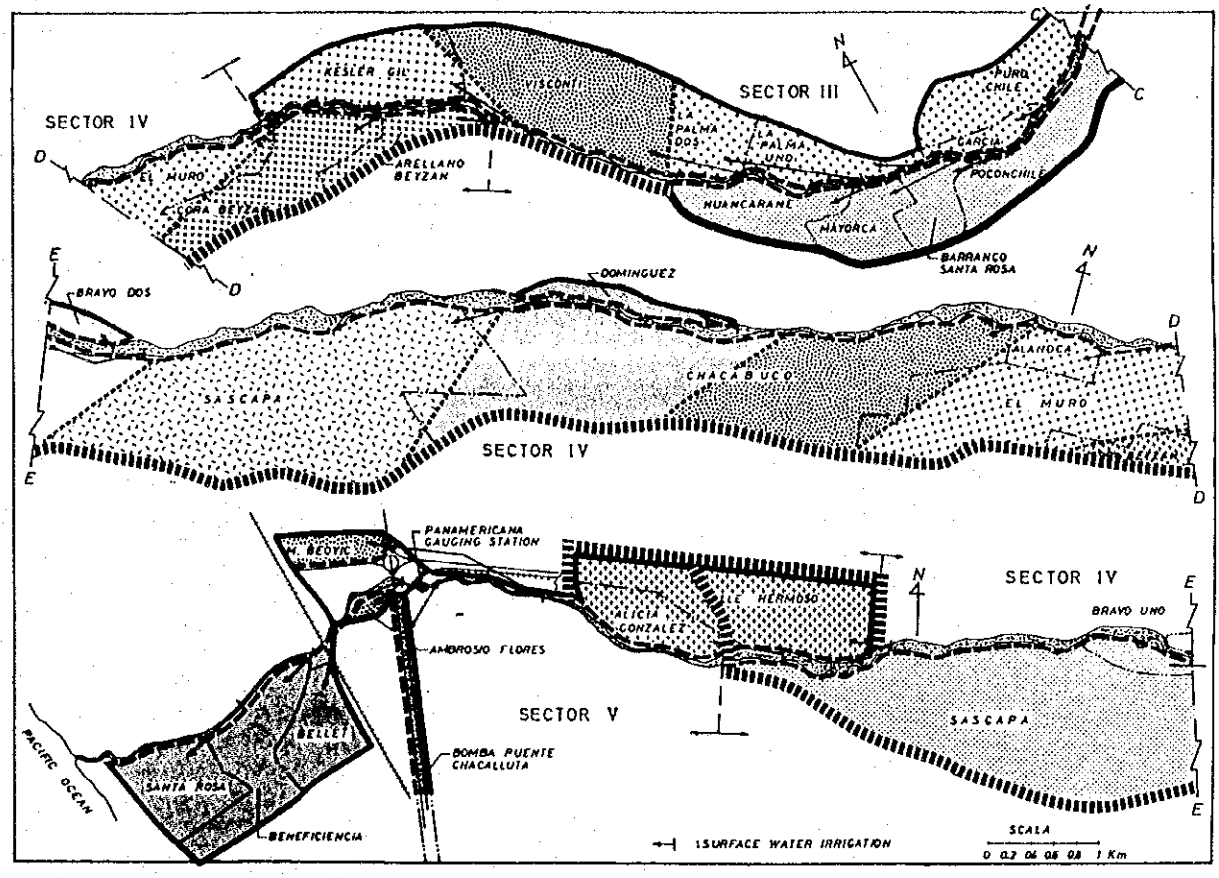


Fig. B-II, 3.6 Proposed New Irrigation System

<Nuevo Sistema de Irrigación Prospuesto>

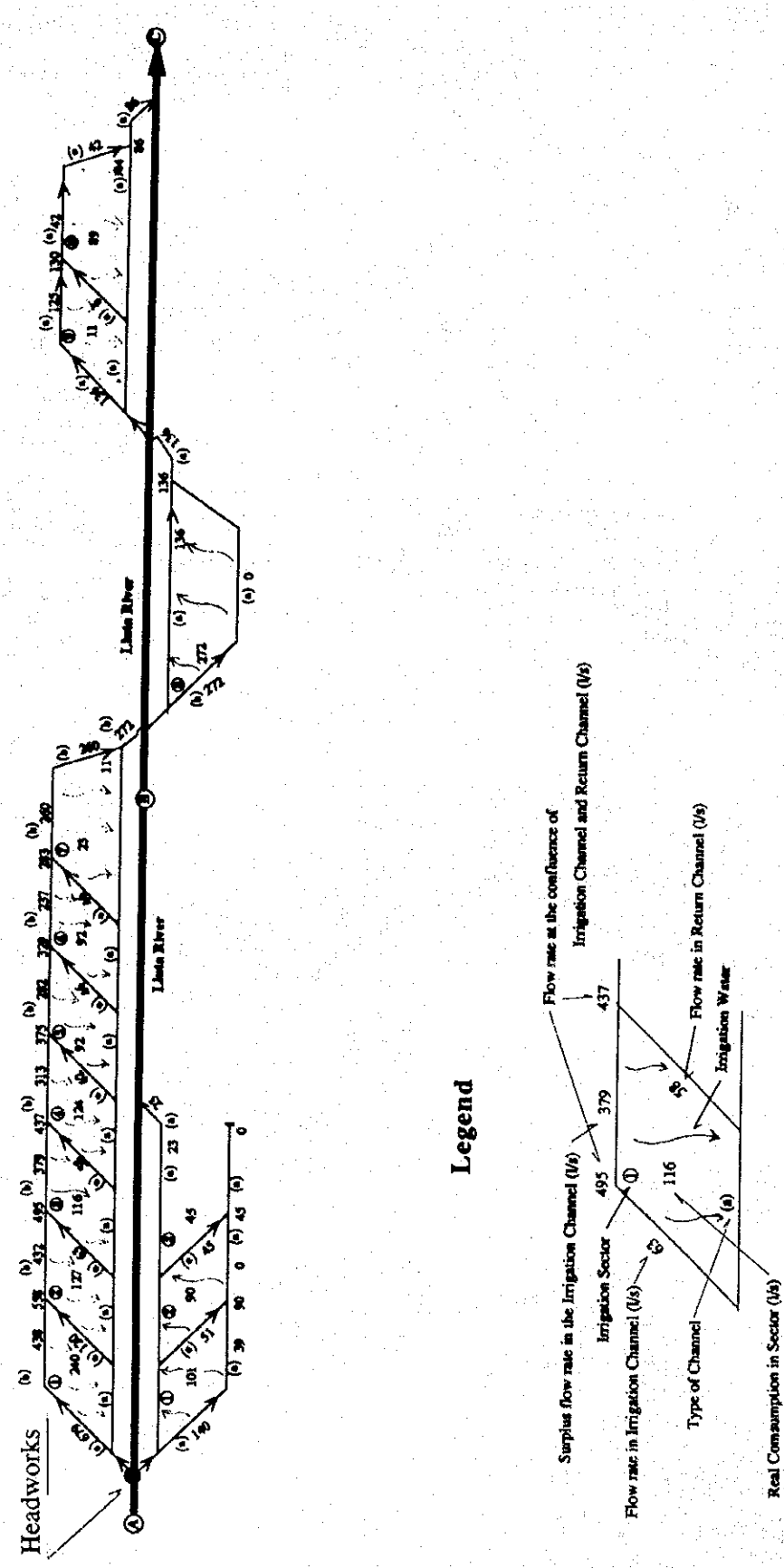
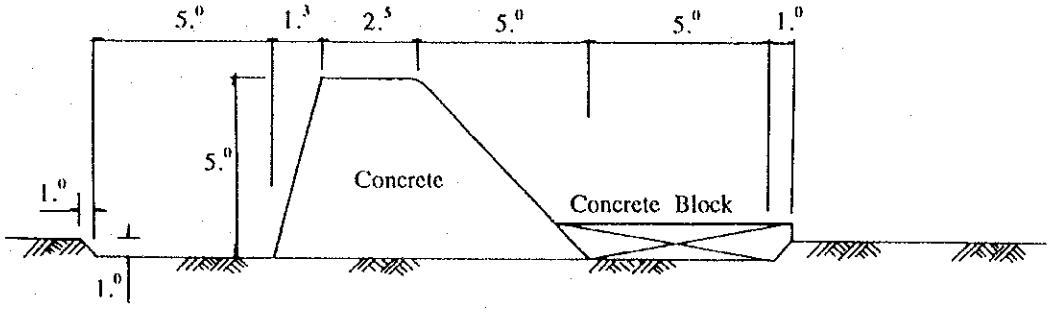
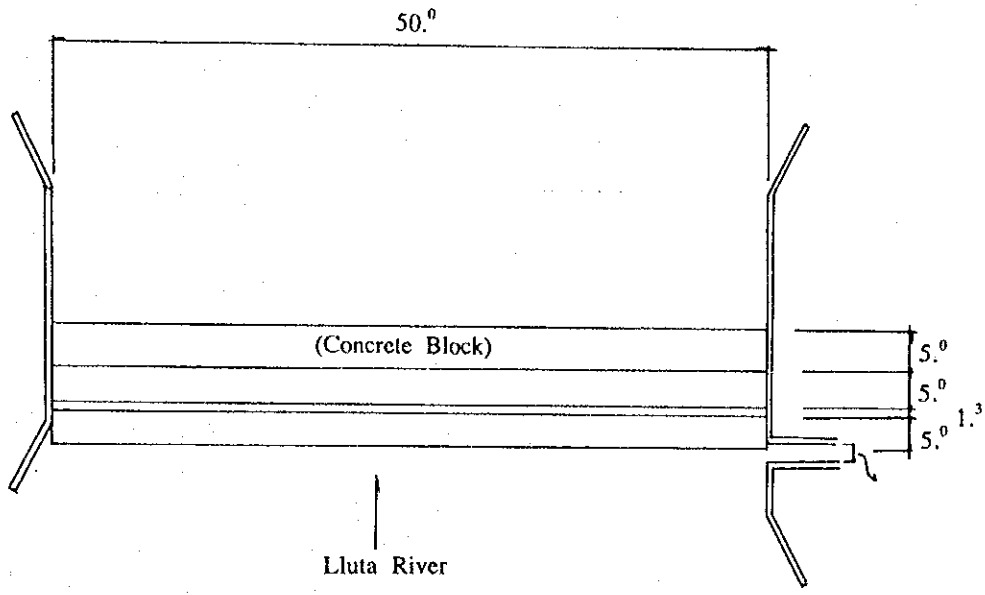


Fig. B-II, 3.7 Conception of Proposed New Irrigation System

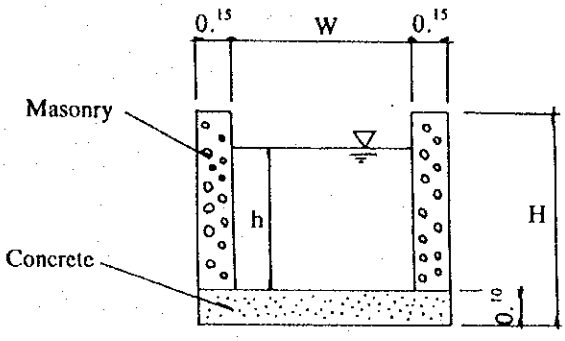
<Concepción del Nuevo Sistema de Irrigación Prospuesto>



Section of Headworks



Plan of Headworks



Type	h(cm)	W(cm)	H(cm)	Q(l/s)	V(m/s)
(a)	30	40	50	190	1.6
(b)	35	65	55	460	2.0
(c)	50	70	70	810	2.3

Section of Irrigation Channel

Fig. B-II, 3.8 Irrigation Facilities

<Facilidadses de Irrigación >

Chapter IV GROUNDWATER MONITORING PLAN

Aquifers in the Lower Lluta River Basin are distributed mainly from Rosario to Villa Frontera. Amount of groundwater extraction is negriliblly small because only two (2) deep wells and some dug wells are used for production.

Although present groundwater extraction is small, total extraction rate will reach to 425 l/sec after the Lower Lluta Groundwater Development will be cmpleted in 1999. Therefore, it is important to observe the water level and water quality of the Lower Lluta Valley.

The JICA Study Team drilled four (4) wells, two (2) test wells and two (2) observation wells. Automatic water level recorders are installed to the observation wells and the recording was already commenced in March, 1994. In addition to these, it is proposed to observe other wells as the periodical observation in the Azapa Valley and Pampa del Tamarugal by DGA.

Items of monitoring are water level and water quality. Proposed wells to be monitored are mentioned below. It is important to continue observation at the same wells and never to change monitoring wells. Items of water quality analysis are same as that of the Azapa Valley.

Total number of 12 wells are selected for the observation as follows. For location, refer Fig. B-II, 2.1.

Well No.	Well Name	Item to be observed	
		Water Level	Water Quality
100-2	Colonia J Fuenzalida	every month	once a year
J-1	JICA Well No. J-1	every month	once a year
J-A	JICA Well No. J-A	every month	once a year
J-2	JICA Well No. J-2	every month	once a year
J-B	JICA Well No. J-B	every month	once a year
101	Carcel de Arica	every month	once a year
103	Villa Frontera	every month	once a year
N-6	Villa Frontera	every month	once a year
N-4	Villa Frontera	every month	once a year
N-0	Villa Frontera	every month	once a year
N-9	Villa Frontera	every month	once a year
N-3	Playa las Machas	every month	once a year