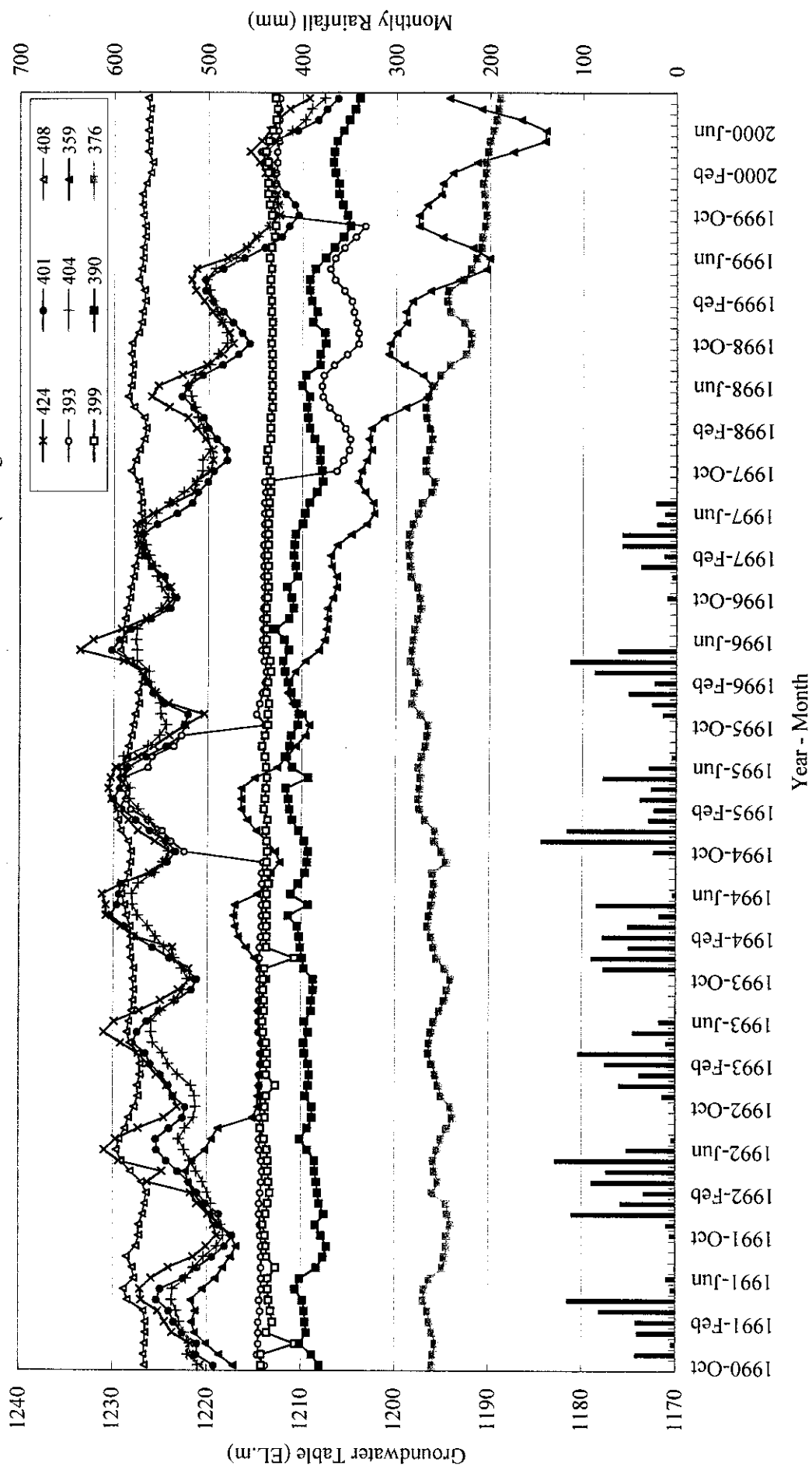
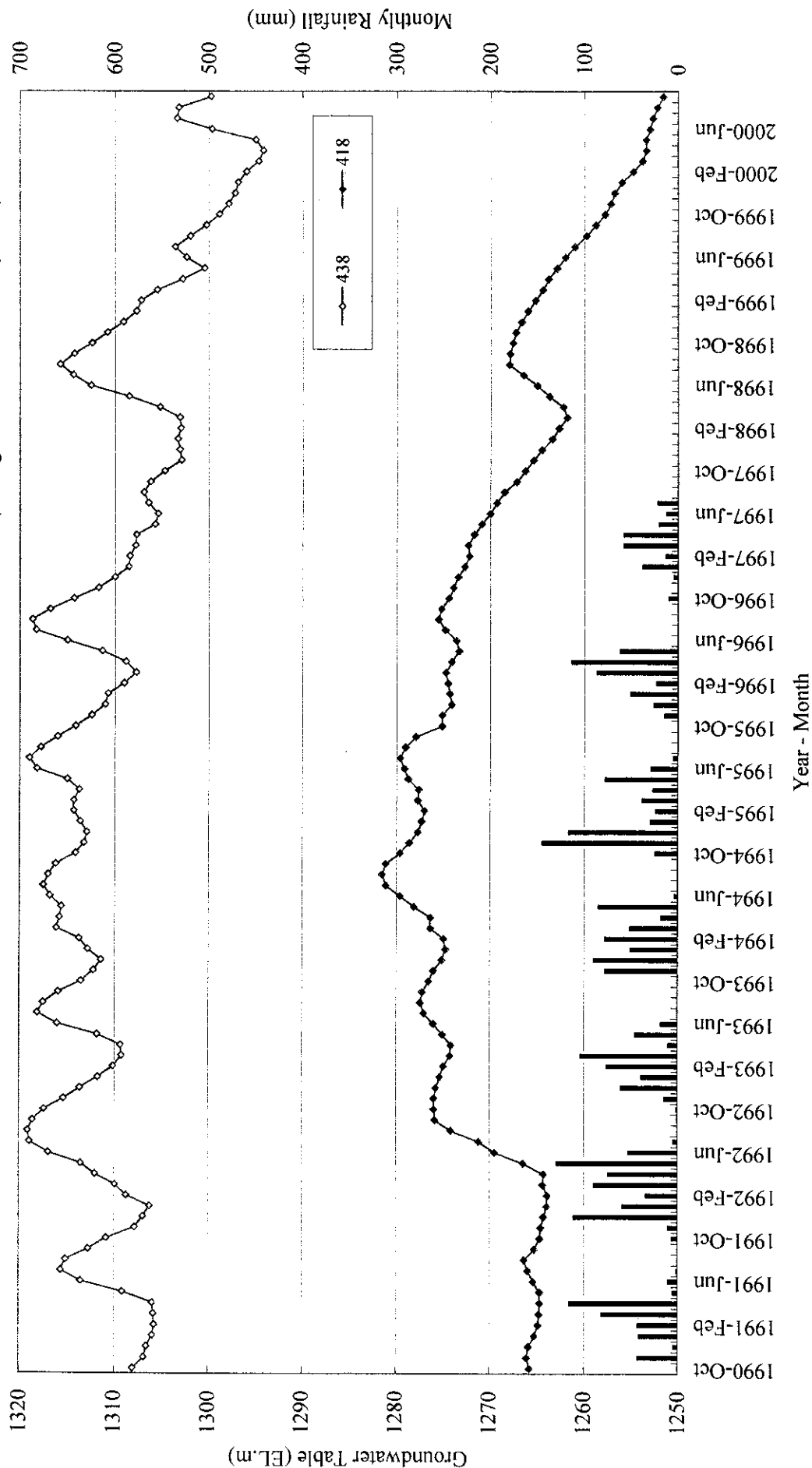


Figure 3.4.1. 41 Groundwater Table in TRWB's Observation Wells(Hashtgred 2/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells
(Oct.1990 - Sep.2000)

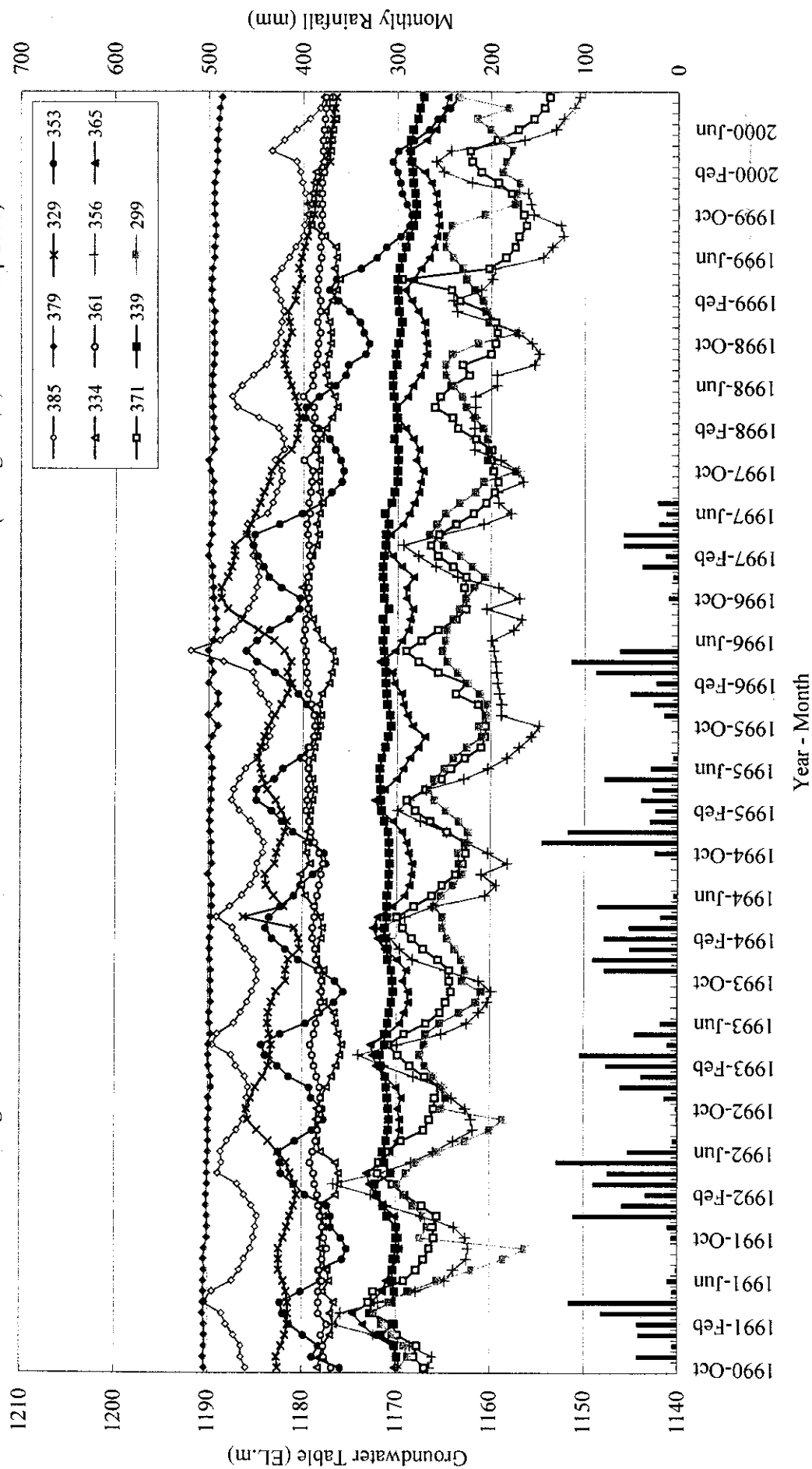
Figure 3.4.1. 42 Groundwater Table in TRWB's Observation Wells(Hashtgerd 1/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

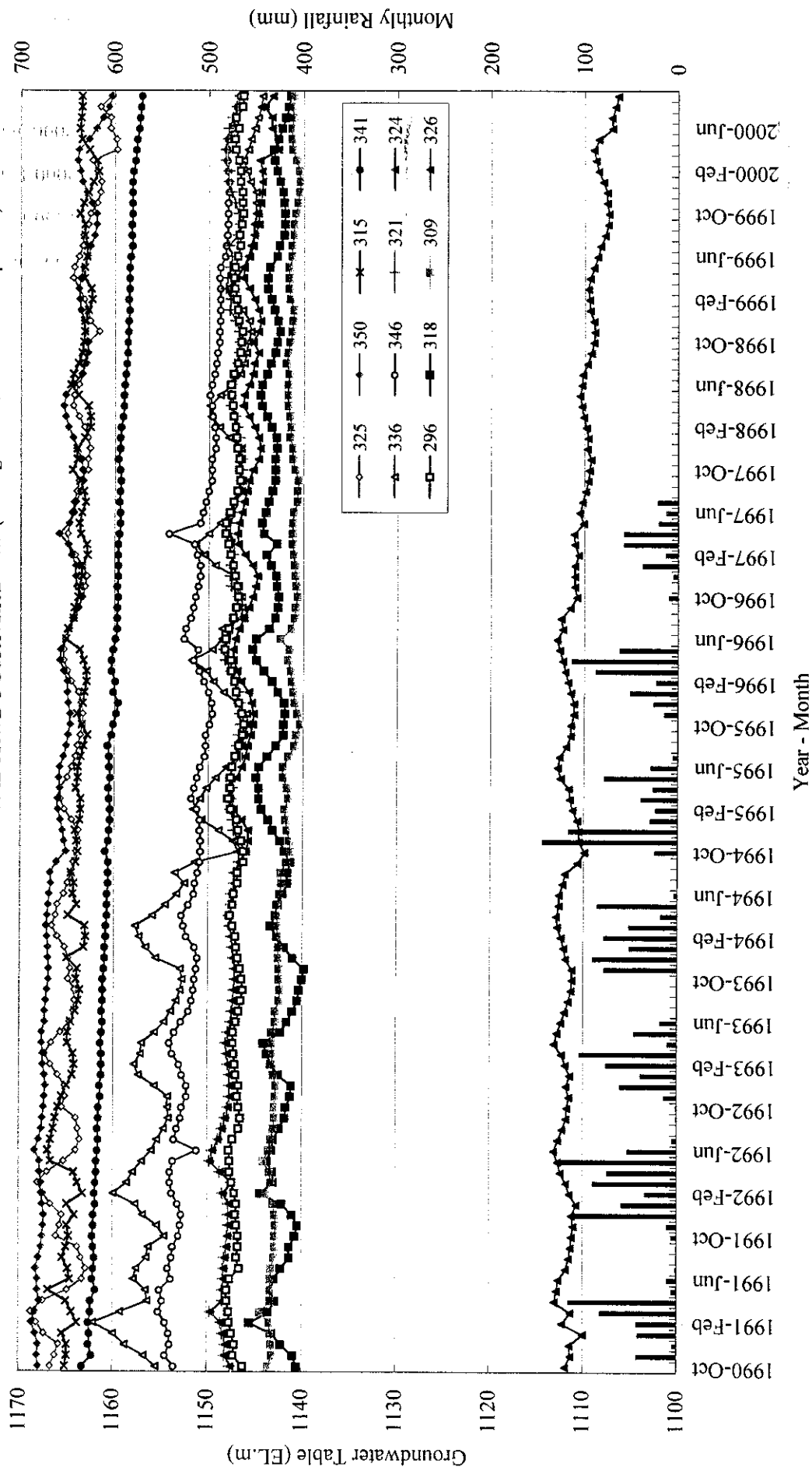
Figure 3.4.1. 43 Groundwater Table in TRWB's Observation Wells(Hashtgerd 3/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

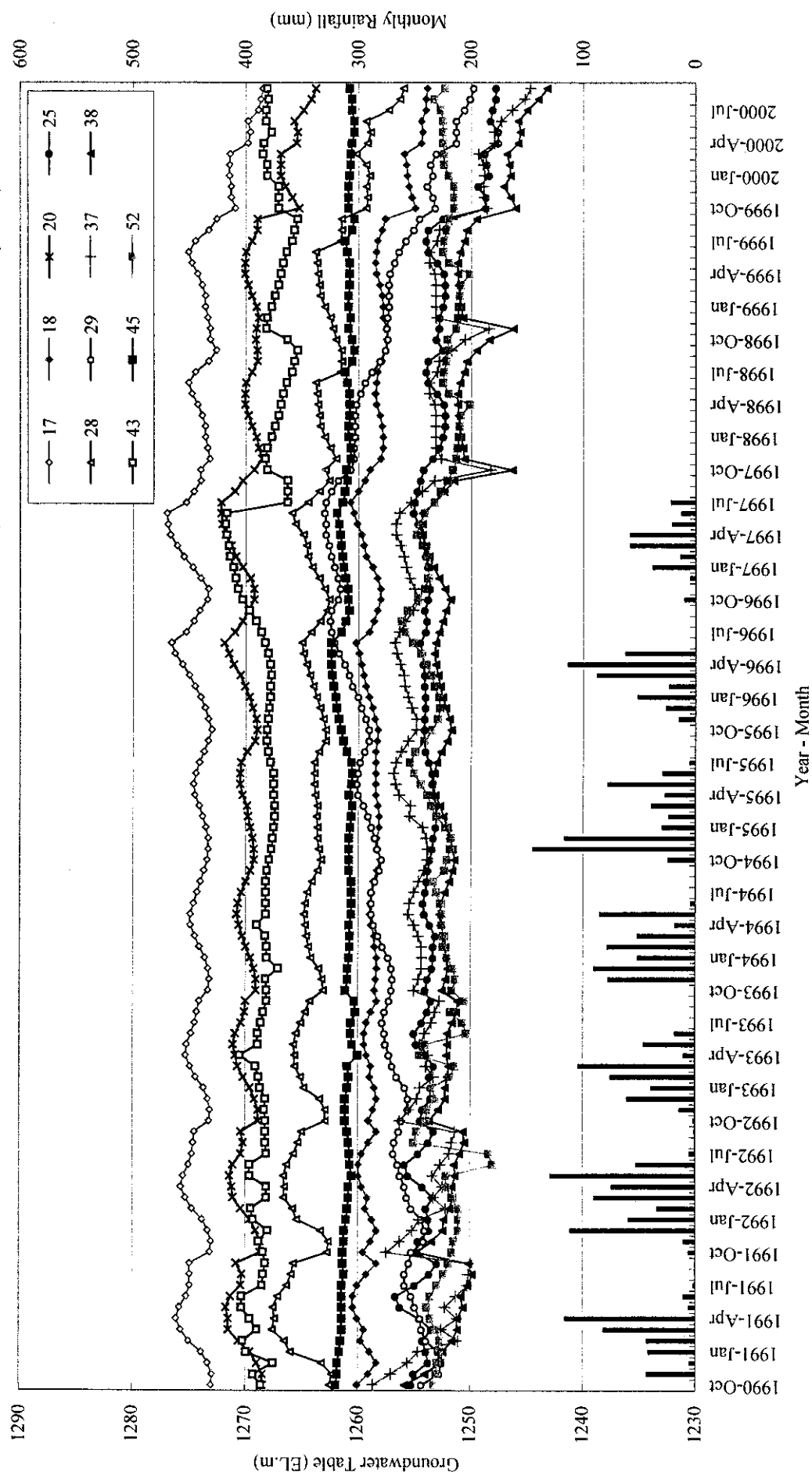
Figure 3.4.1. 44 Groundwater Table in TRWB's Observation Wells(Hashtigred 4/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

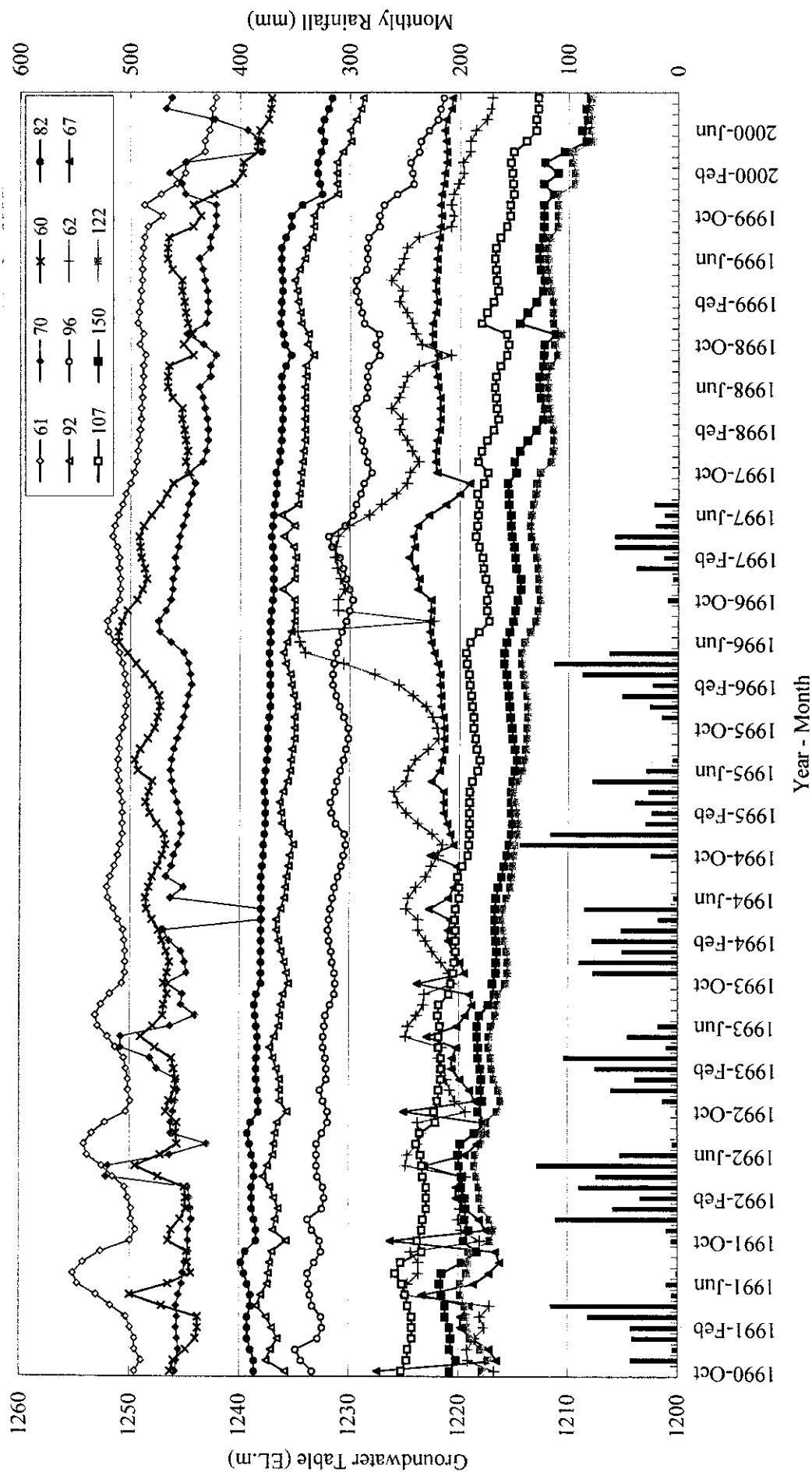
Figure 3.4.1. 45 Groundwater Table in TRWB's Observation Wells(Qazvin north 1/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

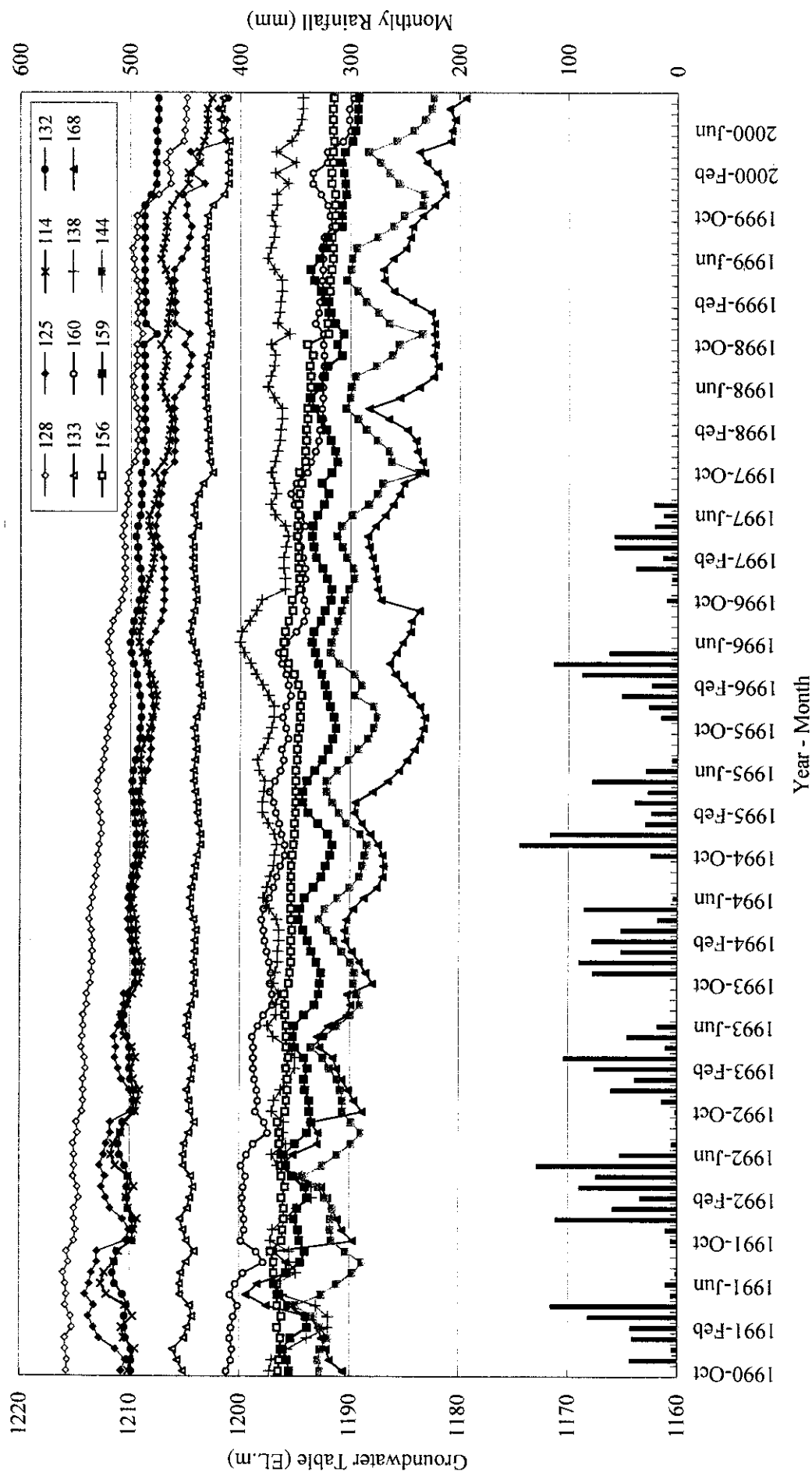
Figure 3.4.1. 46 Groundwater Table in TRWB's Observation Wells(Qazvin north 2/4, Oct.1990 - Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

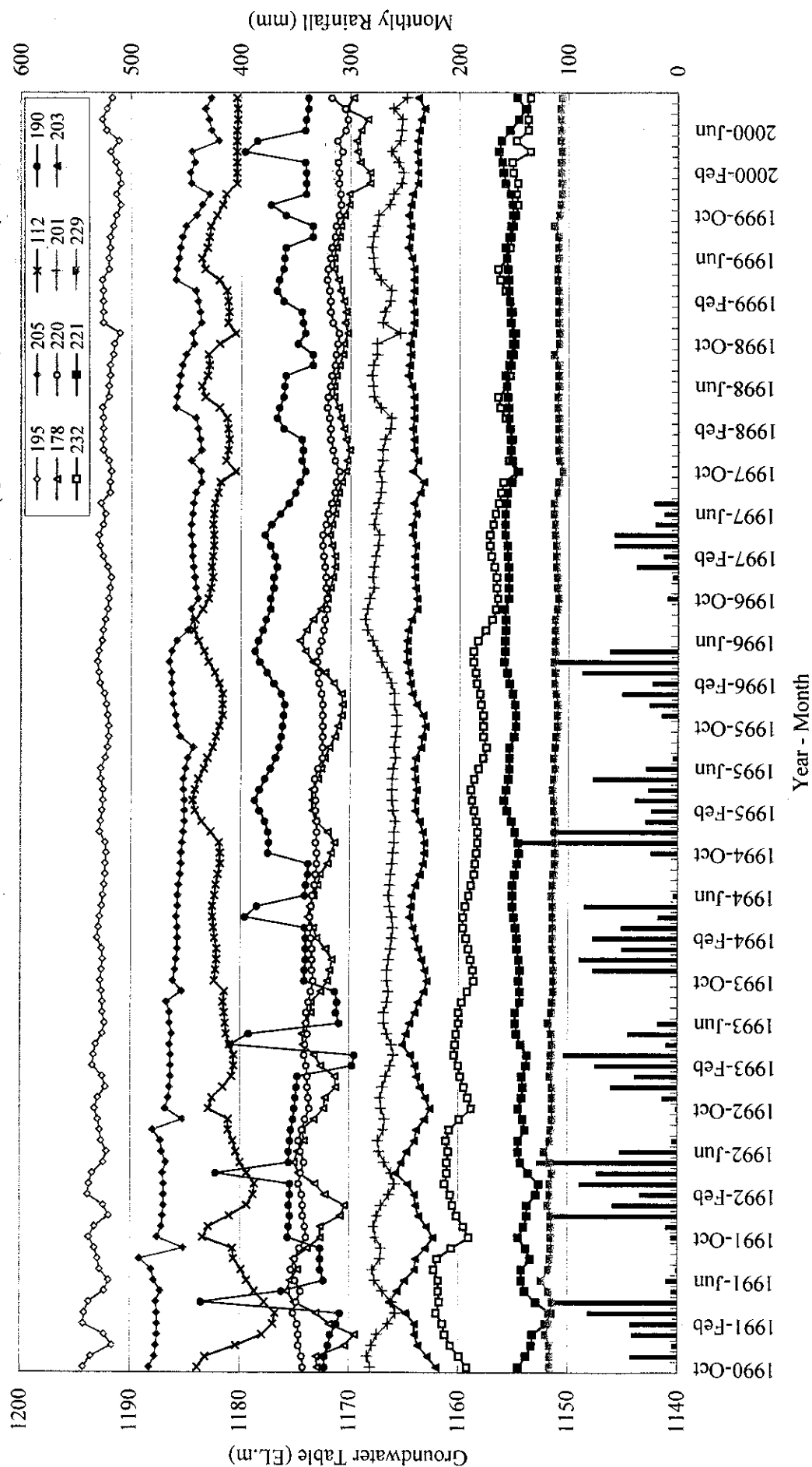
Figure 3.4.1. 47 Groundwater Table in TRWB's Observation Wells(Qazvin north 3/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

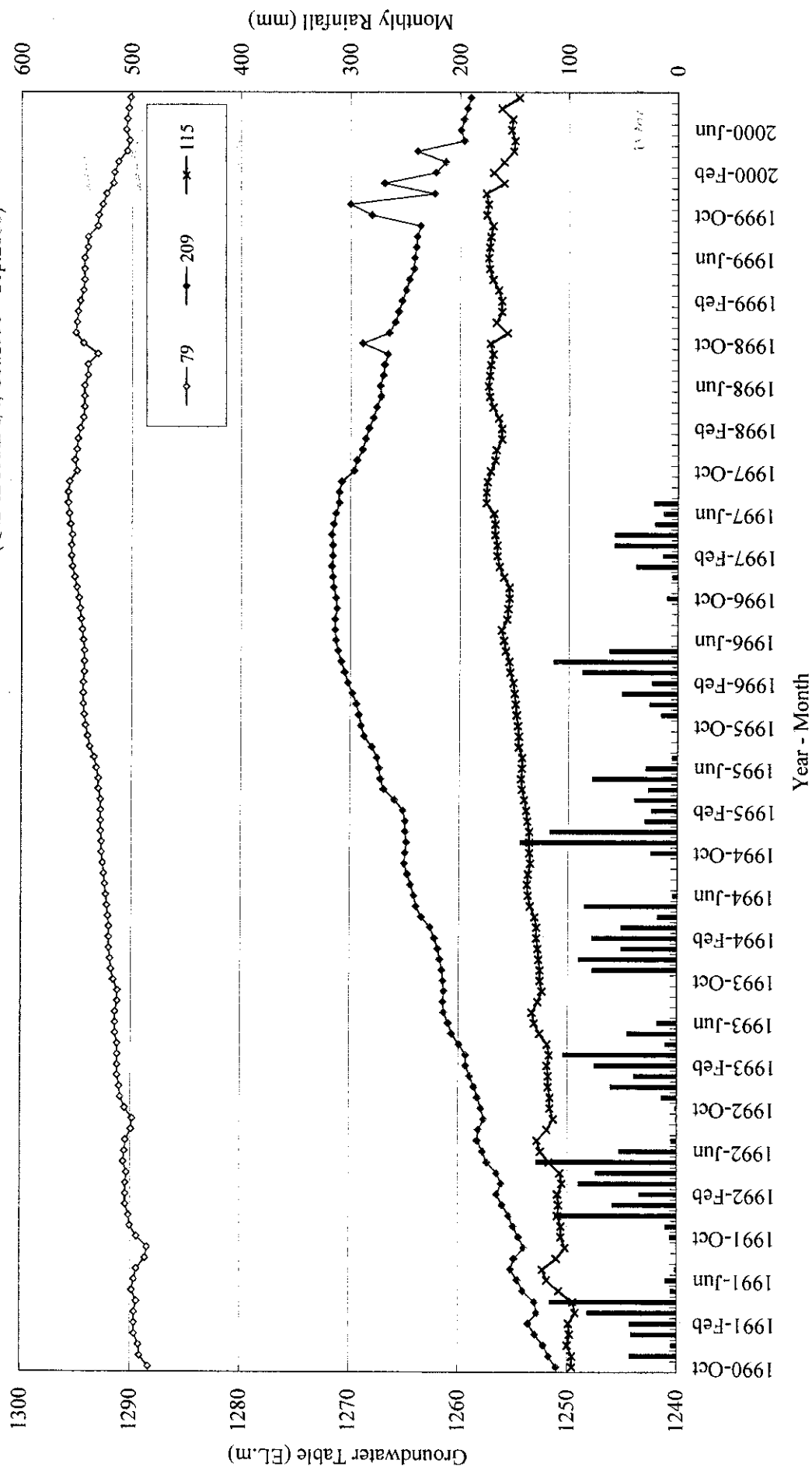
Figure 3.4.1. 48 Groundwater Table in TRWB's Observation Wells(Qazvin north 4/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

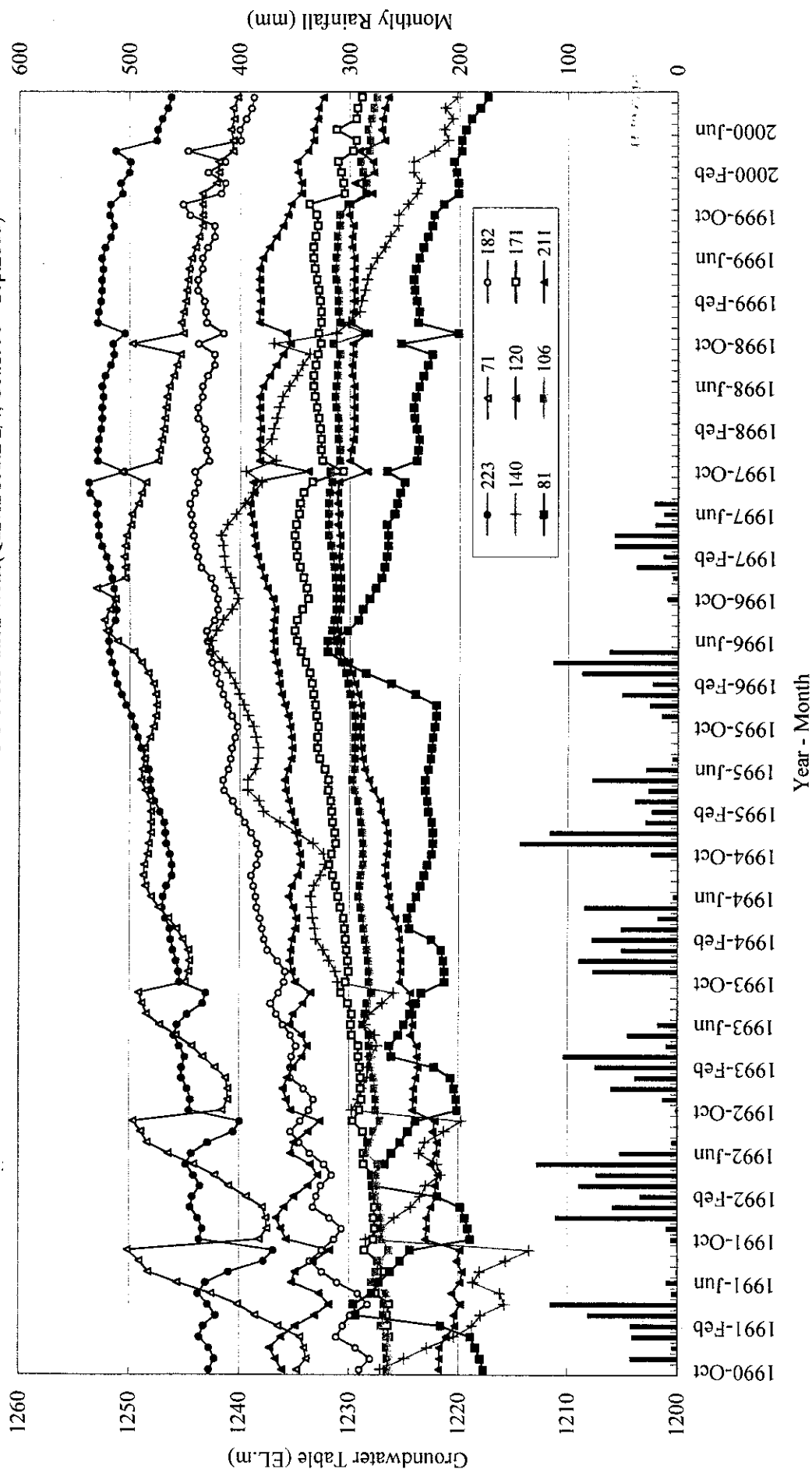
Figure 3.4.1. 49 Groundwater Table in TRWB's Observation Wells(Qazvin south 1/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

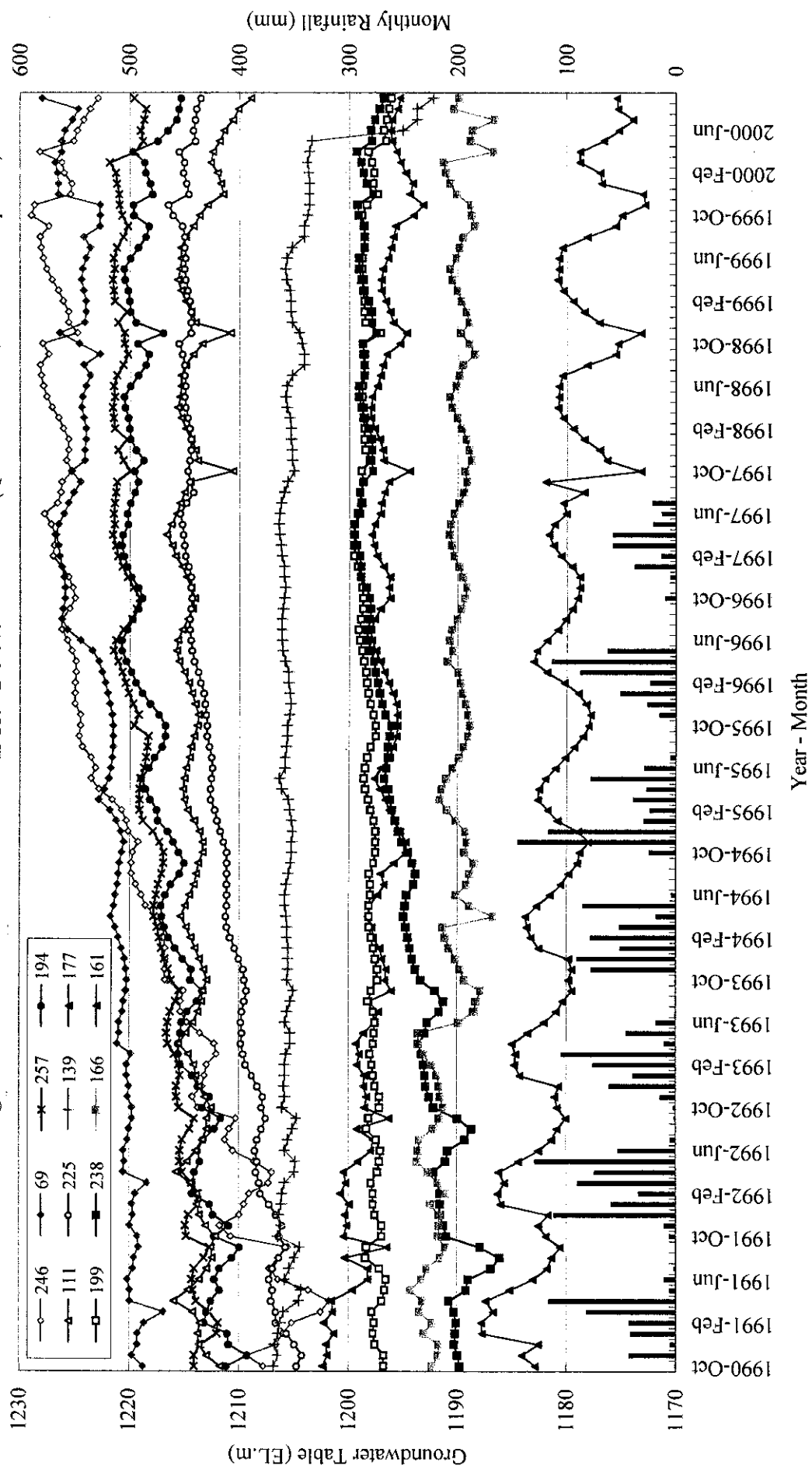
Figure 3.4.1. 50 Groundwater Table in TRWB's Observation Wells(Qazvin south 2/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

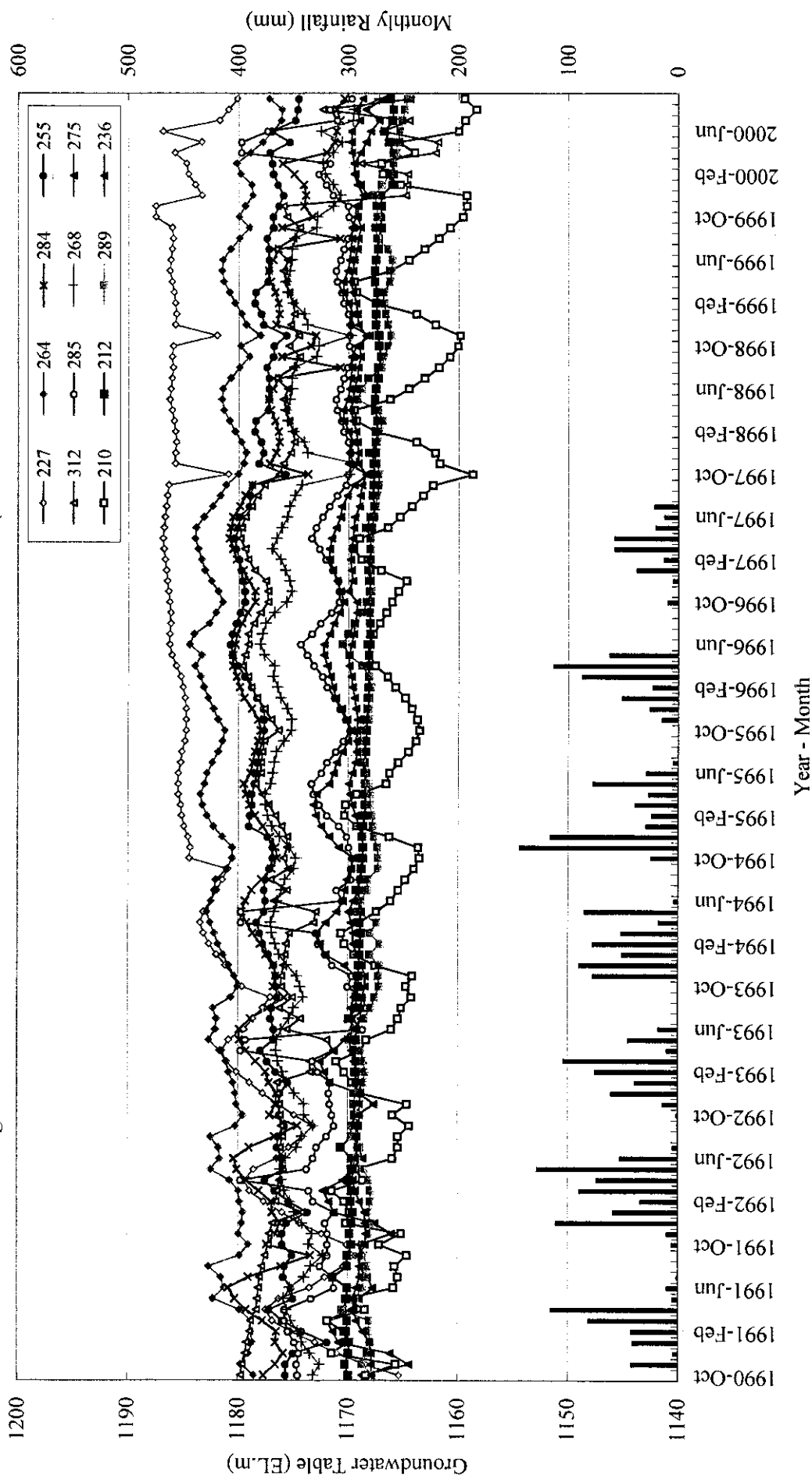
Figure 3.4.1. 51 Groundwater Table in TRWB's Observation Wells(Qazvin south 3/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 - Sep.2000)

Figure 3.4.1. 52 Groundwater Table in TRWB's Observation Wells(Qazvin south 4/4, Oct.1990 – Sep.2000)



Groundwater tables in TRWB's observation wells

(Oct.1990 – Sep.2000)

● Qanats: symbol size is indicated in the proportional scale to discharge rate ranging 0.01 to 9MCM/year.

● Springs: symbol size is indicated in the proportional scale to discharge rate ranging 20 to 80 l/min.

3.80

CHAPTER 4 PROPOSED WATER DEMAND

4.1	Proposed Domestic and Industrial Water Demand	4.1
4.2	Proposed Irrigation Water Demand	4.10

4.1 Proposed Domestic and Industrial Water Demand

(1) Projected Population

Projected Population of the capital area in the Master Plan has been estimated under discussion among many governmental organizations and data concerned such as the Plan and Budget Organization, Provinces of Tehran and Qazvin, each city in the provinces, statistical center office of Iran taking into account the future urban and rural planning, expansion of industrial areas, national policy to allow immigrant from rural to urban area. Jamab Consultant has well prepared the projected population toward the year of 2021 settling the opinion of many agencies and its result is as shown Table 4.1.1. New cities are assumed to be established in the Region of Tehran, Karaj, Hashtgerd and Qazvin and their population also is projected. This projected population is the basis to estimate the water demand in the Master plan and also in the JICA Study.

(2) Per Capita Water Demand (lcd)

The per capita water demand has been estimated carefully by Jamab Consultant in the Master Plan under discussion with T.R.W.B and the water boards in each city managing the water supply. The estimation result also is summarized in Table 4.1.1.

The per capita water demand in Tehran city and some cities in the region of Theran, Karaj and Qazvin is estimated to be decreased from 1996 to 2021 taking into account the minimization of the water supply losses which is about 30 to 35% at present.

(3) Projection Sample in the Master Plan

Samples in the Master Plan to estimate the projected population per capita water demand and total water demand in each urban and rural area are shown in Tables 4.1.2 to 4.1.8 which include major urban area in the capital area.

4.1.1 Population, Domestic, Industrial Water Demand

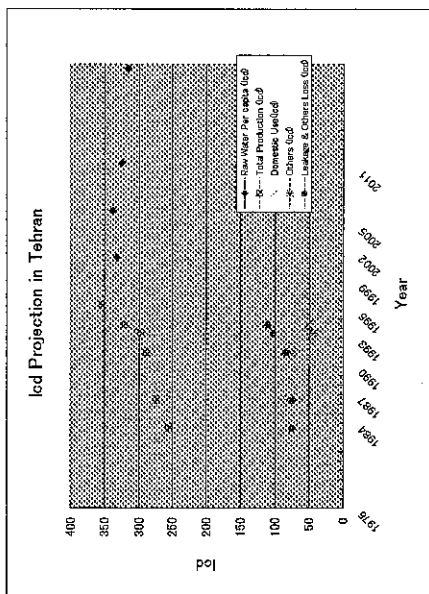
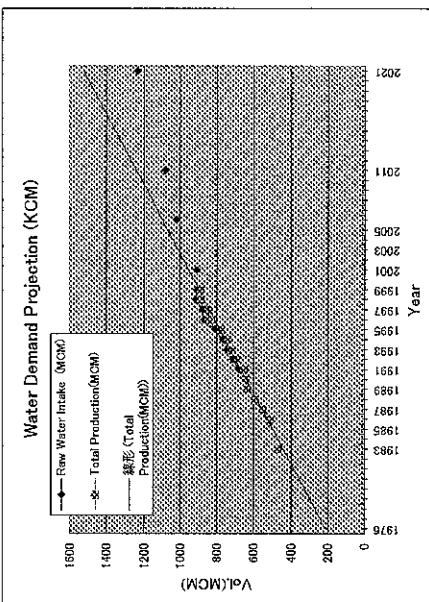
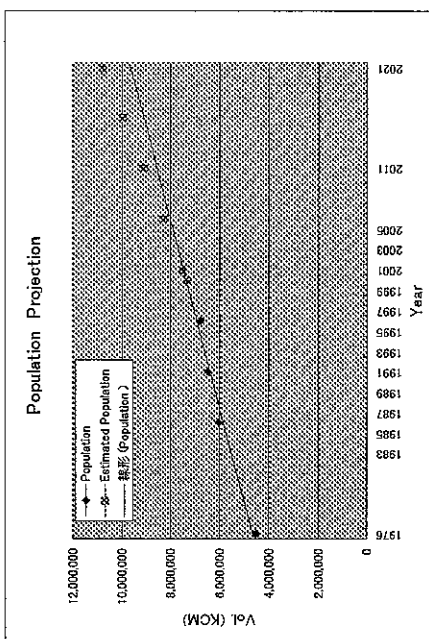
Table 4.1.1 Domestic Water Consumption in 1996 and Future

Water Demand	Population (10 ³)					Water Consumption (MCM)					Per Capita Demand (led)				
	1996	2001	2006	2011	2021	1996	2001	2006	2011	2021	1996	2001	2006	2011	2021
1. Tehran City															
Total	6,758.8	7,492.3	8,286.7	9,137.1	10,725.3	870.0	907.9	1,019.3	1,080.6	1,233.1	353	332	337	324	315
2. Tehran Area															
(1) Urban Area															
Eslam Shahr	265.4	299.1	338.6	380.8	464.6	28.2	31.3	35.2	38.9	46.5	291	287	285	280	274
Gharchak	142.7	159.3	179.3	200.6	242.9	14.9	16.3	18.2	20.1	24.3	286	280	278	275	274
New Cities	0.0	301.7	346.7	400.2	480.6	0.0	27.2	30.4	33.9	37.5		247	240	232	214
Sub-total	408.1	760.1	864.6	981.6	1,188.1	43.1	74.8	83.8	92.9	108.3	289	270	266	259	250
(2) Rural Area	312.9	251.9	226.9	202.5	231.7	21.4	15.3	13.8	12.3	14.0	187	166	166	166	166
Total	721.0	1,012.0	1,091.5	1,184.1	1,419.8	64.5	90.1	97.6	105.2	122.3	245	244	245	243	236
3. Karaj															
(1) Qods															
Robat Karim	138.3	157.3	179.1	202.5	248.9	14.1	16.0	18.1	20.4	24.9	280	279	277	276	274
Hassan Abad	36.5	41.1	47.6	54.6	68.5	3.6	4.1	4.7	5.5	6.9	270	272	273	274	274
Akbarabad	11.2	15.3	19.5	24.0	32.9	1.1	1.5	1.9	2.4	3.3	259	263	265	270	274
Shahrivar	85.1	105.7	129.1	155.2	210.4	8.3	10.4	12.7	15.4	21.0	268	269	270	272	274
Karaj (Karaj Bozor)	40.1	46.2	53.2	60.7	75.6	4.0	4.6	5.3	6.1	7.6	271	272	273	274	274
Mahdasht	941.0	1,045.9	1,173.0	1,308.9	1,578.8	92.0	102.7	115.6	129.9	157.9	268	269	270	272	274
Malard	29.0	32.1	35.6	39.4	46.9	3.2	3.5	3.8	4.1	4.7	300	295	290	285	274
New Cities	88.1	106.7	128.1	152.3	210.8	8.6	10.5	12.6	15.1	20.2	268	269	270	272	262
Sub-total	1,369.3	1,846.9	2,111.8	2,397.8	3,012.0	134.9	180.0	205.1	232.8	288.6	270	267	266	266	262
(2) Rural Area	312.9	251.8	227.0	202.5	231.6	21.4	15.3	13.8	12.3	14.0	187	166	166	166	166
Total	1,682.2	2,098.7	2,338.8	2,600.3	3,243.6	156.3	195.3	218.9	245.1	302.6	255	255	256	258	256
4. Hashgerd Area															
(1) Ilashtgerd															
Nazarabad	32.8	38.0	43.8	50.1	62.5	2.9	3.5	4.1	4.8	6.3	245	250	255	262	274
New Hashtgerd	69.0	79.9	92.3	105.6	132.0	6.3	7.4	8.8	10.2	13.2	249	255	260	265	274
Sub-total	101.8	183.7	353.6	475.0	718.4	9.2	16.8	33.1	45.1	68.6	248	251	256	260	261
(2) Rural Area	112.1	104.0	104.2	104.9	102.6	4.8	5.3	5.3	5.3	5.2	118	139	139	139	139
Total	213.9	287.7	457.8	579.9	821.0	14.0	22.1	38.4	50.4	73.8	180	211	230	238	246
5. Qazvin Plan															
(1) Abyek															
Alvand	32.8	36.6	41.9	47.7	59.0	2.8	3.3	3.9	4.5	5.9	231	245	252	260	274
Qazvin	60.8	69.6	79.4	90.0	110.9	3.2	6.3	7.2	8.3	10.5	144	247	250	253	259
Eghbalieh	291.1	325.1	366.5	410.9	498.8	27.8	31.4	35.6	40.5	49.9	262	265	266	270	274
Buin	31.5	38.4	46.0	54.1	70.3	1.7	3.5	4.2	5.0	5.3	148	247	251	256	205
Danesfahan	10.0	11.5	13.4	15.3	19.2	1.2	1.1	1.3	1.5	1.9	316	260	263	267	273
Shal	8.1	9.5	11.0	12.7	16.1	0.8	0.8	1.0	1.1	1.5	275	234	238	242	247
Eslarvarin	14.1	14.5	14.9	15.2	19.0	1.1	1.0	1.1	1.3	1.7	213	185	211	238	244
Takestan	11.9	13.7	15.7	17.8	22.1	1.0	1.2	1.4	1.6	2.0	230	238	241	244	250
Sub-total	514.5	580.7	659.4	743.6	913.9	44.5	54.2	62.2	71.2	88.6	237	255	258	263	265
(2) Rural Area	297.9	273.9	267.9	262.8	241.7	11.2	13.0	12.7	12.5	11.5	103	130	130	130	130
Total	812.4	854.6	927.3	1,006.4	1,155.6	55.7	67.2	74.9	83.7	100.1	188	215	221	228	237
Grand Total	10,188.3	11,745.3	13,102.1	14,507.8	17,365.3	1,160.5	1,282.6	1,449.1	1,565.0	1,831.9	312	299	303	296	289

Note: The above figure is based on the Master Plan

Table 4.1.2 Population, Water Demand Projection and Percent Demand in Tehran City

	1976	1986	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2006	2011	2016	2021
Population	4,530,223	6,042,584	6,475,527					6,758,800									
Estimated Population																	
Coverage (%)							95.00										
Total Connection			715,930		714,578	742,860	785,479										
Raw Water Intake (MCM)			681.13		745.04	764.89	809.76	870	878	915	907						
Total Production (MCM)		512.70	648.63	683.22	720.29	738.20	776.28	842.39	846.53	886.16	885.41						
Total Consumption (MCM)		442	484		492	505					591						
Raw Water Per capita (lcd)																	
Total Production (lcd)		274.00	288.00		298.00	321.00		353					332	337	324		315
Total Consumption (lcd)		0.00	0.00														
Domestic Use (lcd)		120.00	129.00		153.00	161.00											
Others (lcd)		80.00	76.00		44.00	51.00											
Leakage & Others Loss (lcd)		74.00	83.00		101.00	109.00											



The data after 1996 are from the Master Plan and the rest are from the Tehran Water and Sewage Company. The projection of population is rather high as shown above. The previous rate is 1.1 % and the adopted rate is 1.8 %.

Table 4.1.3 Population, Water Demand Project and Percapt Demand in Karaj Bozor

	1976	1983	1985	1986	1991	1993	1994	1996	2001	2006	2011	2016	2021
Total Population		363,332		450,429	799,990	945,880	892,019	941,000					
Estimated Population									1,045,900	1,173,000	1,308,900	1,450,400	1,578,800
Coverage (%)							90						
Total Connection			26,700		86,000		100,524						
Demand Projection								92.05	102.69	115.60	129.95		157.90
Total Production(MCM)		26.37		43.93	64.21	64.38	75.00						
Total Consumption(MCM)		21.15		34.44	48.80	50.22	56.25						
Domestic Use(MCM)		16.71		27.46	40.00	44.54	44.93						
Others (MCM)		4.51		6.91	8.76	5.52	11.40						
Leakage(MCM)		5.00		9.54	15.48	14.16	18.56						
Total Production(lcd)		199		267	220	186	230	268	269	270	272		274
Total Consumption(lcd)		160		209	167	145	173						
Domestic Use(lcd)		126		167	137	129	138						
Others (lcd)		34		42	30	16	35						
Leakage(lcd)		39		58	53	41	57						

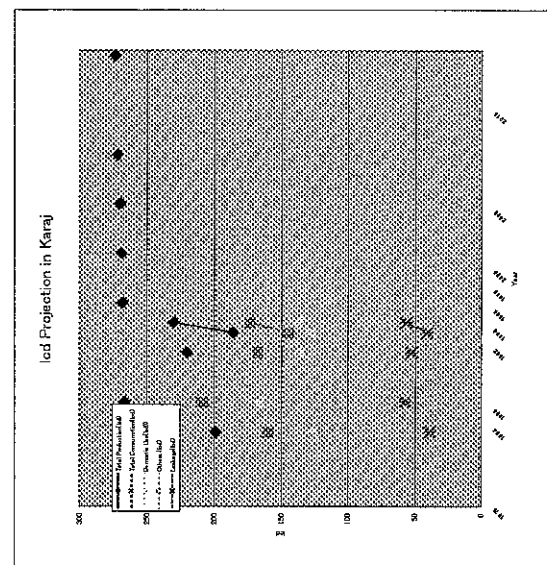
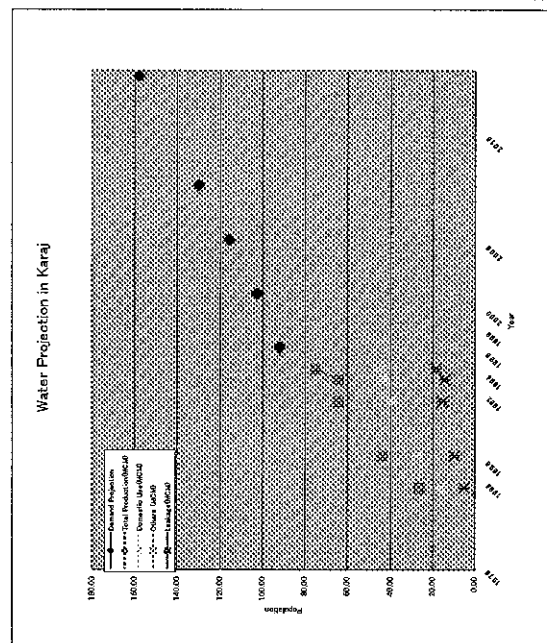
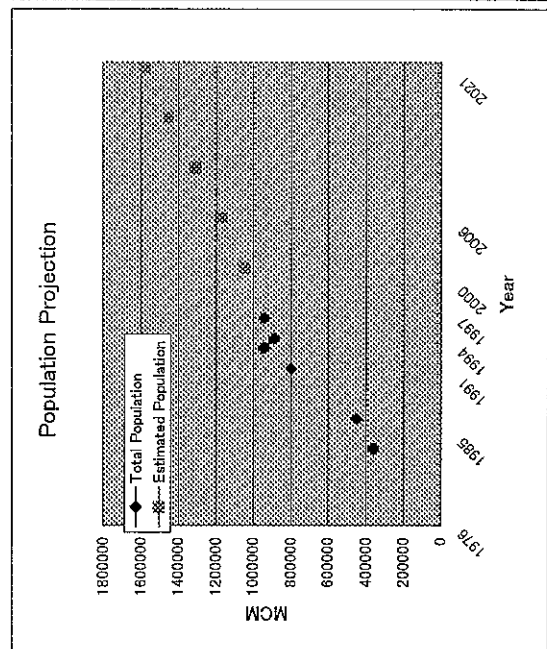
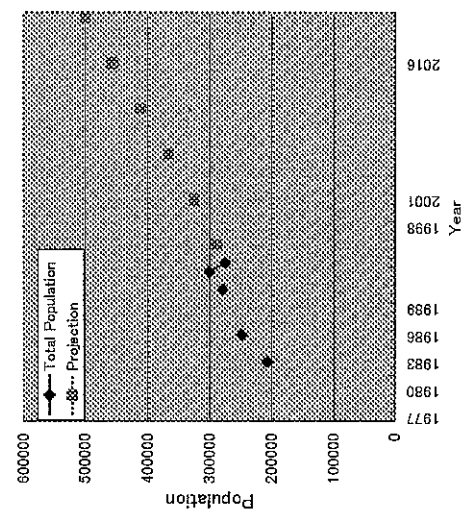


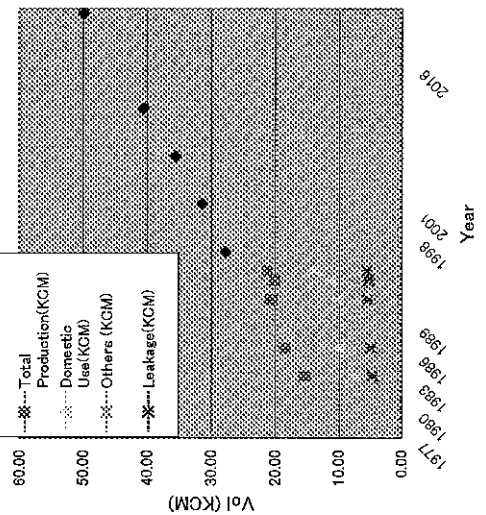
Table 4.1.4 Population, Water Demand Project and Percapt Demand in Qazvin City

	1983	1985	1986	1991	1993	1994	1996	2001	2006	2011	2016	2021
Total Population	207,912		248,591	278,826	301,411	274,975						
Projection							288,627	325,109	366,527	410,861	5E+05	498,805
Coverage (%)						98						
Total Connection		35,152				44,789						
Demand Projection							27.81	31.45	35.59	40.49		49.89
Total Production(KCM)	15.46		18.50	20.58	20.15	21.18						
Total Consumption(KCM)	10.82		13.51	15.02	14.91	15.67						
Domestic Use(KCM)	7.67		9.98	10.18	11.44	14.15						
Others (KCM)	3.19		3.54	3.87	3.41	1.51						
Leakage(KCM)	4.63		4.99	5.50	5.28	5.52						
Total Production(lcd)	204		204	192	183	211	264	265	266	270		274
Total Consumption(lcd)	143		149	138	135	156						
Domestic Use(lcd)	101		110	100	104	141						
Others (lcd)	42		39	38	31	15						
Leakage(lcd)	61		55	54	48	55						

Population Projection in Qazvin



Demand Projection in Ghazvin



lcd Projection in Ghazvin

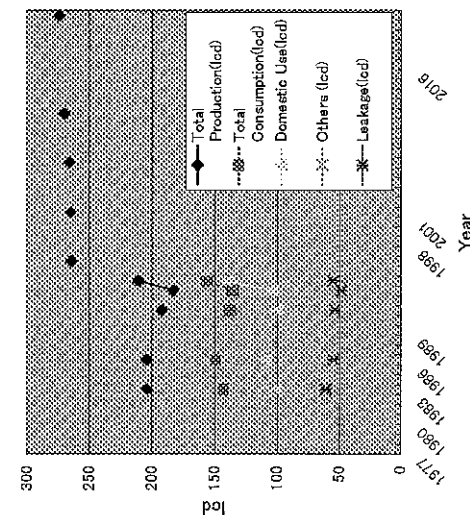


Table 4.1.5 Population, Water Demand Project and Percapt Demand in Tehran Rural Area

[illegible]

Table 4.1.6 Population, Water Demand Project and Percapt Demand in Karaj Rural Area

Area	1983	1993	1994	1996	1996	2001	2006	2011	2016	2021
Rural Community	Population									
	Ground Water									
	Surface Water									
	Total Production(Rural)				21.36	15.26	13.75	12.27		14.04
Rural Community	Total Consumption(Rural)									
	Total Consumption									
	Unaccountable									
	Ground Water									
Industria I Use	Surface Water									
	Total Production(Industry)				199.08	219.13	236.69	256.87		293.48
	Consumption									
	Population									
New City	Ground Water									
	Surface Water									
	Total Production(New City)				0.00	26.74	30.37	33.89		42.12
	Total Consumption(New City)									
New City	Consumption per Capita									
	Unaccountable									

Table 4.1.7 Population, Water Demand Project and Percapt Demand in Hashtgerd Rural Area

Area	1983	1993	1994	1996	1996	2001	2006	2011	2016	2021
Rural Community	Population	96,686	121,400	110,084	112,065	112,065	103,958	104,165	104,617	102,648
	Ground Water	100.00	100.00	100.00	100.00	100.00	99.50	99.80	99.80	99.90
	Surface Water	0.00	0.00	0.00	0.00	0.00	0.50	0.20	0.20	0.10
	Total Production(Rural)	3,529.00	5,095.00	4,822.00	4,908.00	4,908.00	5.27	5.29	5.31	5.21
	Total Consumption(Rural)						139	139	139	139
Industrial Use	Total Consumption		115	120	120		3,955	4,017	4,140	4,166
	Unaccountable						1	1,268	1,168	1,042
	Ground Water		100.00	73.00	91.00					
	Surface Water		0.00	27.00	9.00					
	Total Production(Industrial)	0.00	3.00	179.00	565.00	0.18	10.00	18.92	34.04	43.01
New City	Consumption (Industrial)									
	Population	0	0	0	0	0				
	Ground Water									
	Surface Water									
	Total Production(New City)	0.00	0.00	0.00	0.00	0.00	1.21	1.43	1.67	1.83
New City	Total Consumption(New City)									
	Consumption per Capita(New City)									
	Unaccountable									

Table 4.1.8 Population, Water Demand Project and Percapt Demand in Ghazvin Rural Area

Area	1983	1993	1994	1996	1996	1996	2001	2006	2011	2016	2021
Rural Community	Population	319,017	298,925	294,640	297,914	297,914	273,872	267,940	262,765	254,088	241,692
	Ground Water	100.00	100.00	100.00	100.00	100.00	92.00	96.00	97.00		98.00
	Surface Water	0.00	0.00	0.00	0.00	0.00	8.00	4.00	3.00		2.00
	Total Production(Rural)	11.64	11.13	11.19	11.31	11.19	13.00	12.71	12.47	12.06	11.47
	Total Consumption(Rural)					103	130	130	130	130	130
Industrial Use	Unaccountable	100	102	104	104						
	Ground Water	100.00	100.00	64.00	77.00						
	Surface Water	0.00	0.00	36.00	23.00						
	Total Production(Industrial)	20,218.00	35,477.00	4,502.00	7,012.00	4.50	21.25	37.16	50.72	61.33	74.75
	Consumption (Industrial)										
New City	Population					0	38,900	43,200	47,600	53,800	59,100
	Ground Water										
	Surface Water										
	Total Production					0.00	2.77	3.08	3.39	3.83	4.21
							195	195	195	195	195
Total Consumption (New City)							2,104	2,368	2,643	3,063	3,449
Consumption per Capita(New City)											
Unaccountable							1	707	745	766	757