

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
STATE SECRETARIAT OF PLANNING AND GENERAL COORDINATION,
PARANÁ STATE, THE FEDERATIVE REPUBLIC OF BRAZIL

THE MASTER PLAN STUDY ON
THE UTILIZATION OF WATER RESOURCES IN PARANÁ STATE
IN
THE FEDERATIVE REPUBLIC OF BRAZIL

FINAL REPORT

SECTORAL REPORT VOLUME D
DOMESTIC AND INDUSTRIAL WATER

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December, 1995

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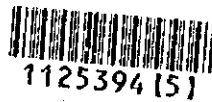
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COMPOSITION OF FINAL REPORT

1. EXECUTIVE SUMMARY
2. MAIN REPORT
 - I. Strategy for Paraná State
 - II. Master Plan for Iguazu River Basin
 - III. Master Plan for Tibagi River Basin
3. SECTORAL REPORT
 - A. Socio-economy
 - B. Meteorology, Hydrology and Surface Water Resources
 - C. Hydrogeology and Groundwater Resources
 - D. Domestic and Industrial Water
 - E. Agriculture
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 - G. Water Utilization Plan
 - H. Flood Control
 - I. Water Quality and Sewerage
 - J. Soil Erosion and Forest
 - K. Ecology
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 - M. Institution
 - N. Cost Estimate, and Economic and Financial Assessment
4. DATA BOOK

**THE MASTER PLAN STUDY ON
THE UTILIZATION OF WATER RESOURCES IN PARANÁ STATE
IN THE FEDERATIVE REPUBLIC OF BRAZIL**

**Sectorial Report Vol. D
Domestic and Industrial Water**

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List of Abbreviations:

1. SEFA State Secretariat for Treasury
Secretaria de Estado da Fazenda
2. SEIC State Secretariat for Industry, Commerce and Economic Development
Secretaria de Estado da Indústria, Comércio e do Desenvolvimento Econômico
3. SEMA State Secretariat for Environment
Secretaria de Estado do Meio Ambiente
4. IPARDES Economic and Social Development Institute of the State of Paraná
Instituto Paranaense de Desenvolvimento Econômico e Social
5. IBGE Foundation of Brazilian Institute of Geography and Statistics
Fundação Instituto Brasileiro de Geografia Estatística
6. SANEPAR Sanitation Company of the State of Paraná
Companhia de Saneamento do Paraná
7. FNS National Health Foundation
Fundação Nacional de Saúde
8. IAP Environmental Institute of Paraná
Instituto Ambiental do Paraná
9. JICA Japan International Cooperation Agency
Agência de Cooperação Internacional do Japão
10. MRH Homogeneous Micro Regions
Microrregiões Homogêneas
11. GDP Gross Domestic Products
12. GRDP Gross Resional Domestic Products

List of Literature Cited:

1. Pan-American Health Organization, World Health Organization (April - May/1994). "Sectoral Analysis of Water Supply and Sanitary Sewage"
2. Japan Water Works Association (1985) "Present Situation of Major Water Utilities in the World"
3. Division Statistics of Management & Coordination Agency JAPAN. "World Statistics"
4. Japan Locational Factor Research Center "Report of Unit Rate Research for Industry" (March 1993)

SUMMARY

(1) Introduction

The Master Plan Study on the Utilization of Water Resources in Paraná State, in the Federative Republic of Brazil (Herein after referred to as the "Study") has been formulated through the environmental Joint-Programming (JP) carried out between the Government of Japan and the Government of the Federative Republic of Brazil to find and establish a project that is necessary and worthwhile.

The purposes of the Study are: 1) to formulate a Master Plan for Water Environment composed of water use plan for various water sectors, such as domestic water, industrial water, agricultural water, hydroelectric power generation, etc., and an improvement or conservation plan for environmental issues, such as flood control, water quality, soil erosion, ecology, etc., for the entire area of the State of Paraná for the target year of 2015, and 2) to promote transference of technology to the Brazilian counterparts during the Study.

The Study is divided into three phases, as follows:

Phase - I: To determine the methodology to formulate the Master Plan.

Phase - II: To formulate a Water Environment Strategy for the whole area of the State of Paraná, and select a pilot river basin(s) for the Phase III.

Phase - III: To formulate the Master Plan for Water Environment for the selected pilot river basin(s).

According to the purposes of the Study and the division of Phases, the study of domestic and industrial water (herein after referred to as "This Sector") is also composed of three Sections, as follows:

1. Strategy for Paraná State.
2. Master Plan for Iguaçu River Basin.
3. Master Plan for Tibagi River Basin.

The objectives of This Sector are: 1) to clarify the present situation of the water consumption, 2) to estimate the present water demand, and 3) to estimate the future water demand in the years of 2005 and 2015.

In this context, Section 1 describes: 1) present situation of domestic water consumption; 2) projection for domestic water demand projection for the target years; 3) present situation of industrial water consumption, and 4) industrial water demand projection for the target years, as a strategy for Paraná State; using the Homogeneous Micro Regions (MRH) as a regional unit in relation to domestic and industrial water demand estimation.

Section 2 describes: 1) present situation of domestic water consumption; 2) domestic water demand projection for the target years; 3) present situation of industrial water consumption, and 4) industrial water demand projection for the target years, as a Master Plan for Iguaçu River Basin using the municipality as regional unit in relation to the domestic and industrial water demand estimation.

Section 3 describes the same matter mentioned above as a Master Plan for Tibagi River Basin using the same methodology of Section 2.

And according to the Alternative Case, mentioned in Sectorial Report Vol. A - "SOCIO-ECONOMY", this Sector describes the water demand estimation for the Alternative Case in each Section.

(2) Strategy for Paraná State

1) Unit Water Consumption Rate

The Unit Water Consumption Rate for domestic water and industrial water were studied and estimated as shown below:

Sector		1993 Category			2005 Category			2015 Category		
		1 st	2 nd	3 rd	1 st	2 nd	3 rd	1 st	2 nd	3 rd
Domestic Water (l/person.day)	Residential	100	85	70	125	100	75	155	125	80
	Non-Residential	30	20	15	35	30	20	45	35	25
	Total	130	105	85	160	130	95	200	160	105
Industrial Water (m ³ /day.US\$1,000.00-VA)		0.059			0.048			0.037		

Remarks: (1): MRH of 1st category in 1993-----MRH 268, 281 and 282
in 2005 and 2015- -MRH 268, 281, 282 and 288
(2): MRH of 2nd category in 1993-----MRH 269, 270, 272 to 276, 279 to 286 and 288 to 291
in 2005 and 2015---MRH 269, 270, 272 to 276, 279, 280, 283, 284, 286 and 289 to 291
(3): MRH of 3rd category in 1993-----MRH 271, 277, 278 and 287
in 2005 and 2015--MRH 271, 277, 278, 285 and 287
(4): (VA) is Value Added

2) Water Demand of Paraná State/Base Case

The domestic water and industrial water of Paraná State for the target years by Base Case was estimated as shown below:

Sector	Domestic Water			Industrial Water			Total		
	Volume			Volume			Volume		
	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%
1993	899,280	10.41	100.00	476,290	5.51	100.00	1,375,570	15.92	100.00
2005	1,338,100	15.49	148.80	724,420	8.38	152.10	2,062,520	23.87	149.94
2015	1,902,100	22.02	211.51	935,070	10.82	196.32	2,837,170	32.84	206.25

Remark: % shows percentage of increase.

3) Comparison between Base Case and Alternative Case

As a comparison between Base Case and Alternative Case, the domestic water for urban population, industrial water and reduction volume of MRH 268/Curitiba in 2015 was estimated as shown below:

	Urban Population	Water Demand (m ³ /day)		
		Domestic Water	Industrial Water	Total Water
Base Case	3,112,700	622,540	475,250	1,097,790
Alternative Case	2,647,700	529,540	404,950	934,490
Reduction	465,000	93,000	70,300	163,300

Regarding This Sector, the following matters were taken into consideration:

- The unit water consumption rate of domestic water will be increased in proportion to the increase of GDP per Capita (shown in Figure-1.3).
- The unit water consumption rate of industrial water per US\$ 1,000.00 of Value Added (GDP of 2nd Sector) will be decreased in accordance to the increasing of water recovery rate (recycle use rate).

(2) Master Plan for Iguacu River Basin

1) Zoning of the Study

The Study zoning for this Section is composed of 101 municipalities.

2) Unit Consumption Rate

The unit consumption rate of domestic water per municipality was estimated per two categories: 1) large-medium size municipalities and 2) other municipalities, per MRH, and for the unit consumption rate of industrial water was considered the same figure considered in Strategy for Paraná State.

3) Water Demand for River Basin / Base Case

The domestic water and industrial water for this river basin, in 1993, 2005 and 2015, by Base Case was estimated as shown below:

Sector	Domestic Water			Industrial Water			Total		
	Volume			Volume			Volume		
	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%
1993	423,480	4.90	100.00	294,800	3.41	100.00	718,280	8.31	100.00
2005	674,250	7.80	159.22	434,950	5.04	147.54	1,109,200	12.84	154.42
2015	986,130	11.41	232.86	556,330	6.44	188.71	1,542,460	17.85	214.74

(3) Master Plan for Tibagi River Basin

1) Zoning of the Study

The study zoning for this Section is composed of 43 municipalities.

2) Unit Consumption Rate

The unit consumption rate was estimated by the same method of Section (2).

(3) Water Demand for River Basin / Base Case

The domestic water and industrial water for this river basin, in 1993, 2005 and 2015, by Base Case, was estimated as shown below:

Sector	Domestic Water			Industrial Water			Total		
	Volume			Volume			Volume		
	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%	m ³ per day	m ³ /sec	%
1993	157,330	1.82	100.00	75,150	0.87	100.00	232,480	2.69	100.00
2005	235,320	2.72	149.57	116,280	1.35	154.73	351,600	4.07	154.24
2015	332,150	3.85	211.12	146,420	1.69	194.84	478,570	5.54	205.85

CHAPTER 1 STRATEGY FOR PARANÁ STATE

1.1 Domestic Water

1.1.1 Present Situation of Domestic Water Consumption

(1) General Situation and Data Source

The domestic water supply service in Paraná State (including sewage service) is divided into three (3) undertakers, as follows:

- 1 - SANEPAR : - Sanitation Company of the State of Paraná
(Companhia de Saneamento do Paraná)
- 2 - F. N. S. : - National Health Foundation
(Fundação Nacional de Saúde)
- 3 - Other Organs : - Autonomous Municipalities
(Municípios Independentes)

These organs divide the water supply service per municipality. According to a report by the Pan-American Health Organization and World Health Organization, "Sector Analysis of Water Supply and Sanitary Sewage", the number of municipalities served by SANEPAR is gradually increasing. In 1970, there were 15 municipalities served by SANEPAR; 271 municipalities were supplied by SANEPAR in 1984 and, in 1993, there were 316 municipalities served by SANEPAR.

The number of municipalities, the target service population by these three organs, the water service population, and the service percentage by SANEPAR are shown in Table - 1.1. The location of municipalities by these three organs is shown in Figure - 1.1. The list of municipalities and the target population by F. N. S. and other organs, is presented in Table - 1.2.

1) Information

According to Table - 1.1, SANEPAR has nowadays a predominant participation in water supply service. In terms of municipality, SANEPAR serves 316 municipalities (approximately 85% of the State's total number); regarding target service population, 7,860,000 inhabitants (approximately 92% of Paraná State total population) is the present goal to be accomplished by SANEPAR in terms of domestic water supply and sewage facilities. Therefore, information and data, related to domestic water consumption, were provided by SANEPAR, and these records were used for the Study of "This Sector".

2) Zoning for the Study

SANEPAR has its own administrative network, described as follows:

Headquarters in Curitiba; Five (5) Superintendencies and Fifteen (15) Regional Offices to manage the company's local operations and services.

For the purpose of this Study, the regional unit for zoning will be the MRH (Homogeneous Micro Region), as defined by the Team in Sectorial Report (A) - SOCIO-ECONOMY. Therefore, the regional division used by SANEPAR will not be considered.

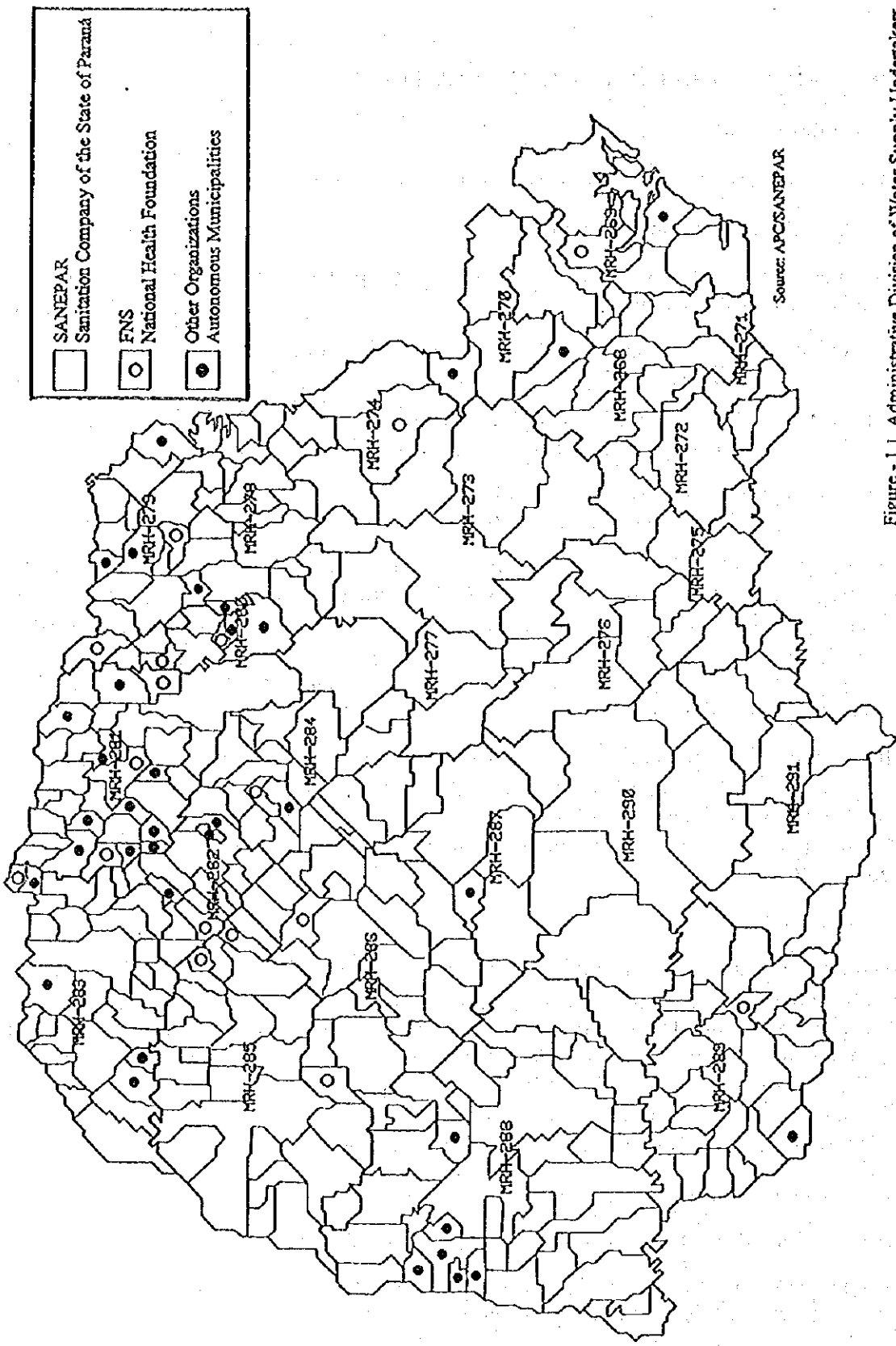


Figure - 1.1 Administrative Division of Water Supply Undertakers

Table - 1.1 Target Water Service Population by Undertaker and Present Water Service Population by SANEPAR per MRH in 1993

No and Name of MRH	SANEPAR				FNS and other Organizations	
	Number of Municipalities	Target Water Service Population	Water Service Population	(%) %	Number of Municipalities	Target Water Service Population
01. MRH 268/CURITIBA	16	2.047.710	1.869.347	91,29	2	39.248
02. MRH 269/L.PARANAENSE	4	52.240	35.598	68,14	2	127.225
03. MRH 270/ALTO RIBEIRA	2	24.873	6.930	27,86	1	5.035
04. MRH 271/A.RIO NEGRO	4	39.818	10.746	26,99	0	0
05. MRH 272/C.LAPA	5	106.660	63.303	59,35	0	0
06. MRH 273/C.PONTA GROSSA	6	414.555	342.204	82,55	0	0
07. MRH 274/C.JAGUARIAIVA	2	37.183	20.640	55,50	1	27.447
08. MRH 275/S.MATEUS DO SUL	3	54.674	20.240	37,02	0	0
09. MRH 276/Col.IRATI	7	173.418	73.856	42,10	0	0
10. MRH 277/ALTO IVAI	5	96.116	24.870	25,87	0	0
11. MRH 278/N.V.WENCESLAU BRAZ	18	167.834	97.614	58,16	0	0
12. MRH 279/N.V.JACAREZINHO	13	223.982	182.576	81,51	7	83.254
13. MRH 280/Alc.ASSAI	4	45.839	27.790	60,63	4	31.959
14. MRH 281/N.N.LONDRINA	18	717.311	675.642	94,19	13	116.183
15. MRH 282/N.N.MARINGA	13	357.982	356.347	99,54	3	82.400
16. MRH 283/N.N.Olhos PARANAÍVA	24	237.684	199.165	83,79	6	33.043
17. MRH 284/N.N.APUCARANA	20	307.705	254.080	82,57	2	11.117
18. MRH 285/N.N. Nova UMAJARAMA	28	384.374	258.668	67,30	2	14.057
19. MRH 286/C.MOURÃO	21	305.677	226.599	74,13	2	24.412
20. MRH 287/PITANGA	7	119.572	29.832	24,95	1	6.019
21. MRH 288/ENT.ONS PARANAENSE	43	974.483	698.071	71,64	6	56.054
22. MRH 289/Sudoeste PARANAENSE	32	450.505	236.683	52,34	2	22.820
23. MRH 290/GUARAPUAVA	10	337.191	162.579	48,22	1	19.270
24. MRH 291/MEDIO IGUAÇU	11	181.011	121.285	67,00	0	0
TOTAL	316	7.860.402	5.994.665	76,26	55	699.543

Source : APCSANEPAR

Remark : Target Water Service Population is estimated population in 1993 by IPARDES

: percentage is water service population divided by Target Water Service Population

: Water Service Population per FNS and Other Organization were not available

: Water Service Population per MRH by SANEPAR was calculated as residential unit by SANEPAR x Average inhabitant per residence estimated by SANEPAR

: Two municipalities (Iraporçu-MRH 268, and Cândido-MRH 290) began to be served by SANEPAR in 1994

: Target water service population and water service population of MRH/269 do not include floating population

Table - 1.2 List of Municipalities not Served by SANEPAR per MRH - 1993

No. and name of MRH	Name of the City	Population - 1993		
		Urban	Rural	Total
MRH 268/CURITIBA	Rio Branco do Sul**	20,104	8,191	28,295
	Itaperuçu (*)	5,017	5,936	10,953
MRH 269/L. PARANAENSE	Antonina*	13,859	2,980	16,839
	Paranaguá**	96,886	13,500	110,386
MRH 270/ALTO RIBEIRA	Doutor Ulysses**	408	4,627	5,035
MRH 274/C. JAGUARIAIVA	Jaguariaíva*	21,644	5,803	27,447
MRH 279/N.V. JACAREZINHO	Abatiá*	5,428	4,964	10,392
	Bandeirantes**	24,950	9,323	34,273
	Itambaracá**	6,532	3,473	10,005
	Nova Fátima**	6,099	2,265	8,364
	Ribeirão Claro**	6,197	4,997	11,194
	S. Antônio do Paraiso**	1,210	1,168	2,378
	Sertaneja*	4,941	1,707	6,648
MRH 280/Alg ASSAI	Jataizinho*	8,565	1,918	10,483
	Nova Santa Bárbara**	2,115	1,552	3,667
	Santa Cecília do Pavão*	2,639	2,141	4,780
	S. Jerônimo da Serra**	5,234	7,795	13,029
MRH 281/N.N. LONDRINA	Alvorada do Sul**	5,953	3,370	9,323
	Ângulo**	1,684	754	2,438
	Colorado**	16,501	3,004	19,505
	Flórida**	1,745	394	2,139
	Ibiporã*	32,425	4,079	36,504
	Iguaraçu**	2,736	668	3,404
	Jaguapitã*	7,789	2,772	10,561
	Lobato*	3,035	853	3,888
	Miraselva**	3,223	2,064	5,287
	Munhoz de Mello**	2,023	1,446	3,469
	N. Senhora das Graças**	2,278	1,117	3,395
	Pitangueiras**	1,222	1,018	2,240
Sertãozinho**	10,188	3,842	14,030	
MRH 282/N.N. MARINGÁ	Marialva**	16,755	6,027	22,782
	Sarandi**	52,105	1,708	53,813
	S. Jorge do Ivaí*	4,341	1,464	5,805
MRH 283/N. Novis. PARANAÍVA	Jardim Olinda*	1,095	342	1,437
	Paranapoema**	2,110	421	2,531
	Pres. Castelo Branco**	2,317	1,258	3,575
	Santa Izabel do Ivaí**	5,874	3,026	8,900
	Santa Mônica**	728	2,194	2,922
	Terra Rica**	10,521	3,157	13,678
MRH 284/N.N. APUCARANA	Kaloré**	2,862	3,455	6,317
	Marumbi*	3,079	1,721	4,800
MRH 285/N. Novis. UMUARAMA	Jussara*	5,054	1,148	6,202
	Japurá*	4,363	3,492	7,855
MRH 286/C. MOURÃO	Mariluz*	8,237	2,417	10,654
	Peabiru*	9,215	4,543	13,758
MRH 287/PITANGA	Mato Rico**	388	5,631	6,019
MRH 288/Extr. Oeste PARANAENSE	Entre Rios do Oeste**	996	1,842	2,838
	Mal. Cândido Rondon**	21,717	11,914	33,631
	Mercedes**	732	3,346	4,078
	Pato Branco**	1,386	2,046	3,432
	Quatro Pontes**	1,136	2,417	3,553
	Tupãssi**	5,368	3,154	8,522
MRH 289/Sudoeste PARANAENSE	Barracão**	4,815	9,140	13,955
	Itapejara*	3,962	4,903	8,865
MRH 290/GUARAPUAVA	Candói (*)	1,811	17,459	19,270
TOTAL		493,597	205,946	699,543

Source : APC/SANEPAR, IPARDES

Remark: (*) Municipality served by FINS (17 municipalities)

(**) Municipality served by organization (36 municipalities)

(*) These two municipalities (Itaperuçu and Candói) began to be served by SANEPAR in 1994

(2) Present Water Consumption Volume

Present water consumption volume is one of the most fundamental information for water demand studies. The main information and data related to water consumption in Paraná State was provided by SANEPAR's Commercial Division and APC/SANEPAR (Section of Planning and Coordination Assistance - SANEPAR), as follows:

- Monthly data about consumption volume divided by Category of users (consumer), such as residential, industrial, commercial and public use in Paraná State in 1993.
- Monthly data about consumption volume divided by Category of user mentioned above and per MRH in 1992 and 1993.
- Number of residential units per MRH supplied by SANEPAR and inhabitants per residential units per MRH estimated by SANEPAR.

According to the information and data mentioned above, an essential item concerning present unit consumption volume was arranged, by dividing the consumption in two categories: 1) residential water and 2) non-residential water (commercial use and public use) as presented in Table - 1.3.

However, the following items should be noted:

1) Water Service Population (população atendida)

Presently, SANEPAR has data about the number of water meter or connections (ligações) and number of residential units (economia), and the consumption volume per category as mentioned in the previous section.

Water service population is estimated by the number of residential units multiplied by the average of inhabitant per residence. In 1993, SANEPAR estimated the average of inhabitant per residence in 4.08, but according to IBGE's information of the "CENSO DEMOGRÁFICO" - 1991 - PARANÁ (Demographic Census - 1991 - Paraná), in the year of 1991 this figure was 3.91 person per residential unit in the urban area of the State of Paraná.

It means that the water service population has approximately from 3.50% to 5.00% of tolerance from the starting point of the estimation included in this Study, and that the unit consumption volume has also from 3.50% to 5.00% of tolerance.

2) Variation of Water Consumption Volume and Unit Water Consumption per Month

Based on data provided by APC/SANEPAR, mentioned above, the variation of water consumption volume and unit water consumption volume per month in the selected MRH, from a viewpoint of its location, water service population, service percentage, etc., are shown in Table - 1.4 and Figure - 1.2.

It shall be noted that the variation between maximum consumption and average consumption in the State of Paraná is approximately of 12% but, for example, MRH 283/N. Novis. Paranavaí had this percentage raised up about 25%.

Table - 1.3 Average Water Consumption Volume and Unit Water Consumption Volume per MRH by SANEPAR - 1993

No. and Name of the MRH	Water Service Population - 1993		Residential Water		Non-Residential Water	
	Population	Average Consumption Volume (m3/month)	Unit Consumption Volume (l/person.day)	Average Consumption Volume (m3/month)	Unit Consumption Volume (l/person.day)	
01. MRH 268/CURITIBA	1,869,347	5,378,457	95.91	1,313,718	23.43	
02. MRH 269/L. PARANENSE	35,598	---	---	38,896	36.42	
03. MRH 270/ALTO RIBEIRA	6,930	13,758	66.18	3,584	17.24	
04. MRH 271/A. RIO NEGRO	10,746	---	---	4,893	15.18	
05. MRH 272/C. LAPA	63,303	129,558	68.22	26,679	14.05	
06. MRH 273/C. PONTA GROSSA	342,204	815,823	79.47	170,344	16.59	
07. MRH 274/C. JAGUARUAIVA	20,640	48,799	78.81	10,153	16.40	
08. MRH 275/S. MATEUS DO SUL	20,240	46,669	76.86	13,018	21.44	
09. MRH 276/Col. IRATI	73,856	143,830	64.91	25,183	11.37	
10. MRH 277/ALTO IVAÍ	24,870	45,568	61.07	8,974	12.03	
11. MRH 278/N. V. WENCESLAU BRAZ	97,614	213,747	72.99	91,662	31.30	
12. MRH 279/N. V. JACAREZINHO	182,576	520,263	94.99	131,774	24.06	
13. MRH 280/Aj. ASSAÍ	27,790	---	---	36,815	44.16	
14. MRH 281/N. N. LONDRINA	675,642	2,064,110	101.83	428,285	21.13	
15. MRH 282/N. N. MARINGÁ	356,347	1,105,361	103.40	443,196	41.46	
16. MRH 283/N. Novis. PARANAVÁJ	199,165	565,636	94.67	---	---	
17. MRH 284/N. N. APUCARANA	254,080	534,920	70.18	99,911	13.11	
18. MRH 285/N. Novis. UMUARAMA	258,668	657,880	84.78	---	---	
19. MRH 286/C. MOURÃO	226,599	551,223	81.09	---	---	
20. MRH 287/PITANGA	29,832	59,032	65.96	14,458	16.15	
21. MRH 288/Extr. Oeste PARANAENSE	698,071	1,854,841	88.57	574,802	27.45	
22. MRH 289/Sudoeste PARANAENSE	236,683	505,536	71.20	116,062	16.35	
23. MRH 290/GUARAPUAVA	162,579	350,762	71.92	72,236	14.81	
24. MRH 291/MÉDIO IGUAÇU	121,285	279,909	76.93	56,149	15.43	
TOTAL	5,994,665	15,385,682	---	3,680,792	---	

Average Unit Consumption Volume of Paraná State

Source: APC/SANEPAR

Remark: Water service Population of MRH 269 does not include the floating population

: The element without figures means collected but not reliable

: Unit Consumption Volume (l/person . day) was calculated by dividing the Average Consumption Volume per MRH by the Water Service Population per MRH

: Average Unit Consumption Volume of Paraná State of Residential Water was calculated by dividing the total average consumption volume of Residential Water by the water service population excluded one of MRH 269, MRH 271 and MRH 280

: Average Unit Consumption Volume of Paraná State of Non-Residential Water was calculated by dividing the Total Average Consumption Volume of Non-Residential Water by the Water Service Population excluded one of MRH 283/ MRH 285 and MRH 268

Table-1.4 Variation of Water Consumption Volume and Unit Water Consumption Volume of Residential Water per Month of Selected MRH.

No. and Name of MRH	Month												Average Volume	
	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.		
MRH 268/Curitiba	Consumption Volume	5972.8	5231.3	5353.5	5748.2	5356.4	4848.8	5037.9	5094.8	5194	5249.4	5705.5	5748.9	5,378.46
	Unit Consumption Volume	106.50	93.28	95.46	102.50	95.51	86.46	88.83	90.85	92.62	93.60	101.74	102.51	95.91
MRH 279/N. V. Jacarezinho	Consumption Volume	592.9	501.8	505.8	533.9	479.3	470	492.9	499.1	528.8	514.5	566	558.3	520.28
	Unit Consumption Volume	108.25	91.61	92.35	97.48	87.51	85.81	89.99	91.12	96.54	93.93	103.34	101.93	94.99
MRH 281/N. N. Londrina	Consumption Volume	2230.5	1973.1	2048.7	2063.2	2000.6	1795.2	1903.8	1871.8	2024.5	2078.8	2422.5	2356.5	2,064.10
	Unit Consumption Volume	110.04	97.34	101.07	101.79	98.70	88.57	93.93	92.35	99.88	102.56	119.52	116.26	101.83
MRH 283/N. Novis. Paranaivai	Consumption Volume	704.5	553.8	527.9	563.9	552.3	524.8	497.3	529.2	566.3	524.2	622.6	620.7	565.63
	Unit Consumption Volume	117.91	92.69	88.35	94.38	92.44	87.83	83.23	88.57	94.78	87.73	104.20	103.88	94.67
MRH 288/Extr. Oeste Paranaense	Consumption Volume	2058.1	1895.2	1840.1	1971.5	1699.9	1567.6	1556.5	1745	2054.8	1827.8	1994.2	2047.5	1,854.85
	Unit Consumption Volume	98.28	90.50	87.87	94.14	81.17	74.85	74.32	83.32	98.12	87.28	95.22	97.77	88.57
Average of Parana State.	Consumption Volume	18299.6	16162.8	15975.4	16784.9	15537.3	14296.3	14688.5	15136.3	16175.5	15734.1	17725.5	17898.9	16,201.26
	Unit Consumption Volume	101.75	89.87	88.83	93.33	86.40	79.49	81.68	84.17	89.94	87.49	98.56	99.43	90.09

Source: APC/SANEPAR

Remark: Unit of Water Consumption Volume is 1.000 m³/month
Unit of Unit Water Consumption Volume is lit/person.day

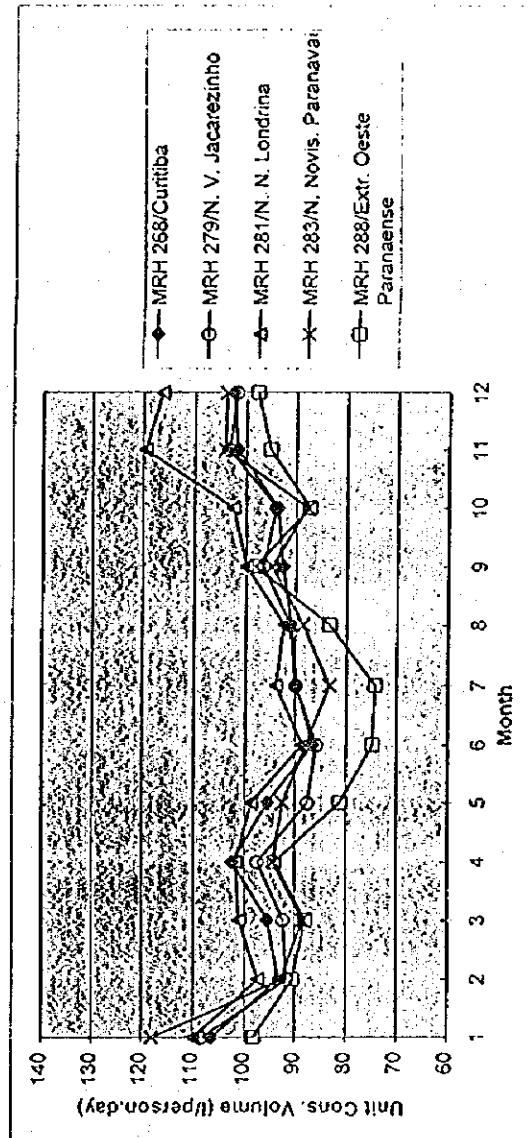


Figure-1.2 Monthly Variation of Unit Water Consumption Volume of Residential Water per Selected MRH

1.1.2 Estimation of Unit Consumption Rate

(1) Present Unit Consumption Rate

1) Average Unit Consumption Rate of Paraná State

a) Average Unit Consumption Rate for Urban Population

Based on Table - 1.3, average unit consumption rate for urban population, divided in residential water and non-residential water was estimated as shown in Table - 1.5.

b) Average Unit Consumption Rate for Rural Population

The residential water for a part of people who live in rural areas of Paraná State has been served, nowadays, by a water supply system of undertakers, but figures for estimation of unit consumption rate as, for example, water consumption volume and water service population, were not available.

Therefore, regarding the unit consumption rate for rural population, it was decided to use the following criteria for the Study:

- unit consumption rate of residential water is the same figure of the MRH of the 3rd category shown in Table - 6.3.
- unit consumption rate of non-residential water is zero.

The estimated average unit consumption rate for rural population is also shown in Table - 1.5.

Table - 1.5 Average Unit Consumption Volume and Average Unit Consumption Rate of Paraná State - 1993

Urban Population				Rural Population			
Residential Water		Non-Residential Water		Residential Water		Non-Residential Water	
Average Consumption Volume (l/person . day)	Average Consumption Rate (l/person . day)	Average Consumption Volume (l/person . day)	Average Consumption Rate (l/person . day)	Average Consumption Volume (l/person . day)	Average Consumption Rate (l/person . day)	Average Consumption Volume (l/person . day)	Average Consumption Rate (l/person . day)
89.44	90.00	23.11	25.00	no data	70.00	no data	0.00

Source: Table 1.3

2) Unit Consumption Rate per Region (MRH)

a) Unit Consumption Rate per MRH of Residential Water for Urban Population

According to the arranged data of unit consumption volume per MRH, shown in Table - 1.3, considering service percentage of water supply by SANEPAR per MRH, GRDP per Capita per MRH (shown in Table - 1.16) and the degrees of concentration of population for urban areas (shown in Table - 1.14) the unit consumption rate per MRH was estimated by classifying the 24 MRH into three categories, as presented in Table - 1.6.

However, it should be noted that each unit consumption rate was estimated by adjusting the figure of average unit consumption rate multiplied by the total urban population and each unit consumption rate per category multiplied by the urban population of each category.

b) Unit Consumption Rate per MRH of Non-Residential Water for Urban Population

This unit rate was estimated for each category mentioned above, approximately in the same proportion between the average unit consumption rate of residential water and non-residential water, also by adjusting it tentatively to the total water demand calculated by multiplying the average unit consumption rate by the total urban population, as shown in Table - 1.6.

c) Unit Consumption Rate of Residential Water per MRH for Rural Population

As the economical and social characteristics of rural population in each MRH were not available, the unit rate was estimated considering the same amount for all MRH, being this rate the one of the MRH classified in the 3rd category, as shown in Table - 1.6.

Table - 1.6 Present Unit Water Consumption Rate per Region (MRH) - 1993

	Classification	No. of MRH	Unit Consumption Rate (l/ person . day)		
			Residential Water	Non-Residential Water	Total Domestic Water
Urban Population	1st Category	MRH 268, MRH 281, MRH 282	100.00	30.00	130.00
	2nd Category	MRH 269, MRH 270, MRH 272 to MRH 276, MRH 279 to MRH 286, MRH 288 to MRH 291	85.00	20.00	105.00
	3rd Category	MRH 271, MRH 277, MRH 278, MRH 287	70.00	15.00	85.00
	Average of Paraná State		90.00	25.00	115.00
Rural Population		All MRH	70.00	0.00	70.00

Source: AFC/SANEPAR

(2) Future Unit Consumption Rate

1) Average Unit Consumption Rate of Paraná State

a) Average Unit Consumption Rate of Residential Water for Urban Population

It can be considered that the unit water consumption rate of residential water is mainly influenced by the living standards and life style of the society as, for example, the household income and the place people live.

In this study, the recent trend of the household income, or personal income, in the State of Paraná, could not be collected. Therefore, the GDP (or GRDP) per Capita has been used as a parameter for the analysis of water demand projection.

GDP per Capita of Paraná State was estimated at approximately US\$ 7,000.00 in 2015, excluding the contribution of hydroelectric power stations (shown in Table - 1.16). As this value is very high, there were no parameters in Paraná State to achieve a precise projection. Therefore, data of unit consumption volume and GRDP per Capita in developed countries was also collected for this study, as shown in Table - 1.7.

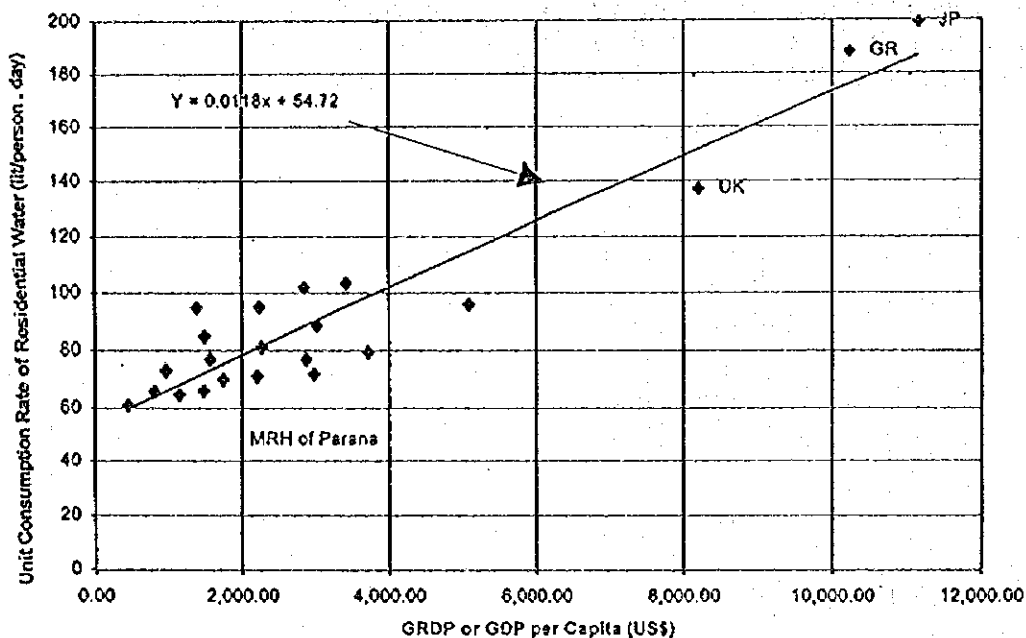
Table - 1.7 Relation between the Unit Water Consumption Volume of Residential Water and GDP per Capita of Developed Countries in 1985

Name of the Country	Unit Consumption Volume (l/ person . day)	GDP per Capita (US\$)
Japan	199.00	11.155.00
United Kingdom	137.00	8.210.00
Germany	188.00	10.237.00

Source: Present Situation of Major Water Utilities in the World/Japan Water Works Association and World Statistics Div. Statistics of Management & Coordination Agency Japan

Remark: Data of Japan is the Average Volume of the Country, data of UK is the Average Volume of the Cities of Northwest, North Umbrian, Southwest, Thames Welsh and Yorkshire, and data of Germany is the same Volume of the cities of Frankfurt and Hamburg.

In order to estimate the trend of the future unit consumption rate, the correlation between unit consumption volume and GDP (or GRDP) per Capita was figured as Figure - 1.3, using the unit consumption volume and GRDP per Capita (shown in Table - 1.16) of 19 MRH, and the same data of three developed countries mentioned above.



JP: Japan, UK: United Kingdom, GR: Germany Source: APC/SANEPAR

Figure - 1.3 Trend of Correlation between Unit Consumption Volume and GDP (or GRDP) per Capita

Based on Figure - 1.3 (Trend of the Correlation between Unit Consumption Volume and GDP (or GRDP) per Capita) and the estimated GDP per Capita of Paraná State in 2005 and 2015 (shown in Table - 1.16) the average unit consumption rate in Paraná State for urban population in 2005 and 2015 was estimated as shown in Table - 1.8.

b) Average Unit Consumption Rate of Non-Residential Water for Urban Population

This unit rate was considered to increase in the same proportion of residential water and non-residential water in 1993, and is also presented in Table - 1.8.

c) Average Unit Consumption Rate for Rural Population

This unit was estimated according to the criterion for present average unit consumption rate for rural population, and is shown in Table - 1.8.

However, it shall be pointed out that future administrative changes in the policies of water supply and water charge were not considered for this estimation.

Table - 1.8 Average Unit Consumption Rate of Paraná State - 2005 and 2015

2005				2015			
Urban Population		Rural Population		Urban Population		Rural Population	
Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)	Residential Water (l/person . day)
115	30	0	75	140	40	80	0

2) Unit Consumption Rate per Region (MRH) - 2005 and 2015

a) Unit Consumption Rate per MRH of Residential Water for Urban Population

This unit consumption rate was estimated per category (shown in Table - 1.6) (not per each MRH) by using Figure - 1.3. For example, 1st category (MRH 268/Curitiba, MRH 281/N. N. Londrina, MRH 282/N. N. Maringá and MRH 288/Extr. Oeste Paranaense) was estimated based on the average GRDP per Capita of these four MRH. The unit consumption rate of these three categories was adjusted tentatively to the total water demand calculated by multiplying the average unit consumption rate (shown in Table - 1.8) by the total urban population.

b) Unit Consumption Rate per MRH of Non-Residential Water for Urban Population

This unit consumption rate was estimated using the same method of estimation of the present unit consumption rate of non-residential water (Section - 1.1.2 (1) 2) b)).

c) Unit Consumption rate per MRH of Residential Water for Rural Population

As in the case of the present unit consumption rate per MRH, this unit rate was estimated considering the same figure of the MRH classified in the 3rd category for all the MRH.

Unit consumption rate of residential water and of non-residential water for urban population and unit consumption rate of residential water for rural population in 2005 and 2015 are summarized in Table - 1.9.

Table - 1.9 Unit Consumption Rate per Region (MRH) - 2005 and 2015

	Classification	No. and Name of the MRH	2005			2015			
			Residential Water	Non Residential Water	Total Domestic Water	Residential Water	Non Residential Water	Total Domestic Water	
			Unit Rate (l/p. d)	Unit Rate (l/p. d)	Unit Rate (l/p. d)	Unit Rate (l/p. d)	Unit Rate (l/p. d)	Unit Rate (l/p. d)	
Urban Population	1st Category	MRH 268/CURITIBA							
		MRH 281/N. N. LONDRINA							
		MRH 282/N. N. MARINGÁ							
			MRH 288/Extr. Oeste PARANAENSE	125	35	160	155	45	200
	2nd Category	MRH 269/L. PARANAENSE							
		MRH 270/ALTO RIBEIRA							
		MRH 272/C. LAPA							
		MRH 273/C. PONTA GROSSA							
		MRH 274/C. JAGUARIAÍVA							
		MRH 275/S. MATEUS do SUL							
MRH 276/Col. IRATI									
		MRH 279/N. V. JACAREZINHO							
		MRH 280/Alg. ASSAÍ							
		MRH 283/N. Novis. PARANAÍ							
		MRH 284/N. N. APUCARANA							
		MRH 286/CAMPO MOURÃO							
		MRH 289/Sudoeste PARANAENSE							
		MRH 290/GUARAPUAVA							
		MRH 291/MÉDIO IGUAÇU	100	30	130	125	35	160	
3rd Category		MRH 271/A. RIO NEGRO							
		MRH 277/ALTO IVAÍ							
		MRH 278/N. V. WENCESLAU BRAZ							
		MRH 285/N. Novis. UMUARAMA							
		MRH 287/PITANGA	75	20	95	80	25	105	
		AVERAGE OF PARANÁ STATE	115	30	145	140	40	180	
RURAL POPULATION			75	0	75	80	0	80	

Remark: (l/p. d) = liter/person . day

1.1.3 Water Demand Projection

(1) Water Demand Projection for Base Case in 1993, 2005 and 2015

The water demand for the target years was estimated by multiplying the estimated urban and rural population per MRH of each year (shown in Table - 1.14) by the unit consumption rate per MRH of the corresponding year, and is presented in Table - 1.12(1), Table - 1.12(2) and Table - 1.12(3).

(2) Water Demand Projection for Alternative Case in 2005 and 2015

As mentioned in Main Report I, Alternative Case was considered as follows:

1) Alternative Regional Development Plan and Alternative Socio-Economic Framework

a) Future Socio-Economic Framework in Curitiba Metropolitan Area

Based on the study of phase II, concerning the water development in the Metropolitan Area of Curitiba, the balance between water demand and water supply will be very tight. In addition to that, problems in water quality, solid waste and other environmental issues will be enlarged to the extent of threatening human life.

As mentioned in the previous Section, it is estimated that in the year of 2015 MRH 268/Curitiba will need a great amount of additional social infrastructure on which more than one million people live. It is also foreseeable that large areas of useful land and basic infrastructure will be required to enable this MRH to cope with the several problems that will be caused by the increase in economic activities, by three times, up to 2015.

b) Alternative Regional Development Plan

To solve the problems above, or to avoid the foreseeable problems mentioned above, JICA Team proposes an alternative regional development plan, as a strategy, with a concept of decentralization of socio-economic activities. It will be necessary to restrict the number of emigrants to Curitiba metropolitan area and to distribute them to the big MRH which have medium local urban centers, such as MRH 281/N. N. Londrina, MRH 288/Extr. Oeste Paranaense, MRH 282/N. N. Maringá, MRH 273/Campos de Ponta Grossa and others, which have the capacity and possibility to accept these immigrants.

(i) Outline of the Alternative Plan

Considering the concept mentioned above as well as the present regional economic activities, an outline of the alternative plan is composed as follows:

Composition of Three Urban Complexes.

a) MRH 281/Londrina and MRH 282/Maringá

To compose the urban axis /Londrina - Maringá/ with the neighboring municipalities, including part of MRH 284/Apucarana, as center of the north region in the State of Paraná.

b) MRH 288/Extr. Oeste Paranaense (Cascavel)

To compose the urban axis /Toledo-Cascavel-Foz do Iguaçu/ as the center of the west region in Paraná State.

c) MRH 273/Ponta Grossa

To compose the urban axis /Ponta Grossa-Castro/ as a new development region near the metropolitan area of Curitiba.

It is needless to say, however, that this plan is still in a level of strategy and it is necessary to study this plan further on from the political and administrative point of view.

c) Alternative Socio-Economic Framework

(i) Restriction and Distribution of the Number of Emigrants

According to Table - 1.14, the increase of urban population in MRH 268/Curitiba is estimated in approximately 1,163,000 people, with an annual growth rate of 2.15% from the year of 1993 to the year of 2015. In order to find the reasonable ratio of restriction, the ratios of 30%, 40% and 50% were studied, respectively, relating them to the growth rate of the four main MRH and the State of Paraná.

As a result of this study, the ratio of 40%, which is equivalent to 253,000 emigrants in 2005, and 465,000 emigrants in 2015, and to about 15% of the estimated urban population of each year, is considered reasonable to be distributed to the four large MRH (MRH 273/Campos de Ponta Grossa, MRH 281/N. N. Londrina, MRH 282/N. N. Maringá and MRH 288/Extr. Oeste Paranaense - Cascavel, Foz do Iguaçu, etc.), according to the proportion of each urban population in 2005 and 2015.

(ii) Distribution of GRDP/Secondary Sector and Tertiary Sector in MRH 268/Curitiba

Consequently, 15% of the amount of the GRDP by Secondary Sector and Tertiary Sector in MRH 268, equivalent to 1,950.00 million US\$ and 750,000 million US\$ in 2005 and 5,100.00 million US\$ and 1,900 million US\$ in 2015, would be distributed to the same four large MRH, according to the same method mentioned above.

The restriction of MRH 268 and distribution for the four large MRH in 2005 and 2015 are shown below in Table - 1.10.

Table - 1.10 Restriction and Distribution of Urban Population, GRDP (Secondary and Tertiary Sector) and GRDP of Secondary Sector, in 2005 and 2015

No. and Name of MRH	2005				2015			
	%	Urban Population	GRDP (2nd and 3rd Sector) million US\$	GRDP of 2nd Sector million US\$	%	Urban Population	GRDP (2nd and 3rd Sector) million US\$	GRDP of 2nd Sector million US\$
MRH 268 Curitiba	100.00	(253,000)	(1,950.00)	(750.00)	100.00	(465,000)	(5,100.00)	(1,900.00)
MRH 271 C. Ponta Grossa	14.70	37,200	285.00	110.00	14.40	67,000	735.00	275.00
MRH 281 N. N. Londrina	31.30	79,200	610.00	235.00	30.60	142,200	1,560.00	580.00
MRH 282 N. N. Maringá	18.30	46,300	355.00	140.00	18.40	85,600	935.00	350.00
MRH 288 Extr. Oeste Paranaense	35.70	90,300	700.00	265.00	36.60	170,200	1,870.00	695.00

Remark: % is percentage of distribution per MRH

The values of GRDP of Secondary Sector and Tertiary Sector are in million US\$

2) Estimated Water Demand

According to the concept mentioned above, and based on the estimated population per MRH by Alternative Case (shown in Table - 1.15), estimated domestic water demand for Alternative Case in 2005 and 2015 was shown in Table - 1.13(1) and Table - 1.13(2), respectively.

(3) Comparison of Domestic Water Demand between Base Case and Alternative Case in 2005 and 2015

As the comparison, the difference of the domestic water demand between Base Case and Alternative Case in 2005 and 2015 is shown below in Table - 1.11.

Table - 1.11 Comparison of Domestic Water Demand between Base Case and Alternative Case in 2005 and 2015

	2005			2015		
	Domestic Water Demand (m ³ /day)		(Decrease) or Increase (m ³ /day)	Domestic Water Demand (m ³ /day)		(Decrease) or Increase (m ³ /day)
	Base Case	Alternative Case		Base Case	Alternative Case	
MRH 268 Curitiba	413,160	372,670	(40,490)	622,540	529,540	(93,000)
MRH 273/C. Ponta Grossa	57,360	62,190	4,830	83,170	93,890	10,720
MRH 281/N. N. Londrina	149,710	162,380	12,670	220,740	249,180	28,440
MRH 282/N. N. Maringá	87,760	95,170	7,410	132,840	149,960	17,120
MRH 288/Extr. Oeste Paranaense	171,050	185,490	14,440	264,100	298,140	34,040

Table -1.12 (1) Projected Domestic Water Demand per Region (MRH) - 1993 / Base Case

No of the MRH/Name of Region	Water Demand for Urban Population					Water Demand for Rural Population			Total Demand m ³ /day
	Urban Population	Residential Water		Non-Residential Water		Rural Population	Unit Rate m ³ / d . p	Total Rural Demand m ³ /day	
		Unit Rate m ³ / d . p	Demand m ³ /day	Unit Rate m ³ / d . p	Demand m ³ /day				
01. MRH 268/CURITIBA	1,949,779	0.100	194,980	0.030	58,490	126,226	0.070	8,840	262,310
02. MRH 269/L. PARANAENSE	145,826	0.085	12,400	0.020	2,920	33,639	0.070	2,350	17,670
03. MRH 270/ALTO RIBEIRA	5,478	0.085	470	0.020	110	24,430	0.070	1,710	2,290
04. MRH 271/A. RIO NEGRO	6,350	0.070	440	0.015	100	33,468	0.070	2,340	2,880
05. MRH 272/C. LAPA	60,616	0.085	5,150	0.020	1,210	46,044	0.070	3,220	9,580
06. MRH 273/C.PONTA GROSSA	349,228	0.085	29,680	0.020	6,980	65,327	0.070	4,570	41,230
07. MRH 274/C.JAGUARIVAI	43,660	0.085	3,710	0.020	870	20,975	0.070	1,470	6,050
08. MRH 275/S. MAT. do SUL	20,122	0.085	1,710	0.020	400	34,552	0.070	2,420	4,530
09. MRH 276/Col. IPATI	71,821	0.085	6,100	0.020	1,440	103,597	0.070	7,250	14,790
10. MRH 277/ALTO IVAI	23,934	0.070	1,680	0.015	360	72,182	0.070	5,050	7,090
11. MRH 278/N. V. WENCESLAU BRAZ	96,440	0.070	6,750	0.015	1,450	71,394	0.070	5,000	13,200
12. MRH 279/N. V. JACAREZINHO	220,756	0.085	18,760	0.020	4,420	86,480	0.070	6,050	29,230
13. MRH 280/AIG. ASSAI	49,386	0.085	4,200	0.020	990	28,412	0.070	1,990	7,180
14. MRH 281/N. N. LONDRINA	738,500	0.100	73,850	0.030	22,160	94,994	0.070	6,650	102,660
15. MRH 282/N. N. MARINGA	404,731	0.100	40,470	0.030	12,140	35,651	0.070	2,500	55,110
16. MRH 283/N. Novis. PARANAVAI	205,603	0.085	17,480	0.020	4,110	65,124	0.070	4,560	26,150
17. MRH 284/N. N. APUCARANA	214,052	0.085	18,190	0.020	4,280	104,770	0.070	7,330	29,800
18. MRH 285/N. Novis. UMUARAMA	260,680	0.085	22,160	0.020	5,210	137,751	0.070	9,640	37,010
19. MRH 286/C. MOURAO	241,901	0.085	20,560	0.020	4,840	132,508	0.070	9,280	34,680
20. MRH 287/PITANGA	33,770	0.070	2,360	0.015	510	91,821	0.070	6,430	9,300
21. MRH 288/Extr. Oeste PARANAENSE	765,866	0.085	65,100	0.020	15,320	264,671	0.070	18,530	98,950
22. MRH 289/Sudeste PARANAENSE	255,122	0.085	19,990	0.020	4,700	238,203	0.070	16,670	41,360
23. MRH 290/ C. GUARAPUAVA	179,566	0.085	15,260	0.020	3,590	157,625	0.070	11,030	29,880
24. MRH291/ MEDIO IGUAÇU	105,048	0.085	8,930	0.020	2,100	75,963	0.070	5,320	16,350
TOTAL OF PARANA STATE	6,428,235	-----	590,380	-----	158,700	2,145,807	-----	150,200	899,280

Remark: m³/d . p = m³/day/person

Table - 1.12 (2) Projected Domestic Water Demand per Region (MRH) - 2005 / Base Case

No of the MRH/Name of Region	Water Demand for Urban Population						Water Demand for Rural Population			Total Demand m ³ /day
	Residential Water		Non-Residential Water		Total Domestic Demand m ³ /day	Rural Population	Unit Rate m ³ / d . p	Total Rural Demand m ³ /day		
	Unit Rate m ³ / d . p	Demand m ³ /day	Unit Rate m ³ / d . p	Demand m ³ /day						
Urban Population	Unit Rate m ³ / d . p	Demand m ³ /day	Unit Rate m ³ / d . p	Demand m ³ /day	Total Domestic Demand m ³ /day	Rural Population	Unit Rate m ³ / d . p	Total Rural Demand m ³ /day		
01. MRH 268/CURITIBA.	2,382,200	0.125	322,780	0.035	90,380	413,160	113,700	0.075	8,530	421,690
02. MRH 269/L. PARANAENSE	1,80,500	0.100	18,050	0.030	5,420	23,470	32,700	0.075	2,450	25,920
03. MRH 270/ALTO RIBEIRA	7,300	0.100	730	0.030	220	950	21,600	0.075	1,620	2,570
04. MRH 271/A. RIO NEGRO	9,100	0.075	680	0.020	180	860	36,200	0.075	2,720	3,580
05. MRH 272/ C. LAPA	73,600	0.100	7,360	0.030	2,210	9,570	46,400	0.075	3,480	13,050
06. MRH 273/C.PONTA GROSSA	441,200	0.100	44,120	0.030	13,240	57,360	55,400	0.075	4,160	61,520
07. MRH 274/C.JAGUARUAVA	69,300	0.100	6,930	0.030	2,080	9,010	15,600	0.075	1,170	10,180
08. MRH 275/S. MAT. do SUL	26,300	0.100	2,630	0.030	790	3,420	35,000	0.075	2,630	6,050
09. MRH 276/Col. IRATI	90,400	0.100	9,040	0.030	2,710	11,750	103,300	0.075	7,750	19,500
10. MRH 277/ALTO IVAI	32,600	0.075	2,450	0.020	650	3,100	59,500	0.075	4,460	7,560
11. MRH 278/N. V. WENCESLAU BRAZ	123,300	0.075	9,250	0.020	2,470	11,720	45,000	0.075	3,380	15,100
12. MRH 279/N. V. JACAREZINHO	262,100	0.100	26,210	0.030	7,860	34,070	50,900	0.075	3,820	37,890
13. MRH 280/Alg. ASSAI	60,200	0.100	6,020	0.030	1,810	7,830	15,900	0.075	1,190	9,020
14. MRH 281/N. N. LONDRINA	935,700	0.125	116,960	0.035	32,750	149,710	48,600	0.075	3,650	153,360
15. MRH 282/N. N. MARINGA	548,500	0.125	68,560	0.035	19,200	87,760	16,800	0.075	1,260	89,020
16. MRH 283/N. Novis. PARANAVAI	240,200	0.100	24,020	0.030	7,210	31,230	35,000	0.075	2,630	33,860
17. MRH 284/N. N. APUCARANA	257,900	0.100	25,790	0.030	7,740	33,530	53,900	0.075	4,040	37,570
18. MRH 285/N. Novis. UMUARAMA	312,000	0.075	23,400	0.020	6,240	29,640	68,500	0.075	5,140	34,780
19. MRH 286/C. MOURAO	310,400	0.100	31,040	0.030	9,310	40,350	72,000	0.075	5,400	45,750
20. MRH 287/PITANGA	50,600	0.075	3,800	0.020	1,010	4,810	79,400	0.075	5,960	10,770
21. MRH 288/Extr. Oeste PARANAENSE	1,069,000	0.125	133,630	0.035	37,420	171,050	160,800	0.075	12,060	183,110
22. MRH 289/Sudoeste PARANAENSE	305,400	0.100	30,540	0.030	9,160	39,700	162,100	0.075	12,160	51,860
23. MRH 290/ C. GUARAPUAVA	230,700	0.100	23,070	0.030	6,920	29,990	159,500	0.075	11,960	41,950
24. MRH291/ MEDIO IGUAÇU	131,700	0.100	13,170	0.030	3,950	17,120	70,900	0.075	5,320	22,440
TOTAL OF PARANA STATE	8,350,200		950,230		270,930	1,221,160	1,558,700		116,940	1,338,100

Remark: m³/d . p = m³/day/person

Table - 1.12 (3) Projected Domestic Water Demand per Region (MRH) - 2015 Base Case

No of the MRH/Name of Region	Water Demand for Urban Population				Water Demand for Rural Population		Total Demand m ³ /day		
	Urban Population	Residential Water		Non-Residential Water		Rural Population		Unit Rate m ³ / d . p	
		Unit Rate m ³ / d . p	Demand m ³ /day	Unit Rate m ³ / d . p	Demand m ³ /day				Total Rural Demand m ³ /day
01. MRH 268/CURITIBA	3,112,700	0.155	482,470	0.045	140,070	96,700	0.080	7,740	630,280
02. MRH 269/L. PARANAENSE	210,000	0.125	26,250	0.035	7,350	30,100	0.080	2,410	36,010
03. MRH 270/ALTO RIBERA	8,800	0.125	1,100	0.035	310	18,400	0.080	1,470	2,880
04. MRH 271/A. RIO NEGRO	11,200	0.080	900	0.025	280	36,100	0.080	2,890	4,070
05. MRH 272/ C. LAPA	84,800	0.125	10,600	0.035	2,970	44,100	0.080	3,530	17,100
06. MRH 273/C.PONTA GROSSA	519,800	0.125	64,980	0.035	18,190	44,800	0.080	3,580	86,750
07. MRH 274/C.JAGUARATVA	87,400	0.125	10,930	0.035	3,060	10,700	0.080	860	14,850
08. MRH 275/S. MAT. do SUL	31,500	0.125	3,940	0.035	1,100	33,100	0.080	2,650	7,690
09. MRH 276/Col. IRATI	105,900	0.125	13,240	0.035	3,710	97,300	0.080	7,780	24,730
10. MRH 277/ALTO IVAI	39,700	0.080	3,180	0.025	990	46,600	0.080	3,730	7,900
11. MRH 278/N. V. WENCESLAU BRAZ	145,700	0.080	11,660	0.025	3,640	28,900	0.080	2,310	17,610
12. MRH 279/N. V. JACAREZINHO	298,200	0.125	37,280	0.035	10,440	30,600	0.080	2,450	50,170
13. MRH 280/Alg. ASSAI	69,500	0.125	8,690	0.035	2,430	9,200	0.080	740	11,860
14. MRH 281/N. N. LONDRINA	1,103,700	0.155	171,070	0.045	49,670	26,000	0.080	2,080	222,820
15. MRH 282/N. N. MARINGA	664,200	0.155	102,950	0.045	29,890	8,400	0.080	670	133,510
16. MRH 283/N. Novis. PARANAVAI	271,500	0.125	33,940	0.035	9,500	19,500	0.080	1,560	45,000
17. MRH 284/N. N. APUCARANA	297,300	0.125	37,160	0.035	10,410	29,200	0.080	2,340	49,910
18. MRH 285/N. Novis. UMUARAMA	357,800	0.080	28,620	0.025	8,950	35,900	0.080	2,870	40,440
19. MRH 286/C. MOURAO	368,600	0.125	46,080	0.035	12,900	40,600	0.080	3,250	62,230
20. MRH 287/PITANGA	63,400	0.080	5,070	0.025	1,590	65,900	0.080	5,270	11,930
21. MRH 288/Extr. Oeste PARANAENSE	1,320,500	0.155	204,680	0.045	59,420	100,300	0.080	8,020	272,120
22. MRH 289/Sudoeste PARANAENSE	366,300	0.125	45,790	0.035	12,820	93,500	0.080	7,480	66,090
23. MRH 290/ C. GUARAPUVA	276,000	0.125	34,500	0.035	9,660	152,100	0.080	12,170	56,330
24. MRH291/ MEDIO IGUAÇU	154,800	0.125	19,350	0.035	5,420	63,100	0.080	5,050	29,820
TOTAL OF PARANA STATE	9,969,300	---	1,404,430	---	404,770	1,161,100	---	92,900	1,902,100

Remark: m³/d . p = m³/day/person

Table - 1.15 (1) Projected Domestic Water Demand per Region (MRH) - 2005 / Alternative Case

No of the MRH/Name of Region	Water Demand for Urban Population				Total Domestic Demand		Water Demand for Rural Population			Total Demand m3/day
	Residential Water		Non-Residential Water		Total Domestic Demand m3/day	Rural Population	Unit Rate		Total Rural Demand m3/day	
	Unit Rate m3 / d . p	Demand m3/day	Unit Rate m3 / d . p	Demand m3/day			m3 / d . p	m3 / d . p		
01. MRH 268/CURITIBA	2,329,200	291,150	0.125	81,520	0.035	372,670	113,700	0.075	8,530	381,200
02. MRH 269/L. PARANAENSE	180,500	18,050	0.100	5,420	0.030	23,470	32,700	0.075	2,450	25,920
03. MRH 270/ALTO RIBEIRA	7,300	730	0.100	220	0.030	950	21,600	0.075	1,620	2,570
04. MRH 271/A. RIO NEGRO	9,100	680	0.075	180	0.020	860	36,200	0.075	2,720	3,580
05. MRH 272/ C. LAPA	73,600	7,360	0.100	2,210	0.030	9,570	46,400	0.075	3,480	13,050
06. MRH 273/C. PONTA GROSSA	478,400	47,840	0.100	14,350	0.030	62,190	55,400	0.075	4,160	66,350
07. MRH 274/C. JAGUARIAVA	69,300	6,930	0.100	2,080	0.030	9,010	15,600	0.075	1,170	10,180
08. MRH 275/S. MAT. do SUL	26,300	2,630	0.100	790	0.030	3,420	35,000	0.075	2,630	6,050
09. MRH 276/Col. IRATI	90,400	9,040	0.100	2,710	0.030	11,750	103,300	0.075	7,750	19,500
10. MRH 277/ALTO IVAI	32,600	2,450	0.075	650	0.020	3,100	59,500	0.075	4,460	7,560
11. MRH 278/N. V. WENCESLAU BRAZ	123,300	9,250	0.075	2,470	0.020	11,720	45,000	0.075	3,380	15,100
12. MRH 279/N. V. JACAREZINHO	262,100	26,210	0.100	7,860	0.030	34,070	50,900	0.075	3,820	37,890
13. MRH 280/Aig. ASSAI	60,200	6,020	0.100	1,810	0.030	7,830	15,900	0.075	1,190	9,020
14. MRH 281/N. N. LONDRINA	1,014,900	126,860	0.125	35,520	0.035	162,380	48,600	0.075	3,650	166,030
15. MRH 282/N. N. MARINGA	594,800	74,350	0.125	20,820	0.035	95,170	16,800	0.075	1,260	96,430
16. MRH 283/N. Novis. PARANAIVAI	240,200	24,020	0.100	7,210	0.030	31,230	35,000	0.075	2,630	33,860
17. MRH 284/N. N. APUCARANA	257,900	25,790	0.100	7,740	0.030	33,530	53,900	0.075	4,040	37,570
18. MRH 285/N. Novis. UMUARAMA	312,000	23,400	0.075	6,240	0.020	29,640	68,500	0.075	5,140	34,780
19. MRH 286/C. MOURAO	310,400	31,040	0.100	9,310	0.030	40,350	72,000	0.075	5,400	45,750
20. MRH 287/PITANGA	50,600	3,800	0.075	1,010	0.020	4,810	79,400	0.075	5,960	10,770
21. MRH 288/Ext. Oeste PARANAENSE	1,159,300	144,910	0.125	40,580	0.035	185,490	160,800	0.075	12,060	197,550
22. MRH 289/Sudoeste PARANAENSE	305,400	30,540	0.100	9,160	0.030	39,700	162,100	0.075	12,160	51,860
23. MRH 290/ C. GUARAPUAVA	230,700	23,070	0.100	6,920	0.030	29,990	159,500	0.075	11,960	41,950
24. MRH291/ MEDIO IGUAÇU	131,700	13,170	0.100	3,950	0.030	17,120	70,900	0.075	5,320	22,440
TOTAL OF PARANA STATE	8,350,200	949,290	-----	270,730	-----	1,220,020	1,558,700	-----	116,940	1,336,960

Remark: m3/d . p = m3/day . person

Table - 1.13 (2) Projected Domestic Water Demand per Region (MRH) - 2015 / Alternative Case

No of the MRH/Name of Region	Water Demand for Urban Population				Water Demand for Rural Population			Total Demand m ³ /day	
	Residential Water		Non-Residential Water		Total Domestic Demand m ³ /day	Rural Population	Unit Rate m ³ / d . p		Total Rural Demand m ³ /day
	Unit Rate m ³ / d . p	Demand m ³ /day	Unit Rate m ³ / d . p	Demand m ³ /day					
01. MRH 268/CURITIBA	0.155	410,390	0.045	119,150	529,540	96,700	0.080	7,740	537,280
02. MRH 269/L. PARANAENSE	0.125	26,250	0.035	7,350	33,600	30,100	0.080	2,410	36,010
03. MRH 270/ALTO RIBEIRA	0.125	1,100	0.035	310	1,410	18,400	0.080	1,470	2,880
04. MRH 271/A. RIO NEGRO	0.080	900	0.025	280	1,180	36,100	0.080	2,890	4,070
05. MRH 272/ C. LAPA	0.125	10,600	0.035	2,970	13,570	44,100	0.080	3,530	17,100
06. MRH 273/C. PONTA GROSSA	0.125	73,350	0.035	20,540	93,890	44,800	0.080	3,580	97,470
07. MRH 274/C. JAGUARUAVA	0.125	10,930	0.035	3,060	13,990	10,700	0.080	860	14,850
08. MRH 275/S. MAT. 66 SUL	0.125	3,940	0.035	1,100	5,040	33,100	0.080	2,650	7,690
09. MRH 276/Col. IRATI	0.125	13,240	0.035	3,710	16,950	97,300	0.080	7,780	24,730
10. MRH 277/ALTO IVAI	0.080	3,180	0.025	990	4,170	46,600	0.080	3,730	7,900
11. MRH 278/N. V. WENCESLAU BRAZ	0.080	11,660	0.025	3,640	15,300	28,900	0.080	2,310	17,610
12. MRH 279/N. V. JACAREZINHO	0.125	37,280	0.035	10,440	47,720	30,600	0.080	2,450	50,170
13. MRH 280/Alg. ASSAI	0.125	8,690	0.035	2,430	11,120	9,200	0.080	740	11,860
14. MRH 281/N. N. LONDRINA	0.155	193,110	0.045	56,070	249,180	26,000	0.080	2,080	251,260
15. MRH 282/N. N. MARINGA	0.155	116,220	0.045	33,740	149,960	8,400	0.080	670	150,630
16. MRH 283/N. Novis. PARANAVAI	0.125	33,940	0.035	9,500	43,440	19,500	0.080	1,560	45,000
17. MRH 284/N. N. APUCARANA	0.125	37,160	0.035	10,410	47,570	29,200	0.080	2,340	49,910
18. MRH 285/N. Novis. UMUARAMA	0.080	28,620	0.025	8,950	37,570	35,900	0.080	2,870	40,440
19. MRH 286/C. MOURAO	0.125	46,080	0.035	12,900	58,980	40,600	0.080	3,250	62,230
20. MRH 287/PITANGA	0.080	5,070	0.025	1,590	6,660	65,900	0.080	5,270	11,930
21. MRH 288/Ext. Oeste PARANAENSE	0.155	231,060	0.045	67,080	298,140	100,300	0.080	8,020	306,160
22. MRH 289/Sudoeste PARANAENSE	0.125	45,790	0.035	12,820	58,610	93,500	0.080	7,480	66,090
23. MRH 290/ C. GUARAPUAVA	0.125	34,500	0.035	9,660	44,160	152,100	0.080	12,170	56,330
24. MRH291/MEDIO IGUAU	0.125	19,350	0.035	5,420	24,770	63,100	0.080	5,050	29,820
TOTAL OF PARANA STATE	-----	1,402,410	-----	404,110	1,806,520	1,161,100	-----	92,900	1,899,420

Remark: m³/d. p = m³/day . person

Table-I.14 Projected Population in Paraná State per MRH - 1993, 2005 and 2015 / Base Case

No of the MRH/Name of Region	1993			2005			2015		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
	01. MRH 268/CURITIBA	1,949,779	126,226	2,076,005	2,582,200	113,700	2,695,900	3,112,700	96,700
02. MRH 269/L. PARANAENSE	143,826	33,639	179,465	180,500	32,700	213,200	210,000	30,100	240,100
03. MRH 270/ALTO RIBEIRA	5,478	24,430	29,908	7,300	21,600	28,900	8,800	18,400	27,200
04. MRH 271/A. RIO NEGRO	6,350	33,468	39,818	9,100	36,200	45,300	11,200	36,100	47,300
05. MRH 272/C. LAPA	60,616	46,044	106,660	73,600	46,400	120,000	84,800	44,100	128,900
06. MRH 273/C.PONTA GROSSA	349,228	65,327	414,555	441,200	55,400	496,600	519,800	44,800	564,600
07. MRH 274/C.JAGUARIAIVA	43,660	20,975	64,635	69,300	15,600	84,900	87,400	10,700	98,100
08. MRH 275/S. MAT. do SUL	20,122	34,552	54,674	26,300	35,000	61,300	31,500	33,100	64,600
09. MRH 276/Col. IRATI	71,821	103,597	175,418	90,400	103,300	193,700	105,900	97,300	203,200
10. MRH 277/ALTO IVAI	23,934	72,182	96,116	32,600	59,500	92,100	39,700	46,600	86,300
11. MRH 278/N. V. WENCESLAU BRAZ	96,440	71,394	167,834	123,300	45,000	168,300	145,700	28,500	174,200
12. MRH 279/N. V. JACAREZINHO	220,756	86,480	307,236	262,100	50,900	313,000	298,200	30,600	328,800
13. MRH 280/Aig. ASSAI	49,386	28,412	77,798	60,200	15,900	76,100	69,500	9,200	78,700
14. MRH 281/N. N. LONDRINA	738,500	94,994	833,494	935,700	48,600	984,300	1,103,700	26,000	1,129,700
15. MRH 282/N. N. MARINGA	404,731	35,651	440,382	548,500	16,800	565,300	664,200	8,400	672,600
16. MRH 283/N. Novis. PARANAVAI	205,603	65,124	270,727	240,200	35,000	275,200	271,500	19,500	291,000
17. MRH 284/N. N. APUCARANA	214,052	104,770	318,822	257,900	53,900	311,800	297,300	29,200	326,500
18. MRH 285/N. Novis. UMUARAMA	260,680	137,751	398,431	312,000	68,500	380,500	357,800	35,900	393,700
19. MRH 286/C. MOURAO	241,901	132,508	374,409	310,400	72,000	382,400	368,600	40,600	409,200
20. MRH 287/PITANGA	33,770	91,821	125,591	50,600	79,400	130,000	63,400	65,900	129,300
21. MRH 288/Entr. Oeste PARANAENSE	765,866	264,671	1,030,537	1,069,000	160,800	1,229,800	1,320,500	100,300	1,420,800
22. MRH 289/Sudoeste PARANAENSE	235,122	238,203	473,325	305,400	162,100	467,500	366,300	93,500	459,800
23. MRH 290/C. GUARAPUAVA	179,566	157,623	337,191	230,700	159,500	390,200	276,000	152,100	428,100
24. MRH 291/MEDIO IGUAÇU	105,048	75,963	181,011	131,700	70,900	202,600	154,800	63,100	217,900
TOTAL OF PARANA STATE	6,428,235	2,143,807	8,574,042	8,350,200	1,538,700	9,908,900	9,969,300	1,161,100	11,130,400

Source: Population of 1993 is Preliminary Projection by IPARDES

Remark: Population of 2005 and 2015 was projected by JICA Team

Table 1.15 Projected Population in Paraná State per MRH - 2005 and 2015 / Alternative Case

No of the MRH/Name of Region	2005				2015					
	Urban	%	Rural	%	Urban	%	Rural	%		
	Total	%	Total	%	Total	%	Total	%		
01. MRH 268/CURITIBA	2,329,200	27.89	113,700	7.29	2,442,900	24.65	96,700	8.33	2,744,400	24.66
02. MRH 269/L. PARANAENSE	180,500	2.16	32,700	2.10	213,200	2.15	30,100	2.59	240,100	2.16
03. MRH 270/ALTO RIBEIRA	7,300	0.09	21,600	1.39	28,900	0.29	8,800	0.09	27,200	0.24
04. MRH 271/A. RIO NEGRO	9,100	0.11	36,200	2.32	45,300	0.46	11,200	0.11	47,300	0.42
05. MRH 272/ C. LAPA	73,600	0.88	46,400	2.98	120,000	1.21	84,800	0.85	128,900	1.16
06. MRH 273/C.PONTA GROSSA	478,400	5.73	55,400	3.55	533,800	5.39	586,800	5.89	631,600	5.67
07. MRH 274/C.JAGUARIATA	69,300	0.83	15,600	1.00	84,900	0.86	87,400	0.88	98,100	0.88
08. MRH 275/S. MAT. do SUL	26,300	0.31	35,000	2.25	61,300	0.62	31,500	0.32	64,600	0.58
09. MRH 276/Col. IRATI	90,400	1.08	103,300	6.63	193,700	1.95	105,900	1.06	203,200	1.83
10. MRH 277/ALTO IVAI	32,600	0.39	59,500	3.82	92,100	0.93	39,700	0.40	86,300	0.78
11. MRH 278/N. V. WENCESLAU BRAZ	123,300	1.48	43,000	2.89	168,300	1.70	145,700	1.46	174,600	1.57
12. MRH 279/N. V. JACAREZINHO	262,100	3.14	50,900	3.27	313,000	3.16	298,200	2.99	328,800	2.95
13. MRH 280/AIç. ASSAI	60,200	0.72	15,900	1.02	76,100	0.77	69,500	0.70	78,700	0.71
14. MRH 281/N. N. LONDRINA	1,014,900	12.15	48,600	3.12	1,063,500	10.73	1,245,900	12.50	1,271,900	11.43
15. MRH 282/N. N. MARINGÁ	594,800	7.12	16,800	1.08	611,600	6.17	749,800	7.52	758,200	6.81
16. MRH 283/N. Novis. PARANAVAI	240,200	2.88	35,000	2.25	275,200	2.78	271,500	2.73	291,000	2.61
17. MRH 284/N. N. APUCARANA	257,900	3.09	53,900	3.46	311,800	3.15	297,300	2.99	326,500	2.93
18. MRH 285/N. Novis. UMUARAMA	312,000	3.74	68,500	4.40	380,500	3.84	357,800	3.59	393,800	3.54
19. MRH 286/C. MOURAO	310,400	3.72	72,000	4.62	382,400	3.86	368,600	3.70	409,100	3.68
20. MRH 287/PITANGA	50,600	0.61	79,400	5.09	130,000	1.31	63,400	0.64	129,300	1.16
21. MRH 288/Extr. Oeste PARANAENSE	1,159,300	13.88	160,800	10.32	1,320,100	13.32	1,490,700	14.95	1,591,000	14.29
22. MRH 289/Sudoeste PARANAENSE	305,400	3.66	162,100	10.40	467,500	4.72	366,300	3.68	459,800	4.13
23. MRH 290/ C. GUARAPUAVA	230,700	2.76	159,500	10.23	390,200	3.94	276,000	2.77	428,100	3.85
24. MRH291/ MEDIO IGUAÇU	131,700	1.58	70,900	4.55	202,600	2.04	154,800	1.55	217,900	1.96
TOTAL OF PARANA STATE	8,350,200	100.00	1,558,700	100.00	9,908,900	100.00	9,969,300	100.00	11,130,400	100.00

Remark: Projected by JICA Team

Table -1.16 Estimated GRDP per MRH and GRDP per Capita per MRH in 1993, 2005 and 2015

No. and Name of MRH	GRDP / MRH (US\$ Million)			GRDP per Capita (US\$)							
	1993	2005	2015	%	2005	2015	%	1993	2005	2015	%
1. MRH 268/CURTIBA	10,538.30	20,213.73	34,326.41	44.28	42.47	34,326.41	163.87	5,080.00	7,500.00	10,700.00	153.74
2. MRH 269/L. PARANAENSE	442.86	732.61	1,088.63	1.40	1.54	1,088.63	79.68	2,470.00	3,430.00	4,530.00	65.09
3. MRH 270/ALTO RIBEIRA	44.18	77.41	133.11	0.17	0.16	133.11	47.74	1,480.00	2,680.00	4,390.00	70.26
4. MRH 271/A. RIO NEGRO	32.22	61.37	105.60	0.14	0.13	105.60	26.13	810.00	1,350.00	2,230.00	32.04
5. MRH 272/ C.da LAPA	362.82	667.94	1,163.22	1.50	1.40	1,163.22	109.68	3,400.00	5,570.00	9,020.00	129.60
6. MRH 273/C. de PONTA GROSSA	1,545.30	2,870.83	4,632.53	5.98	6.03	4,632.53	120.32	3,730.00	5,780.00	8,200.00	117.82
7. MRH 274/C. de JAGUARIAIVA	294.55	660.63	1,055.69	1.36	1.39	1,055.69	147.10	4,560.00	7,780.00	10,760.00	154.60
8. MRH 275/S. MATEUS do SUL	85.74	160.89	282.33	0.36	0.34	282.33	50.65	1,570.00	2,620.00	4,370.00	62.79
9. MRH 276/Col. de IRAI	200.53	383.82	637.75	0.82	0.81	637.75	36.77	1,140.00	1,980.00	3,140.00	45.11
10. MRH 277/ALTO IVAI	42.78	69.22	104.06	0.13	0.15	104.06	14.52	450.00	750.00	1,210.00	17.39
11. MRH 278/N. V. DE WENCESLAU B.	149.02	216.28	332.69	0.43	0.45	332.69	28.71	890.00	1,290.00	1,910.00	27.44
12. MRH 279/N. V. JACAREZINHO	664.9	1,013.13	1,436.03	1.85	2.13	1,436.03	69.68	2,160.00	3,240.00	4,370.00	62.79
13. MRH 280/ALG. de ASSAI	135.06	171.29	191.06	0.25	0.36	191.06	56.13	1,740.00	2,250.00	2,430.00	34.91
14. MRH 281/N. N. LONDRINA	2,344.76	3,862.85	5,990.97	7.73	8.12	5,990.97	90.65	2,810.00	3,920.00	5,300.00	76.15
15. MRH 282/N. N. MARINGA	1,510.93	2,931.00	4,915.47	6.34	6.16	4,915.47	110.65	3,430.00	5,180.00	7,310.00	105.03
16. MRH 283/N. Noviss. PARANAVAI	375.86	515.05	654.40	0.84	1.08	654.40	44.84	1,390.00	1,870.00	2,250.00	32.33
17. MRH 284/N. N. APUCARANA	556.79	857.07	1,253.83	1.62	1.80	1,253.83	56.45	1,750.00	2,750.00	3,840.00	55.17
18. MRH 285/N. Noviss. UMUARAMA	594.16	626.05	686.23	0.89	1.32	686.23	48.06	1,490.00	1,650.00	1,740.00	25.00
19. MRH 286/C. MOURAO	850.96	1,252.64	1,817.18	2.34	2.63	1,817.18	73.23	2,270.00	3,280.00	4,440.00	63.79
20. MRH 287/PITANGA	101.33	198.64	335.22	0.43	0.42	335.22	26.13	810.00	1,530.00	2,590.00	37.21
21. MRH 288/Ext. OESTE PARANAENSE	3,234.55	5,711.90	9,048.13	11.67	12.00	9,048.13	101.29	3,140.00	4,640.00	6,370.00	91.52
22. MRH 289/SUDOESTE PARANAENSE	1,006.21	1,545.04	2,428.76	3.13	3.25	2,428.76	68.71	2,130.00	3,300.00	5,280.00	75.86
23. MRH 290/ C. de GUARAPUAVA	1,022.30	2,000.58	3,480.28	4.49	4.20	3,480.28	97.74	3,030.00	5,130.00	8,130.00	116.81
24. MRH291/ MEDIO IGUAÇU	452.69	790.96	1,416.72	1.83	1.66	1,416.72	80.65	2,500.00	3,900.00	6,500.00	93.39
Subtotal of MRH/Average of MRH	26,388.80	47,590.93	77,516.30	100.00	100.00	77,516.30	100.00	3,100.00	4,800.00	6,960.00	100.00
Contribution of Hydroelectric Power Stations	1,222.20	2,354.07	3,837.70	---	---	3,837.70	---	---	---	---	---
Total of the STATE/Average of the STATE	27,811.00	49,945.00	81,354.00	---	---	81,354.00	---	3,240.00	5,040.00	7,310.00	---

Source: Estatística Econômico-Financeira (Finance Economic Statistics) 74/85, 86/87, 88/89 and 91/93 - SEFA; Fundo de Participação dos Municípios - Índices Provisórios - 95 (Municipalities' Participation Fund - Preliminary Indexes - 95) - SEFA

Remark: Values in 2005 and 2015 were projected by JICA Team

: % of GRDP per Capita means ratio from average of Paraná State

1.2 Industrial Water

1.2.1 Present Situation of Industrial Water Consumption

(1) General

The study for industrial water demand is to be done by using the following information, generally:

- Present water consumption volume and water recovery rate of factories by industrial type
- Value added of factories by industrial type
- GDP (GRDP) of Secondary Sector (Industrial Sector)

Unfortunately, the Team obtained very little information about industrial water consumption, and the information obtained is shown below:

- SANEPAR: approximately 7,900 factories with consumption volume are listed by category of consumption volume per month;
- IAP: 563 factories with applying consumption volume are listed as granted (per river basin and per municipality);
932 factories with present water consumption volume and effluent volume were listed per river basin and per municipality in the inventory of water resources in Paraná State (but the inventory is incomplete);
- SEIC: the number of factories in Paraná State (approximately 25,600 units) per MRH and by industrial type in 1993 are listed.

Therefore, in the Study the present industrial water consumption can roughly be estimated.

(2) Water Consumption

For the time being, the following results could be achieved according to the analysis made with the information mentioned above:

- 563 factories granted for water use: approximately 476,000 m³/day is estimated, as intake volume;
- 932 factories listed in the inventory of water resources in Paraná State: approximately 900 factories are using 362,000 m³/day, estimated by the sewage discharge volume or 8 hours/day of average operating time of the water pumps, and added drinking water (5%), the volume estimated is of 401,000 m³/day, approximately;
- water from water service undertakers (SANEPAR): 7,900 factories are using 960,000 m³/month (41,000 m³/day). Among these factories, 216 factories (2.60%) use more than 500 m³/month (average consumption 153 m³/day), other 7,680 factories (97.40%) were factories with small consumption, using an average of 1.65 m³/day.

1) Estimated Present Water Consumption Volume

Present water consumption volume is estimated by classifying the total number of factories (25,600 units-listed by SEIC) into three categories, as follows:

- Large Consumer: 900 factories with total consumption volume of 401,000 m³/day, which are listed in the inventory of IAP.
- Medium Consumer: 8,800 factories supplied by water service undertakers with total consumption volume of 46,000 m³/day (7,900 factories supplied by SANEPAR + 900 factories supplied by other water service undertakers).
- Small Consumer: 15,900 factories with total consumption volume of 27,000 m³/day (approximately 1.65 m³/day . factory, considered as factory with small consumption supplied by SANEPAR).

The present water consumption is summarized as shown below in Table - 1.17.

Table - 1.17 Present Industrial Water Consumption Volume - 1993

	Large Consumer	Medium Consumer	Small Consumer	Total
Number of Establishments	900	8,800	15,900	25,600
Consumption Volume (m ³ /day)	401,000	46,000	27,000	474,000

1.2.2 Estimation of Unit Consumption Rate

(1) Present Average Unit Consumption Rate per Value Added (V.A.)

Based on the estimated present industrial consumption volume (shown in Table - 1.17) and on the estimated value added of Secondary Sector, excluding the contribution of hydroelectric power stations (shown in table - 1.24), the present unit consumption rate is estimated below:

$$474,000 \text{ m}^3/\text{day} \div 8,072.80 \text{ million US\$} = 0.059 \text{ m}^3/\text{day } 1,000.00 \text{ US\$ (V.A.)}$$

(2) Future Average Unit Consumption Rate per Value Added (V.A.)

For the estimation of future unit consumption rate, one of the most fundamental information is the water recovery rate of industrial water. However, this information is not available presently. Therefore, this unit rate is estimated applying 50% of the industrial water recovery rate (75%) in 1993 of Japan, for the target year 2015. In other words, future average water recovery rate of industrial water in Paraná State is estimated by an increase of 19% in 2005 and 37.5% in 2015, respectively. The estimated average unit consumption rate is shown below in Table - 1.18.

Table - 1.18 Average Unit Consumption Rate per Value Added - 1993, 2005 and 2015

Unit Rate - 1993 Unit Rate with Present Recovery Rate m ³ /day . US\$ 1,000.00 (V.A.)	Unit Rate - 2005 Increase of Water Recovery Rate: 19% m ³ /day . US\$ 1,000.00 (V.A.)	Unit Rate - 2015 Increase of water Recovery Rate: 37.50% m ³ /day . US\$ 1,000.00 (V.A.)
0.059	0.048	0.037

And as a reference, information of Japan about average unit consumption rate per value added in 1985 and 1993, and unit consumption rate per value added by industrial type in 1990 are presented as Table - 1.19 and Table - 1.20, respectively.

Table-1.19 Unit Consumption Rate of Industrial Water in Japan - 1985 and 1991.

Year	GDP Million US\$	GDP by Secondary Sector US\$		Water Demand 10 ³ m ³ /day			Water Consumption Rate m ³ /day 1,000.00 US\$ (VA)	Recycling Rate (%)	Fresh Water Consumption Rate m ³ /day 1,000.00 US\$ (VA)
		Value Million US\$	% ⁽²⁾	Factory unit more than 30 workers	Other factory	Total			
1985	1,344,251 (2,344,472)	444,616 (776,620)	33.1 *(3)	137,300	19,730*(1)	157,030	0.353 (0.202)	74.6	0.090 (0.051)
1991	3,346,411	1,072,852	32.0	149,100	21,420	170,520	0.159	76.0	0.038
*(1) Average							0.181	75.3	(0.045)

Source: World Statistics (1994) Div. Statistics of Management & Coordination Agency - Japan
Census of Water Resources (1994) Japan Land Agency

Remark: *(1) estimated number

: *(2) in percentage of participation of Secondary Sector in GDP (Secondary Sector not includes the construction sector)

: US\$ 1.00 = 238.54 Yen (1985), and US\$ 1.00 = 136.67 Yen (1991)

: (.....) in 1985 was calculated using the Exchange Rate of US\$ 1.00 = 136.67 Yen (1991)

: *(3) Average of Water Consumption Rate and Fresh Water Consumption Rate were calculated using the Exchange Rate of US\$ 1.00 = 136.67 (1991)

Table - 1.20 Unit Consumption Volume of Industrial Water per Type Activity in Japan / 1991

Code	Type of Activity	Consumption Volume m ³ /day US\$ 1,000.00 (VA)	Recycling Rate (%)	Fresh Water Consumption Volume m ³ /day US\$ 1,000.00 (VA)
12	Food Production	0.095	38.1	0.059
13	Beverage and Tobacco Production	0.070	29.6	0.049
14	Textile Production	0.230	20.7	0.182
15	Clothing Production	0.008	0.6	0.008
16	Wood and Lumber Production	0.015	15.8	0.012
17	Furniture Production	0.008	11.4	0.007
18	Wood Pulp and Paper Production	0.884	43.3	0.501
19	Editorial and Graphical Art Prod.	0.013	76.9	0.003
20	Chemical Production	0.594	81.4	0.110
21	Refinery of Oil and Coal	1.615	88.2	0.191
22	Plastic Material Production	0.118	61.2	0.046
23	Rubber Production	0.110	76.4	0.026
24	Leather, Skins and Similar Prod.	0.016	4.9	0.015
25	Ceramics and Stone Production	0.144	71.6	0.041
26	Metallurgy Production	0.937	89.9	0.095
27	Non-Metallic Mineral Production	0.229	71.2	0.066
28	Metallic Mineral Production	0.032	45.5	0.017
29	General Mechanics Production	0.024	66.8	0.008
30	Electrical and Mechanics Prod.	0.040	72.0	0.011
31	Transportation Material Prod.	0.144	92.5	0.011
32	Precision Mechanics Production	0.024	49.9	0.012
33	Arms and Weapon Production	0.008	39.8	0.005

Source : Report of Unit Rate Research for Industry / March, 1993

Remark: Data Regarding Consumption Volume, Recycling Rate and Fresh Water Consumption

Volume is of 1990, and of Factory Unit more than 30 workers

: Exchange Rate is US\$ 1.00 = Yen 136,67 (1991)

1.2.3 Water Demand Projection

(1) Water Demand Projection for Base Case in 1993, 2005 and 2015

The water demand for the target years was estimated by multiplying GRDP by Secondary Sector per MRH of each year (shown in Table - 1.24) by average unit consumption rate of the corresponding year, and is presented in Table - 1.22.

(2) Water Demand Projection for Alternative Case in 2005 and 2015

According to the concept of Alternative Regional Development Plan and Alternative Socio-Economic Framework, which mentioned in Section of Domestic Water, estimated industrial water demand by Alternative Case in 2005 and 2015 is shown in Table - 1.23.

(3) Comparison of Water Demand between the Base Case and Alternative Case in 2005 and 2015

As the comparison, the difference of the industrial water demand between Base Case and Alternative Case in 2005 and 2015 is shown below in Table - 1.21.

Table - 1.21 Comparison of Industrial Water Demand between Base Case and Alternative Case in 2005 and 2015

	2005			2015		
	Industrial Water Demand (m ³ /day)		(Decrease) or Increase (m ³ /day)	Industrial Water Demand (m ³ /day)		(Decrease) or Increase (m ³ /day)
	Base Case	Alternative Case		Base Case	Alternative Case	
MRH 268/Curitiba	371,690	333,690	(36,000)	475,250	404,950	(70,300)
MRH 273/C. Ponta Grossa	51,690	56,970	5,280	64,890	75,070	10,180
MRH 281/N. N. Londrina	59,300	70,580	11,280	76,230	97,690	21,460
MRH 282/N. N. Maringá	54,370	61,090	6,720	76,200	89,150	12,950
MRH 288/Extr. Oeste Paranaense	30,090	42,810	12,720	31,460	57,170	25,710

Table - 1.22 Projected Industrial Water Demand per Region (MRH) in 1993, 2005 and 2015 / Base Case

YEAR	1993				2005				2015			
	VA (Secondary Sector) 1,000.00 US\$	Unit Rate M3/D. US\$ 10 ³	Demand M3/day	VA (Secondary Sector) 1,000.00 US\$	Unit Rate M3/D. US\$ 10 ³	Demand M3/day	VA (Secondary Sector) 1,000.00 US\$	Unit Rate M3/D. US\$ 10 ³	Demand M3/day	VA (Secondary Sector) 1,000.00 US\$	Unit Rate M3/D. US\$ 10 ³	Demand M3/day
1. MRH 268/CURITIBA	4,261,840	0.059	251,450	7,743,530	0.048	371,690	12,844,630	0.037	475,250			
2. MRH 269/L. PARANAENSE	42,920	0.059	2,530	17,010	0.048	820	8,750	0.037	320			
3. MRH 270/ALTO RIBEIRA	14,890	0.059	880	22,650	0.048	1,090	35,030	0.037	1,300			
4. MRH 271/A. RIO NEGRO	6,770	0.059	400	12,890	0.048	620	24,160	0.037	890			
5. MRH 272/C. da LAPA	144,480	0.059	8,520	259,400	0.048	12,450	461,010	0.037	17,060			
6. MRH 273/C. de PONTA GROSSA	530,690	0.059	31,310	1,076,900	0.048	51,690	1,753,810	0.037	64,890			
7. MRH 274/C. de JAGUARAIVA	147,340	0.059	8,690	371,520	0.048	17,830	714,920	0.037	26,450			
8. MRH 275/S. MATEUS do SUL	30,250	0.059	1,790	48,950	0.048	2,350	91,880	0.037	3,400			
9. MRH 276/Col. de IRATI	53,750	0.059	3,170	102,170	0.048	4,900	179,220	0.037	6,630			
10. MRH 277/ALTO IVAI	4,780	0.059	280	8,300	0.048	400	14,900	0.037	550			
11. MRH 278/N. V. DE WENCESLAU B.	10,440	0.059	620	29,970	0.048	1,440	61,210	0.037	2,270			
12. MRH 279/N. V. JACAREZINHO	147,340	0.059	8,690	289,030	0.048	13,870	472,990	0.037	17,500			
13. MRH 280/ALG. de ASSAI	32,520	0.059	1,920	40,370	0.048	1,940	49,030	0.037	1,810			
14. MRH 281/N. N. LONDRINA	654,410	0.059	38,610	1,235,390	0.048	59,300	2,060,310	0.037	76,230			
15. MRH 282/N. N. MARINGA	532,350	0.059	31,410	1,132,770	0.048	54,370	2,059,370	0.037	76,200			
16. MRH 283/N. Noviss. PARANAVAI	98,390	0.059	5,810	198,550	0.048	9,530	353,600	0.037	13,080			
17. MRH 284/N. N. APUCARANA	152,550	0.059	9,000	359,040	0.048	17,230	632,910	0.037	23,420			
18. MRH 285/N. Noviss. UMUARAMA	128,480	0.059	7,580	241,850	0.048	11,610	418,130	0.037	15,470			
19. MRH 286/C. MOURAO	152,110	0.059	8,970	286,980	0.048	13,780	496,730	0.037	18,380			
20. MRH 287/PITANGA	5,590	0.059	330	11,270	0.048	540	20,060	0.037	740			
21. MRH 288/Ext. O. PARANAENSE	424,100	0.059	25,020	626,890	0.048	30,090	850,150	0.037	31,460			
22. MRH 289/SUD. PARANAENSE	168,980	0.059	9,970	400,320	0.048	19,220	746,020	0.037	27,600			
23. MRH 290/C. de GUARAPUAVA	180,500	0.059	10,650	315,380	0.048	15,140	600,430	0.037	22,220			
24. MRH291/MEDIO IGUAQU	147,330	0.059	8,690	260,820	0.048	12,520	323,050	0.037	11,950			
TOTAL PARANA STATE	8,072,800		476,290	15,091,930		724,420	25,272,300		935,070			

Remark: D.US\$ 10³ is day - 1,000.00 US\$

: US\$. V.A. is Value Added in US\$

Table - 1.23 Projected Industrial Water Demand per Region (MRH) in 2005 and 2015/Alternative Case

YEAR	No. and NAME of MRH	2005				2015				
		VA (Secondary Sector) 1,000 US\$	Unit Rate m ³ /day . 1,000 US\$ - VA	Demand m ³ /day	VA(Secondary Sector) 1,000 US\$	Unit Rate m ³ /day . 1,000 US\$ - VA	Demand m ³ /day	VA(Secondary Sector) 1,000 US\$	Unit Rate m ³ /day . 1,000 US\$ - VA	Demand m ³ /day
	1. MRH 268/CURITIBA	6.993.530	0.048	335.690	10.944.630	0.037	404.950			
	2. MRH 269/L. PARANAENSE	17.010	0.048	820	8.750	0.037	320			
	3. MRH 270/ALTO RIBEIRA	22.650	0.048	1.090	35.030	0.037	1.300			
	4. MRH 271/A. RIO NEGRO	12.890	0.048	620	24.160	0.037	890			
	5. MRH 272/C. da LAPA	259.400	0.048	12.450	461.010	0.037	17.060			
	6. MRH 273/C. de PONTA GROSSA	1.186.900	0.048	56.970	2.028.810	0.037	75.070			
	7. MRH 274/C. de JAGUARUAIVA	371.520	0.048	17.830	714.920	0.037	26.450			
	8. MRH 275/S. MATEUS do SUL	48.950	0.048	2.350	91.880	0.037	3.400			
	9. MRH 276/Col. de IRATI	102.170	0.048	4.900	179.220	0.037	6.630			
	10. MRH 277/ALTO IVAI	8.300	0.048	400	14.900	0.037	550			
	11. MRH 278/N. V. DE WENCESLAU B.	29.970	0.048	1.440	61.210	0.037	2.270			
	12. MRH 279/N. V. JACAREZINHO	289.030	0.048	13.870	472.990	0.037	17.500			
	13. MRH 280/ALG. de ASSAI	40.370	0.048	1.940	49.030	0.037	1.810			
	14. MRH 281/N. N. LONDRINA	1.470.390	0.048	70.580	2.640.310	0.037	97.690			
	15. MRH 282/N. N. MARINGA	1.272.770	0.048	61.090	2.409.370	0.037	89.150			
	16. MRH 283/N. Noviss. PARANAIVAI	198.550	0.048	9.530	353.600	0.037	13.080			
	17. MRH 284/N. N. APUCARANA	359.040	0.048	17.230	632.910	0.037	23.420			
	18. MRH 285/N. Noviss. UNGARAMA	241.830	0.048	11.610	418.130	0.037	15.470			
	19. MRH 286/C. MOURAO	286.980	0.048	13.780	496.730	0.037	18.380			
	20. MRH 287/PITANGA	11.270	0.048	540	20.060	0.037	740			
	21. MRH 288/Ext. O. PARANAENSE	891.890	0.048	42.810	1.545.150	0.037	57.170			
	22. MRH 289/SUD. PARANAENSE	400.320	0.048	19.220	746.020	0.037	27.600			
	23. MRH 290/C. de GUARAPUAVA	315.380	0.048	15.140	600.430	0.037	22.220			
	24. MRH291/ MEDIO IGUAÇU	260.820	0.048	12.520	323.050	0.037	11.950			
	TOTAL PARANA STATE	15.091.930		724.420	25.272.300		935.070			

Remark: US\$ - V.A. is Value Added in US\$

Table -1.24 GRDP per MRH/Primary Sector and Secondary Sector/ in 1993, 2005 and 2015

No. and Name of MRH	PRIMARY SECTOR						SECONDARY SECTOR					
	GRDP /MRH (US\$ Million)			GRDP /MRH (US\$ Million)			GRDP /MRH (US\$ Million)			GRDP /MRH (US\$ Million)		
	1993	%	2005	1993	%	2015	1993	%	2005	1993	%	2015
1. MRH 268/CURITIBA	55.82	1.77	75.77	1.98	102.35	2.10	4,261.84	52.79	7,745.53	51.31	12,844.63	50.82
2. MRH 269/L. PARANAENSE	4.33	0.14	6.11	0.16	7.80	0.16	42.92	0.53	17.01	0.11	8.75	0.03
3. MRH 270/ALTO RIBEIRA	7.12	0.23	12.29	0.32	19.98	0.41	14.89	0.18	22.65	0.15	35.03	0.14
4. MRH 271/A. RIO NEGRO	10.14	0.32	12.19	0.32	15.11	0.31	6.77	0.08	12.89	0.09	24.16	0.10
5. MRH 272/ C.da LAPA	75.47	2.40	110.70	2.89	163.77	3.36	144.48	1.79	259.40	1.72	461.01	1.82
6. MRH 273/C. de PONTA GROSSA	171.57	5.45	262.20	6.84	362.14	7.43	530.69	6.57	1,076.90	7.14	1,753.81	6.94
7. MRH 274/C. de JAGUARIAVA	58.20	1.85	89.57	2.34	129.16	2.65	147.34	1.83	371.52	2.46	714.92	2.83
8. MRH 275/S. MATEUS do SUL	22.69	0.72	29.51	0.77	40.94	0.84	30.25	0.37	48.95	0.32	91.88	0.36
9. MRH 276/Col. de IRATI	49.17	1.56	76.48	2.00	109.67	2.25	53.75	0.67	102.17	0.68	179.22	0.71
10. MRH 277/ALTO IVAI	19.03	0.60	22.60	0.59	27.29	0.56	4.78	0.06	8.30	0.05	14.90	0.06
11. MRH 278/N. V. DE WENCESLAU B.	58.67	1.86	53.63	1.40	56.54	1.16	10.44	0.13	29.97	0.20	61.21	0.24
12. MRH 279/N. V. JACAREZINHO	180.86	5.74	215.88	5.64	259.30	5.32	147.34	1.83	289.03	1.92	472.99	1.87
13. MRH 280/ALG. de ASSAI	61.62	1.96	69.10	1.80	71.65	1.47	32.52	0.40	40.37	0.27	49.03	0.19
14. MRH 281/N. N. LONDRINA	311.08	9.88	383.33	10.01	486.43	9.98	654.41	8.11	1,235.39	8.19	2,060.31	8.15
15. MRH 282/N. N. MARINGA	199.17	6.32	310.59	8.11	442.07	9.07	532.35	6.59	1,132.77	7.51	2,059.37	8.15
16. MRH 283/N. Noviss. PARANAVAI	108.97	3.46	93.05	2.43	84.81	1.74	98.39	1.22	198.55	1.32	353.60	1.40
17. MRH 284/N. N. APUCARANA	122.17	3.88	125.62	3.28	139.88	2.87	152.55	1.89	359.04	2.38	632.91	2.50
18. MRH 285/N. Noviss. UMUARAMA	154.68	4.91	89.03	2.32	55.56	1.14	128.48	1.59	241.83	1.60	418.13	1.65
19. MRH 286/C. MOURAO	282.36	8.97	309.39	8.08	366.04	7.51	152.11	1.88	286.98	1.90	496.73	1.97
20. MRH 287/PITANGA	39.16	1.24	56.90	1.49	79.45	1.63	5.59	0.07	11.27	0.07	20.06	0.08
21. MRH 288/Ext. OESTE PARANAENSE	675.86	21.46	860.00	22.45	1,116.14	22.90	424.10	5.25	626.89	4.15	850.15	3.36
22. MRH 289/SUDOESTE PARANAENSE	239.34	7.60	234.31	6.12	272.46	5.59	168.98	2.09	400.32	2.65	746.02	2.95
23. MRH 290/ C. de GUARAPUAVA	165.60	5.26	231.38	6.04	329.48	6.76	180.50	2.24	315.38	2.09	600.43	2.38
24. MRH291/ MEDIO IGUAÇU	75.92	2.41	101.37	2.65	135.98	2.79	147.33	1.83	260.82	1.73	323.05	1.28
Subtotal of MRH	3,149.00	100.00	3,831.00	100.00	4,874.00	100.00	8,072.80	100.00	15,091.93	100.00	25,272.30	100.00
Contribution of Hydroelectric Power Stations	---	---	---	---	---	---	1,222.20	---	2,354.07	---	3,837.70	---
TOTAL OF THE STATE	3,149.00	---	3,831.00	---	4,874.00	---	9,295.00	---	17,446.00	---	29,110.00	---

Source: Estatística Econômico-Financeira (Finance Economic Statistics) 74/85, 86/87, 88/89 and 91/93 - SEFA; Fundo de Participação dos Municípios - Índices Provisórios - 95 (Municipalities' Participation Fund - Preliminary Indexes - 95) - SEFA

Remark: Values in 2005 and 2015 were projected by JICA Team

CHAPTER 2 MASTER PLAN FOR IGUAÇU RIVER BASIN

2.1 Domestic Water

2.1.1 Present Situation of Domestic Water Consumption

(1) General

1) Regional Unit and Zoning of the Study

According to the regional unit of collected data concerning the socio-economic area and the domestic water consumption, it was decided to use the municipalities as a regional unit. Therefore, the zoning lines for the Study were drawn following the boundary lines of the municipalities. However, as the Study should be made by river basin, it was decided to use the following criteria for inclusion (or exclusion) of municipalities that straddle other river basins, in the zoning of the Study:

- All municipalities that have their urban center located within the river basin, regardless if only a part of the urban area is inside the river, were included in the zoning.
- If the urban center of the municipality is not included in this basin, but there is a chance that this municipality will start to use a small river that belongs to this river basin in the future, the municipality is included in the zoning.
- In the case of only a small part of the rural area of the municipality, approximately less than 10% of total area, be included in this river basin, the municipality is excluded of the zoning.
- Recommendations of the Counterpart Team were considered as to the inclusion of municipalities in the zoning, in accordance to the criteria, such as water supply system of undertakers.

The zoning for this river basin is composed of 101 municipalities, and is presented in Figure - 2.1.

2) Average Unit Consumption Rate of Paraná State and Unit Consumption Rate per MRH - 1993, 2005 and 2015

As described in Section - 1, the presented average unit consumption rate of Paraná state and the present unit consumption rate per MRH, and future unit consumption rate regarding what was mentioned above, were estimated as shown in Table - 2.1, Table - 2.2 and Table - 2.3.

Table - 2.1 Average Unit Consumption Rate of Paraná State - 1993, 2005 and 2015

	Average Unit Consumption Rate (l / person . day)								
	Residential Water			Non-Residential Water			Total Domestic Water		
	1993	2005	2015	1993	2005	2015	1993	2005	2015
Urban Population	90	115	140	25	30	40	115	145	180
Rural Population	70	75	80	0	0	0	70	75	80

Remark: Unit rate of residential water for rural population was estimated as unit rate of the 3rd Category of the classification of MRH (shown in Table-2.2 and Table -2.3)

Table - 2.2 Unit Consumption Rate per MRH - 1993

	Classification	No. of MRH	Unit Consumption Rate (l / person . day)		
			Residential Water	Non-Residential Water	Total Domestic Water
Urban Population	1st Category	MRH 268, 281, 282	100	30	130
	2nd Category	MRH 269, 270, MRH 272 to MRH 276, MRH 279 to MRH 280, MRH 283 to MRH 286, MRH 288 to MRH 291	85	20	105
	3rd Category	MRH 271, 277, 278, 287	70	15	85
Rural Population	----	All MRH	70	---	70

Table - 2.3 Unit Consumption Rate per MRH - 2005 and 2015

	Classification	No. of MRH	Unit Consumption Rate (l / person . day)					
			Residential Water		Non-Residential Water		Total Domestic Water	
			2005	2015	2005	2015	2005	2015
Urban Population	1st Category	MRH 268, 281, 282, 288	125	155	35	45	160	200
	2nd Category	MRH 269, 270, MRH 272 to MRH 276, MRH 279 to MRH 280, MRH 283, MRH 285 to MRH 286, MRH 289 to MRH 291	100	125	30	35	130	160
	3rd Category	MRH 271, 277, 278, 284, 287	75	80	20	25	95	105
Rural Population	----	All MRH	75	80	---	---	75	80

(2) Present Unit Consumption Volume per Municipality

The 101 municipalities in the Study Zoning were related to 11 MRH, and each MRH was composed of municipalities with different sizes in terms of population and GRDP, therefore the Team collected the data of present unit consumption volume of residential water of some large-medium size municipalities in this river basin. Based on the information provided by ABC/SANEPA, the unit consumption volume of 12 selected municipalities is presented in Table - 2.4.

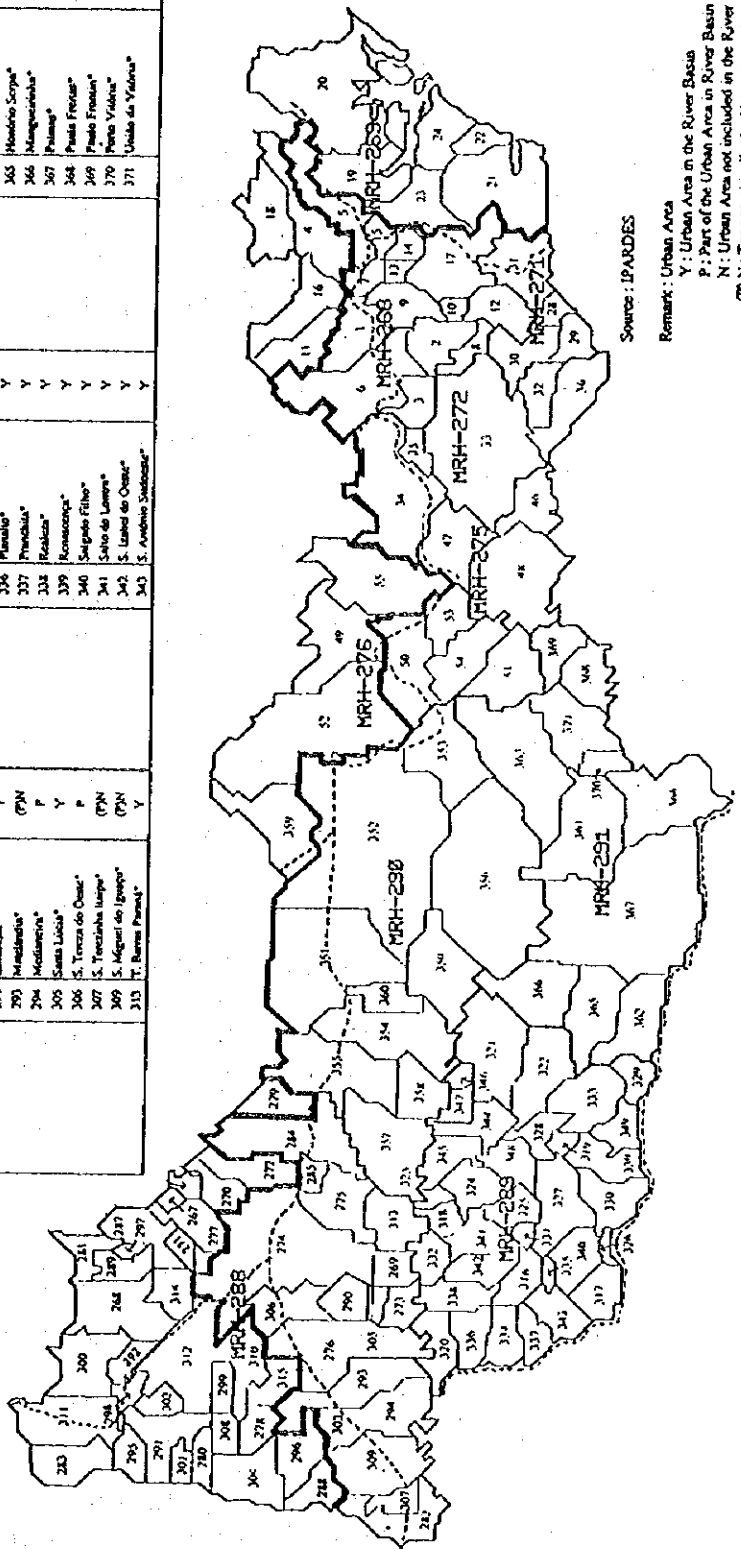
Table - 2.4 Present Unit Consumption Volume of Large and Medium Size Municipalities - 1993

No. and Name of MRH	No. and Name of Municipality	Average Consumption Volume per Month (m ³)	Service Population Estimated by SANEPA	Estimated Consumption Volume per Capita (l/day)
MRH 268 Curitiba	2 Araucária	129,776	56,128	77.07
	9 Curitiba	4,470,662	1,340,585	111.16
	17 S. José dos Pinhais	231,614	95,719	80.66
MRH 272/Campos da Lapa	36 Rio Negro	47,658	19,612	81.00
MRH 275/S. Mateus do Sul	48 São Mateus do Sul	40,512	16,758	80.58
MRH 288/Extr. O. Paranaense	274 Cascavel	468,394	171,538	91.02
	282 Foz do Iguaçu	533,569	168,849	105.33
	312 Toledo	187,816	68,430	91.49
MRH 289/Sud. Paranaense	322 Coronel Vivida	28,327	11,900	79.35
	327 Francisco Beltrão	118,736	45,193	87.58
	333 Pato Branco	119,193	43,432	91.48
MRH 290/C. Guarapuava	352 Guarapuava	152,056	101,722	84.62

Source: APC/SANEPA

Municipalities in Iguauçu River Basin

No. and Name of MRH	No.	Name	Urban Area	No. and Name of MRH	No.	Name	Urban Area	No. and Name of MRH	No.	Name	Urban Area	No. and Name of MRH	No.	Name	Urban Area
MRH 268 Candeia	1	Alm. Tingüará*	Y	MRH 272 Campos de Lago	32	Campos de Tenório*	Y	MRH 279 Sudoeste Paranaense (cont)	316	Amparo*	Y	MRH 290 Campos de Grammares	330	Candeia*	Y
	2	Arundina*	Y		33	Lago*	Y		317	Barral*	Y		344	São João*	Y
	3	Balsa Nova*	Y		34	Palmeira*	Y		318	Boa Esperança do Iguauçu*	Y		345	São João do Oeste*	Y
	4	Campina Oeste do Sul*	(PN)	35	Ponte Amarelas*	Y	319		Boa Sucesso do Sul*	Y	346		Saudade do Iguauçu*	Y	
	5	Campo Largo*	Y	36	Rio Negro*	Y	320		Copacabana*	Y	347		Silveira*	Y	
	6	Colônia*	Y	46	Arundina Oeste*	Y	321		Chapadinho*	Y	348		Vaçara*	Y	
	7	Condição*	Y	47	São João Trensfer*	Y	322		Coronel Viriato*	Y	349		Viamão*	Y	
	8	Cristóvão*	Y	48	São Mateus do Sul*	Y	323		Cruciano do Iguauçu*	Y					
	9	Curitiba*	Y	50	Irati*	Y	324		Orléans Votado*	Y					
	10	Estância Rio Grande*	Y	51	Mallet*	Y	325		Est. Marquês*	Y					
	11	Estância Rio Grande*	Y	52	Robinet*	Y	326		Flor da Serra do Sul*	Y					
	12	Mandrituba*	Y	54	Rio Azul*	Y	327		Francisco Bahlus*	Y					
	13	Pinhal*	Y	269	B. Vila Agrícola*	Y	328		Império do Oeste*	Y					
	14	Pratânia*	Y	273	C. Leão Marquês*	Y	329		Manoelito*	Y					
	15	Quatro Barras*	Y	274	Cacavei*	Y	330		Mariópolis*	Y					
	16	S. José das Palmeiras*	Y	275	Carandina*	Y	331		N. Esperança do Sudoeste*	Y					
	17	S. José das Palmeiras*	Y	276	Civ. Azai*	(PN)	332		N. Pira do Iguauçu*	Y					
18	Aguaçu do Sul*	Y	282	Foz do Iguauçu*	(PN)	333	Pão Branco*	Y							
19	Itaipu*	Y	284	Guarânia*	Y	334	Pinhal São Bento*	Y							
20	Ouricangá*	Y	290	Itaipua*	Y	335	Piratuba*	Y							
21	Tijucas do Sul*	Y	291	Medianeira*	Y	336	Ponteio*	Y							
			294	Medianeira*	Y	337	Pratânia*	Y							
			305	Santa Lúcia*	Y	339	Ressaca*	Y							
			307	S. Trizão do Oeste*	Y	340	Sergipe Filho*	Y							
			309	S. Terezinha Impor*	Y	341	S. João de Lameira*	Y							
			309	S. Miguel do Iguauçu*	(PN)	342	S. Lázaro do Oeste*	Y							
			313	T. Barão Pombal*	Y	343	S. Antônio Sudoeste*	Y							
			311		Y										
			312		Y										
			313		Y										
			314		Y										
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			334		Y										
			335		Y										
			336		Y										
			337		Y										
			338		Y										
			339		Y										
			340		Y										
			341		Y										
			342		Y										
			343		Y										
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			363		Y										
			364		Y										
			365		Y										
			366		Y										
			367		Y										
			368		Y										
			369		Y										
			370		Y										
			371		Y										



Source: IPARDES

Remark: Urban Area

Y: Urban Area in the River Basin

P: Part of the Urban Area in River Basin

N: Urban Area not included in the River Basin

(?) N: Topographically the Urban Area does not belong to the River Basin, but the Study will consider it as a part of it

Figure - 2.1 Zoning of the Study / Iguauçu River Basin

2.1.2 Estimation of Unit Consumption Rate per Municipality

(1) Present Unit Consumption Rate per Municipality

1) Unit Consumption Rate per Municipality of Residential water for Urban Population

According to Table - 2.2 and Table - 2.4, this unit rate was estimated tentatively between unit rate of large-medium size municipalities and other municipalities, by adjusting it to the total water demand per MRH to which they belong, calculated by multiplying the unit rate per MRH by the urban population per MRH.

2) Unit Consumption Rate per Municipalities of Non-Residential Water for Urban Population

This unit was estimated by the same method mentioned above, approximately in the same proportion between the unit rate of residential water and non-residential water of the MRH to which they belong.

3) Unit Consumption Rate per Municipality for Rural Population

This unit rate was estimated using the same figure of the unit consumption rate per MRH and average unit consumption rate of Paraná State. It means that the same unit rate was applied to all municipalities.

According to what was mentioned above, present unit consumption rate per municipality for urban population and rural population is shown in Table - 2.5.

(2) Future Unit Consumption Rate per Municipality

1) Unit Consumption Rate per Municipality of Residential water for Urban Population

Based on the unit consumption rate per MRH in 2005 and 2015 (shown in Table - 2.3) and present unit consumption rate per municipality (shown in Table - 2.4), this unit rate was estimated by the same method mentioned in the previous Section, approximately in the same proportion of present unit consumption rate between large-medium size municipalities and other municipalities.

2) Unit Consumption rate per Municipality of Non-Residential Water for Urban Population

Based on the unit consumption rate per MRH in 2005 and 2015, this unit rate was estimated by the same method of present unit consumption rate per municipality.

3) Unit Consumption Rate per Municipality for Rural Population

This unit in 2005 and 2015 was estimated using the same figure of the unit consumption rate per MRH in 2005 and 2015, respectively.

According to what was mentioned above, the unit consumption rate per municipality in 2005 and 2015 is shown in Table - 2.6 and Table - 2.7, respectively.

Table - 2.5 Present Unit Consumption Rate per Municipality of Domestic Water - 1993

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l / person . day)				
			Urban Population			Rural Population	
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water	
1st Category	MRH 268/Curitiba	Curitiba	110	35	145	70	
		Other Municipalities	80	20	100	70	
2nd Category	MRH 272/Campos da Lapa MRH 275/S. Mateus do Sul MRH 276/Col. Irati MRH 290/C. Guarapuava MRH 291/Médio Iguçu	All Municipalities	85	20	105	70	
		MRH 288/Extr. Oeste Paranaense	Foz do Iguçu	105	35	140	
			Cascavel	90	20	110	
			Other Municipalities	70	15	85	70
		MRH 289/Sud. Paranaense	Pato Branco, Francisco Beltrão	90	25	115	
Other Municipalities	80	20	100	70			
3rd Category	MRH 271/A. Rio Negro	All Municipalities	70	15	85	70	

Source: APC/SANEPAR

Remark: Toledo in MRH 288 does not belong to the Basin but is estimated in the same way as Cascavel

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification

Table - 2.6 Future Unit Consumption Rate per Municipality of Domestic Water - 2005

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l / person . day)				
			Urban Population			Rural Population	
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water	
1st Category	MRH 268/Curitiba	Curitiba	140	40	180		
		Other Municipalities	100	30	130	75	
	MRH 288/Extr. Oeste Paranaense	Foz do Iguçu	140	40	180		
		Cascavel	125	35	160		
2nd Category	MRH 272/Campos da Lapa MRH 275/S. Mateus do Sul MRH 276/Col. Irati MRH 290/C. Guarapuava MRH 291/Médio Iguçu	All Municipalities	100	30	130	75	
		MRH 289/Sud. Paranaense	Pato Branco, Francisco Beltrão	110	35	145	
			Other Municipalities	95	25	120	75
			All Municipalities	75	20	95	75
		3rd Category	MRH 271/A. Rio Negro	All Municipalities	75	20	95

Remark: Toledo in MRH 288 does not belong to the Basin but is estimated in the same way as Cascavel

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification

Table - 2.7 Future Unit Consumption Rate per Municipality of Domestic Water - 2015

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l / person . day)				
			Urban Population			Rural Population	
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water	
1st Category	MRH 268/Curitiba	Curitiba	170	50	220		
		Other Municipalities	135	40	175	80	
	MRH 288/Extr. Oeste Paranaense	Foz do Iguçu	165	50	215		
		Cascavel	155	45	200		
2nd Category	MRH 272/Campos da Lapa MRH 275/S. Mateus do Sul MRH 276/Col. Irati MRH 290/C. Guarapuava MRH 291/Médio Iguçu	All Municipalities	125	35	160	80	
		MRH 289/Sud. Paranaense	Pato Branco, Francisco Beltrão	135	40	175	
			Other Municipalities	115	30	145	80
			All Municipalities	80	25	105	80
		3rd Category	MRH 271/A. Rio Negro	All Municipalities	80	25	105

Remark: Toledo in MRH 288 does not belong to the Basin but is estimated in the same way as Cascavel

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification

2.1.3 Water Demand Projection

(1) Water Demand Projection for Base Case in 1993, 2005 and 2015

Water demand in 1993, 2005 and 2015 was estimated by multiplying the urban and rural population per municipality of each year by the unit consumption rate per municipality of the corresponding year (shown in Table - 2.5, Table - 2.6 and Table - 2.7) as is presented in Table - 2.13 (1)/Table - 2.13 (3), Table - 2.14(1)/Table 2.14(3) and Table - 2.15(1)/ Table - 2.15 (3).

(2) Water Demand Projection for Alternative Case in 2005 and 2015

1) Alternative Development Plan

In Main Report I, alternative regional development plan was estimated as shown below in Table - 2.8, using the MRH as regional unit.

Table - 2.8 Restriction and Distribution of Urban Population, in 2005 and 2015

No. and Name of MRH	2005		2015	
	%	Urban Population	%	Urban Population
MRH 268/Curitiba	100.00	(253,000)	100.00	(465,000)
MRH 271/C. Ponta Grossa	14.70	37,200	14.40	67,000
MRH 281/N.N. Londrina	31.30	79,200	30.60	142,200
MRH 282/N.N. Maringá	18.30	46,300	18.40	85,600
MRH 288/Extr. Oeste Paranaense	35.70	90,300	36.60	170,200

Remark: % is percentage of distribution per MRH

According to the concept of the alternative development plan (described in Section - 1), it was considered that three municipalities: Cascavel, Foz do Iguaçu and Toledo participate in MRH 268/Extr. Oeste Paranaense. The participation of these municipalities is shown in Table - 2.9.

Table - 2.9 Participation of Urban Population of Three Municipalities in 2005 and 2015 by Alternative Case

YEAR	2005		2015	
	%	Urban Population	%	Urban Population
MRH 288/Extr. Oeste Paranaense	100.00	(90,300)	100.00	(170,200)
274 Cascavel	35.00	31,600	35.00	59,600
282 Foz do Iguaçu	50.00	45,200	50.00	85,100
312 Toledo * (1)	15.00	13,500	15.00	25,500

Remark: Toledo is located in other basin

2) Water Demand Projection

Based on the participation mentioned in Table - 2.9, the estimated water demand for urban population of Cascavel and Foz do Iguaçu by Alternative Case in 2005 and 2015 is shown in Table - 2.10 and Table - 2.11, respectively.

Table - 2.10 Estimated Water Demand for Urban Population by Alternative Case in 2005

No. and Name of Municipality		Water Demand for Urban Population					
		Urban Population	Residential Water		Non-Residential Water		Total Urban
No.	Name	in 2005	Unit Rate m ³ /d . p	Demand m ³ /day	Unit Rate m ³ /d . p	Demand m ³ /day	Demand m ³ /day
274	Cascavel	281,880	0.125	35,235	0.035	9,866	45,100
282	Foz do Iguaçu	399,120	0.140	55,877	0.040	15,966	71,840

Remark: m³/d . p = m³/day . person

Table - 2.11 Estimated Water Demand for Urban Population by Alternative Case in 2015

No. and Name of Municipality		Water Demand for Urban Population					
		Urban Population	Residential Water		Non-Residential Water		Total Urban
No.	Name	in 2015	Unit Rate m ³ /d . p	Demand m ³ /day	Unit Rate m ³ /d . p	Demand m ³ /day	Demand m ³ /day
274	Cascavel	362,880	0.155	56,246	0.045	16,330	72,580
282	Foz do Iguaçu	564,840	0.165	93,139	0.050	28,224	121,360

Remark: m³/d . p = m³/day . person

(3) Comparison of Water Demand for Urban Population between Base Case and Alternative Case

As the comparison, the difference of water demand between Base Case and Alternative Case of the two municipalities above, is shown below in Table - 2.12.

Table - 2.12 Comparison of Water Demand for Urban Population between Base Case and Alternative Case

No. and Name of Municipality		2005			2015		
		Water Demand for Urban Population (m ³ /day)		Increase of Water Demand (m ³ /day)	Water Demand for Urban Population (m ³ /day)		Increase of Water Demand (m ³ /day)
No.	Name	Base Case	Alternative Case		Base Case	Alternative Case	
274	Cascavel	40,050	45,100	5,050	60,660	72,580	11,920
282	Foz do Iguaçu	63,710	71,840	8,130	103,070	121,360	18,290

Table - 2.15(1) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 1993 / Base Case

No. and Name of MRH	No. and Name of Municipality		Water Demand for Urban Population					Water Demand for Rural Population			Total Demand m ³ /day												
			Urban Area	Urban Population	Residential Water		Non-Residential Water		Total Domestic Demand	Rural Population		Area Involved (%)	Unit Rate m ³ /d.p										
					Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day															
MRH 268 CURITIBA	No.	Name																					
	1	Almirante Tamandaré	Y	65,600	0,080	5,248	0,020	1,312	6,560	7,045	36,311	0,070	180	6,740									
	2	Araucária	Y	59,259	0,080	4,741	0,020	1,185	5,920	7,680	100,000	0,070	540	6,470									
	3	Balsa Nova	Y	2,627	0,080	210	0,020	53	260	5,266	99,321	0,070	370	630									
	5	Campana Grande do Sul	(PN)	15,192	0,080	1,215	0,020	304	1,520	6,790	14,28	0,070	70	1,590									
	6	Campo Largo	Y	55,837	0,080	4,467	0,020	1,117	5,580	18,791	23,53	0,070	310	5,890									
	7	Colombo	Y	120,802	0,080	9,664	0,020	2,416	12,080	7,404	67,29	0,070	350	12,430									
	8	Contenda	Y	4,925	0,080	394	0,020	99	490	4,118	100,000	0,070	290	780									
	9	Curitiba	Y	1,337,892	0,110	147,168	0,035	46,826	193,990	0	100,000	0,070	0	193,990									
	10	Fazenda Rio Grande	Y	26,498	0,080	2,120	0,020	530	2,650	3,401	100,000	0,070	240	2,890									
	12	Mandirituba	Y	4,669	0,080	374	0,020	93	470	9,452	100,000	0,070	660	1,130									
	13	Pinhais	Y	75,045	0,080	6,004	0,020	1,501	7,510	3,843	100,000	0,070	270	7,780									
	14	Piraquara	Y	20,482	0,080	1,639	0,020	410	2,050	12,847	100,000	0,070	900	2,950									
	15	Quatro Barras	Y	9,149	0,080	732	0,020	183	920	1,825	54,32	0,070	70	990									
	17	S. José dos Pinhais	Y	122,604	0,080	9,808	0,020	2,452	12,260	16,652	73,60	0,070	860	13,120									
	MRH 271 A. RIO NEGRO	28	Aguáes do Sul	Y	752	0,070	53	0,015	11	60	5,451	100,000	0,070	380	440								
		29	Pinó	Y	1,541	0,070	108	0,015	23	130	6,464	100,000	0,070	450	580								
	30	Quitandinha	Y	2,508	0,070	176	0,015	38	210	12,239	100,000	0,070	860	1,070									
	31	Tijucas do Sul	Y	1,280	0,070	90	0,015	19	110	9,314	62,25	0,070	410	520									
MRH 272 C. DA LAPA	32	Campo do Tenente	Y	2,243	0,085	191	0,020	45	240	3,276	100,000	0,070	230	470									
	33	Lapa	Y	20,074	0,085	1,706	0,020	401	2,110	20,809	100,000	0,070	1,460	3,570									
	35	Palmeira	N	0	0,000	0	0,000	0	0	14,533	18,22	0,070	190	190									
	35	Porto Amazonas	Y	2,435	0,085	207	0,020	49	260	1,223	73,98	0,070	60	320									
	36	Rio Negro	Y	20,643	0,085	1,755	0,020	413	2,170	6,203	100,000	0,070	430	2,600									
MRH 275 C. DE PONTA GROSSA	46	Antônio Olinto	Y	675	0,070	57	0,020	14	70	7,268	100,000	0,070	510	580									
	47	São João Truão	Y	2,598	0,085	221	0,020	52	270	9,679	99,43	0,070	670	940									
	48	São Marcos do Sul	Y	16,489	0,085	1,402	0,020	330	1,730	17,605	100,000	0,070	1,230	2,960									
MRH 276 Cbl. de IRATI	50	Irati	N	0	0,000	0	0,000	0	0	16,180	45,51	0,070	520	520									
	51	Mallet	Y	5,948	0,085	506	0,020	119	630	6,146	100,000	0,070	430	1,060									
	53	Rebouças	Y	5,579	0,085	474	0,020	112	590	7,636	98,35	0,070	530	1,120									
	54	Rio Azul	Y	3,260	0,085	277	0,020	65	340	9,426	100,000	0,070	660	1,000									
MRH 288 Ext. Oeste Paranaense	269	B. Vista Aparecida	Y	3,140	0,070	220	0,015	47	270	7,020	100,000	0,070	490	760									
	273	C. León, Marques	Y	5,799	0,070	406	0,015	87	490	5,996	100,000	0,070	420	910									
	274	Catavel	P	185,746	0,090	16,717	0,020	3,715	20,430	14,184	55,57	0,070	550	20,980									
	275	Catanduvas	Y	5,050	0,070	354	0,015	76	430	5,693	100,000	0,070	400	830									
	276	Ceu Azul	(PN)	5,720	0,070	400	0,015	86	490	3,637	79,09	0,070	200	690									

(To be continued)

Table - 2.13(2) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 1993 / Base Case

No. and Name of NRCH	No. and Name of Municipality		Water Demand for Urban Population				Water Demand for Rural Population			Total				
	No.	Name	Urban Area	Urban Population	Residential Water Demand m ³ /d.p.	Unit Rate m ³ /d.p.	Demand m ³ /day	Non-Residential Water Unit Rate m ³ /d.p.	Demand m ³ /day	Total Domestic Demand	Area Involved (%)	Unit Rate m ³ /d.p.	Demand m ³ /day	
NRCH 288 Ext.Oeste Paranaense (cont.)	282	Foz do Iguaçu	(P)N	204,365	0,105	21,458	0,035	7,153	28,610	65,58	0,070	170	28,780	
	284	Guaraçuçu	(P)N	7,965	0,070	558	0,015	119	680	47,03	0,070	430	1,110	
	285	Ibema	P	4,018	0,070	281	0,015	60	340	2,74	0,070	160	500	
	290	Lindóeste	Y	847	0,070	59	0,015	13	70	5,472	0,070	380	450	
	293	Mateiândia	(P)N	8,529	0,070	597	0,015	128	730	4,551	0,070	310	1,040	
	294	Medianeira	P	30,268	0,070	2,119	0,015	454	2,570	8,392	0,070	460	3,030	
	305	Santa Lúcia	Y	1,874	0,070	131	0,015	28	160	2,725	0,070	100	350	
	306	S. Tereza do Oeste	P	3,370	0,070	236	0,015	51	290	55,64	0,070	100	390	
	307	S. Terezinha Itaipu	(P)N	12,189	0,070	853	0,015	183	1,040	2,329	55,04	0,070	90	1,130
	309	S. Miguel do Iguaçu	(P)N	10,321	0,070	722	0,015	155	880	9,401	45,70	0,070	300	1,180
	313	T. Barros Páram	Y	4,040	0,070	283	0,015	61	340	10,060	100,00	0,070	700	1,040
	NRCH 289 Sudoeste Paranaense	316	Ampere	Y	6,043	0,080	483	0,020	121	600	6,760	0,070	470	1,070
		317	Barnado	Y	4,815	0,080	385	0,020	96	480	9,140	0,070	640	1,120
		318	Boa Esperança do Iguaçu	Y	541	0,080	43	0,020	11	50	3,129	0,070	220	270
		319	Bom Sucesso do Sul	Y	1,036	0,080	83	0,020	21	100	2,799	0,070	200	300
		320	Capitania	Y	7,798	0,080	624	0,020	156	780	10,662	0,070	750	1,530
321		Chopinópolis	Y	8,437	0,080	675	0,020	169	840	11,159	0,070	780	1,620	
322		Coronel Vívoda	Y	12,518	0,080	1,001	0,020	250	1,250	12,285	0,070	860	2,110	
323		Cruzeiro do Iguaçu	Y	2,045	0,080	164	0,020	41	210	3,136	0,070	220	430	
324		Dois Vizinhos	Y	21,453	0,080	1,717	0,020	429	2,150	10,350	0,070	730	2,880	
325		Eréias Marques	Y	1,423	0,080	114	0,020	28	140	5,822	0,070	410	550	
326		Flor da Serra do Sul	Y	304	0,080	24	0,020	6	30	4,894	0,070	340	370	
327		Francisco Beltrão	Y	48,417	0,090	4,358	0,025	1,210	5,570	15,017	0,070	1,050	6,620	
328		Itaipava do Oeste	Y	3,962	0,080	317	0,020	79	400	4,903	0,070	340	370	
329		Maripólis	Y	2,896	0,080	232	0,020	58	290	3,368	0,070	240	530	
330		Marmeleiro	Y	6,197	0,080	496	0,020	124	620	9,225	0,070	650	1,270	
331		N. Esperança do Sudoeste	Y	713	0,080	57	0,020	14	70	4,790	0,070	330	400	
332		N. Prata do Iguaçu	Y	4,147	0,080	332	0,020	83	420	6,790	0,070	480	900	
333		Pão Branco	Y	43,856	0,090	3,947	0,025	1,096	5,040	9,210	0,070	650	5,690	
334		Perola do Oeste	Y	3,219	0,080	258	0,020	64	320	8,454	0,070	590	910	
335		Pinhai São Bento	Y	544	0,080	44	0,020	11	50	2,193	0,070	150	200	
336		Planalto	Y	4,064	0,080	325	0,020	81	410	10,336	0,070	720	1,130	
337		Pranchita	Y	2,729	0,080	218	0,020	55	270	5,579	0,070	390	660	
338		Realiza	Y	9,173	0,080	734	0,020	183	920	7,231	0,070	510	1,430	
339	Renasçença	Y	2,120	0,080	170	0,020	42	210	5,348	0,070	370	580		

(To be continued)

Table - 2.13(3) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 1993 / Base Case

No. and Name of MRH	No. and Name of Municipality		Water Demand for Urban Population				Water Demand for Rural Population				Total Demand m ³ /day	
	Urban Area	Urban Population	Residential Water Unit Rate m ³ /d.p	Residential Water Demand m ³ /day	Non-Residential Water Unit Rate m ³ /d.p	Non-Residential Water Demand m ³ /day	Total Domestic Demand	Rural Population	Area Involved (%)	Unit Rate m ³ /d.p		Demand m ³ /day
MRH 289												
Sudoeste Paranaense (cont.)												
	Y	1,804	0,080	144	0,020	36	180	9,278	100,00	0,070	650	830
	Y	4,798	0,080	384	0,020	96	480	8,601	100,00	0,070	600	1,080
	Y	4,573	0,080	366	0,020	91	460	7,388	100,00	0,070	520	980
	Y	8,554	0,080	684	0,020	171	860	8,431	100,00	0,070	590	1,450
	Y	4,899	0,080	392	0,020	98	490	8,343	100,00	0,070	580	1,070
	Y	3,746	0,080	300	0,020	75	380	6,097	100,00	0,070	430	810
	Y	1,943	0,080	155	0,020	39	190	2,656	100,00	0,070	190	380
	Y	931	0,080	74	0,020	19	90	3,964	100,00	0,070	280	370
	Y	2,769	0,080	222	0,020	55	280	7,186	100,00	0,070	500	780
	Y	2,645	0,080	212	0,020	53	270	3,749	100,00	0,070	260	530
MRH 290												
C. de Guarapuava												
	Y	1,811	0,085	154	0,020	36	190	17,459	100,00	0,070	1,220	1,410
	Y	6,792	0,085	577	0,020	136	710	20,200	100,00	0,070	500	1,300
	Y	117,385	0,085	9,978	0,020	2,348	12,330	27,041	81,95	0,070	1,550	13,880
	Y	2,527	0,085	215	0,020	51	270	11,858	98,04	0,070	810	1,080
	Y	19,954	0,085	1,696	0,020	399	2,100	11,473	89,02	0,070	720	2,820
	Y	316	0,085	27	0,020	6	30	12,035	45,09	0,070	380	410
	Y	10,068	0,085	856	0,020	201	1,060	24,076	100,00	0,070	1,690	2,750
	Y	16,343	0,085	1,389	0,020	327	1,720	14,885	100,00	0,070	1,040	2,760
	Y	694	0,085	59	0,020	14	70	4,502	100,00	0,070	320	390
	Y	611	0,085	52	0,020	12	60	2,847	100,00	0,070	200	260
MRH 291												
Medio Iguaçu												
	Y	5,881	0,085	500	0,020	118	620	7,170	100,00	0,070	500	1,120
	Y	13,277	0,085	1,129	0,020	266	1,390	4,718	100,00	0,070	330	1,720
	Y	2,540	0,085	216	0,020	51	270	14,275	100,00	0,070	1,000	1,270
	Y	6,670	0,085	567	0,020	133	700	5,123	100,00	0,070	360	1,060
	Y	803	0,085	68	0,020	16	80	7,075	100,00	0,070	500	580
	Y	4,783	0,085	407	0,020	96	500	13,912	100,00	0,070	970	1,470
	Y	25,957	0,085	2,206	0,020	519	2,730	9,860	100,00	0,070	690	3,420
	Y	1,639	0,085	139	0,020	33	170	3,091	100,00	0,070	220	390
	Y	1,648	0,085	140	0,020	33	170	5,060	100,00	0,070	350	520
	Y	1,871	0,085	159	0,020	37	200	1,916	100,00	0,070	130	330
	Y	39,979	0,085	3,398	0,020	800	4,200	3,763	100,00	0,070	260	4,460
TOTAL OF BASIN		3,016,518					373,480	820,076			50,090	423,480

Remark: m³/d.p = m³/day . person

: Palmeiras/GRH 272 and Itaipu/GRH 276 were listed in Tibagi River Basin

Table - 2.14(1) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2005 / Base Case

No. and Name of MRH	No. and Name of Municipality		Urban Area	Water Demand for Urban Population				Water Demand for Rural Population				Total Demand m ³ /day		
	No.	Name		Urban Population	Residential Water		Non-Residential Water		Rural Population	Area Involved %	Unit Rate m ³ /d.p		Total Rural Demand	
					Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day						Total Domestic Demand
MRH 268 CURITIBA	1	Alm. Temandar	Y	121,910	0,100	12,191	0,030	3,657	6,530	36,31	0,075	189	16,030	
	2	Araucaria	Y	102,280	0,100	10,228	0,030	3,068	7,120	100,00	0,075	530	13,830	
	3	Basia Nova	Y	4,350	0,100	435	0,030	131	4,910	99,32	0,075	370	940	
	5	Campina Grande de Sul	(P)N	40,100	0,100	4,010	0,030	1,203	5,870	14,28	0,075	60	5,270	
	6	Campo Largo	Y	72,070	0,100	7,207	0,030	2,162	15,930	23,53	0,075	280	9,650	
	7	Colombo	Y	208,640	0,100	20,864	0,030	6,259	6,420	67,29	0,075	320	27,440	
	8	Contenda	Y	6,000	0,100	600	0,030	190	3,850	100,00	0,075	290	1,070	
	9	Curtuba	Y	1,546,490	0,140	216,509	0,040	61,860	0	100,00	0,075	0	278,370	
	10	Fazenda Rio Grande	Y	76,310	0,100	7,631	0,030	2,289	3,760	100,00	0,075	280	10,200	
	12	Mandrituba	Y	6,700	0,100	670	0,030	201	9,460	100,00	0,075	710	1,580	
	13	Pinhais	Y	102,520	0,100	10,252	0,030	3,076	4,490	100,00	0,075	340	13,670	
	14	Piraquara	Y	25,580	0,100	2,558	0,030	767	13,330	100,00	0,075	1,010	4,340	
	15	Quatro Barras	Y	18,150	0,100	1,815	0,030	545	2,360	54,32	0,075	60	2,450	
	17	S. José dos Pinhais	Y	210,530	0,100	21,053	0,030	6,310	14,920	73,60	0,075	820	28,160	
	MRH 271 A. RIO NEGRO	28	Agudos do Sul	Y	740	0,075	56	0,020	15	5,890	100,00	0,075	440	510
		29	Pitén	Y	3,420	0,075	257	0,020	68	6,830	100,00	0,075	510	840
		30	Quitanduba	Y	3,310	0,075	248	0,020	66	12,950	100,00	0,075	970	1,280
	31	Tijucas de Sul	Y	1,630	0,075	122	0,020	33	10,530	62,25	0,075	490	650	
MRH 272 C. DA LAPA	32	Campo do Tenente	Y	3,900	0,100	390	0,030	117	3,530	100,00	0,075	270	780	
	33	Lapa	Y	24,860	0,100	2,486	0,030	746	19,810	100,00	0,075	1,490	4,720	
	34	Palmeira	Y	0	0,000	0	0,000	0	15,500	18,22	0,075	210	210	
	35	Porro Amazonas	Y	2,820	0,100	282	0,030	85	1,380	73,98	0,075	80	450	
	36	Rio Negro	Y	24,120	0,100	2,412	0,030	724	6,180	100,00	0,075	460	3,600	
MRH 275 S. MATEUS DO SUL	46	Antônio Olinto	Y	1,120	0,100	112	0,030	34	7,390	100,00	0,075	550	700	
	47	São João Trunfo	Y	4,060	0,100	406	0,030	122	9,600	99,43	0,075	720	1,250	
	48	São Mateus do Sul	Y	21,120	0,100	2,112	0,030	634	18,010	100,00	0,075	1,350	4,100	
MRH 276 Col. de IRATI	50	Irati	N	0	0,000	0	0,000	0	12,840	45,51	0,075	440	440	
	51	Mallet	Y	9,040	0,100	904	0,030	271	5,170	100,00	0,075	390	1,570	
	53	Rebouças	Y	7,000	0,100	700	0,030	210	7,680	98,83	0,075	570	1,480	
	54	Rio Azul	Y	3,710	0,100	371	0,030	111	10,090	100,00	0,075	760	1,240	
MRH 288 Ext.Oeste Paranaense	269	B. Vista Aparecida	Y	2,770	0,110	305	0,030	83	6,210	100,00	0,075	470	860	
	273	C. Leôn. Marques	Y	5,630	0,110	619	0,030	169	2,290	100,00	0,075	170	960	
	274	Cacavel	P	250,280	0,125	31,285	0,035	8,760	40,050	55,57	0,075	380	40,430	
	275	Caandivas	Y	6,230	0,110	685	0,030	187	3,700	100,00	0,075	280	1,150	
	276	Cou Azul	(P)N	6,520	0,110	717	0,030	196	3,330	79,09	0,075	200	1,110	
	282	Foz de Iguaçu	(P)N	353,920	0,140	49,549	0,040	14,157	63,710	1,020	0,075	50	63,760	
	284	Guaranicá	(P)N	9,500	0,110	1,045	0,030	285	9,120	47,03	0,075	320	1,650	

(To be continued)

Table - 2.14 (2) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2005 / Base Case

No. and Name of MRH	No. and Name of Municipality		Urban Area	Water Demand for Urban Population				Water Demand for Rural Population				Total Demand m ³ /day	
	No.	Name		Urban Population	Residential Water		Non-Residential Water		Rural Population	Area Involved %	Unit Rate m ³ /d.p		Total Rural Demand
					Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day					
MRH 288 Ext. Oeste Paranaense	285	Ibema	P	5.630	0,110	619	0,030	169	2.080	97,79	0,075	150	940
	290	Lindoele	Y	480	0,110	53	0,030	14	3.250	100,00	0,075	240	310
	293	Marelandia	(P/N)	9.890	0,110	1.054	0,030	287	2.010	98,37	0,075	150	1.490
	294	Medianeira	P	36.360	0,110	4.000	0,030	1.091	5.040	77,72	0,075	290	5.380
	305	Santa Lúcia	Y	1.810	0,110	199	0,030	54	1.280	100,00	0,075	100	380
	306	S. Tereza do Oeste	P	3.900	0,110	429	0,030	117	1.470	55,64	0,075	60	610
	307	S. Tereza Itaipu	(P/N)	16.410	0,110	1.805	0,030	492	1.490	55,94	0,075	60	2.360
	309	S. Miguel do Iguaçu	(P/N)	12.850	0,110	1.414	0,030	386	4.390	45,70	0,075	150	1.950
	313	T. Barros Pádua	Y	3.940	0,110	433	0,030	118	6.160	100,00	0,075	460	1.010
	316	Ampère	Y	6.700	0,095	637	0,025	168	4.200	100,00	0,075	320	1.120
	317	Barracão	Y	7.420	0,095	705	0,025	186	5.360	100,00	0,075	400	1.290
	318	Boa Esperança do Iguaçu	Y	900	0,095	86	0,025	23	1.940	100,00	0,075	150	260
	319	Bom Sucesso do Sul	Y	1.350	0,095	128	0,025	34	2.510	100,00	0,075	190	350
320	Capitania	Y	7.360	0,095	699	0,025	184	6.660	100,00	0,075	460	1.340	
321	Chopininho	Y	9.790	0,095	930	0,025	245	1.180	7.380	100,00	0,075	550	1.730
322	Coronel Vivida	Y	14.240	0,095	1.353	0,025	356	1.710	8.820	100,00	0,075	660	2.370
323	Cruzeiro do Iguaçu	Y	3.400	0,095	323	0,025	85	410	1.970	100,00	0,075	150	560
324	Dois Vizinhos	Y	35.060	0,095	3.331	0,025	877	4.200	5.600	100,00	0,075	420	4.620
325	Enéas Marques	Y	1.580	0,095	150	0,025	40	190	4.210	100,00	0,075	320	510
326	Flor da Serra do Sul	Y	360	0,095	34	0,025	9	40	4.400	100,00	0,075	330	370
327	Francisco Beltrão	Y	73.320	0,110	8.065	0,035	2.566	10.630	10.760	100,00	0,075	810	11.440
328	Itapejara do Oeste	Y	4.600	0,095	437	0,025	115	550	3.350	100,00	0,075	250	800
329	Mairópolis	Y	3.280	0,095	312	0,025	82	390	2.860	100,00	0,075	220	610
330	Marmeleiro	Y	9.870	0,095	938	0,025	247	1.180	9.390	100,00	0,075	700	1.880
331	N. Esperança do Sudoeste	Y	820	0,095	78	0,025	21	100	4.430	100,00	0,075	330	430
332	N. Praia do Iguaçu	Y	4.200	0,095	399	0,025	105	500	3.650	100,00	0,075	270	770
333	Pato Branco	Y	56.450	0,110	6.210	0,035	1.976	8.190	7.310	100,00	0,075	550	8.740
334	Pérola do Oeste	Y	3.280	0,095	312	0,025	82	390	5.050	100,00	0,075	380	770
335	Pinhal São Bento	Y	630	0,095	60	0,025	16	80	1.480	100,00	0,075	110	190
336	Planalto	Y	4.200	0,095	399	0,025	105	500	6.210	100,00	0,075	470	970
337	Piñochita	Y	3.750	0,095	356	0,025	94	450	3.200	100,00	0,075	240	690
338	Realiza	Y	8.980	0,095	853	0,025	225	1.080	4.150	100,00	0,075	310	1.390
339	Renascença	Y	2.010	0,095	191	0,025	50	240	4.820	100,00	0,075	360	600
340	Salgado Filho	Y	2.150	0,095	204	0,025	54	260	7.370	100,00	0,075	550	810
341	Salto do Lontra	Y	6.300	0,095	599	0,025	158	760	5.030	100,00	0,075	380	1.140
342	S. Izabel do Oeste	Y	4.470	0,095	425	0,025	112	540	4.560	100,00	0,075	340	880
343	S. Antônio Sudoeste	Y	9.740	0,095	925	0,025	244	1.170	5.040	100,00	0,075	380	1.550

(To be continued)

Table - 2.14 (3) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2005 /Base Case

No. and Name of MRH	No. and Name of Municipality		Urban Area	Water Demand for Urban Population				Water Demand for Rural Population			Total Demand m3/day		
	No.	Name		Urban Population	Residential Water Demand m3/day	Unit Rate m3/d.p.	Non-Residential Water Demand m3/day	Unit Rate m3/d.p.	Total Domestic Demand	Rural Population		Area Involved %	Unit Rate m3/d.p.
MRH 289 Suboeste Paranaense (cont)	344	São João	Y	5,930	563	0,095	148	0,025	710	5,070	100,00	0,075	380
	345	São Jorge do Oeste	Y	3,330	316	0,095	83	0,025	400	3,750	100,00	0,075	280
	346	Saúde do Iguaçu	Y	2,290	218	0,095	57	0,025	280	2,220	100,00	0,075	170
	347	Sulina	Y	820	78	0,095	21	0,025	100	2,330	100,00	0,075	180
	348	Ver	Y	3,730	354	0,095	93	0,025	450	4,800	100,00	0,075	360
	349	Vitorino	Y	3,090	294	0,095	77	0,025	370	2,860	100,00	0,075	220
	350	Candi	Y	2,320	232	0,100	70	0,030	300	15,970	100,00	0,075	1,500
MRH 290 C. de Guaparuva	351	Cantagalo	Y	17,910	1,791	0,100	537	0,030	2,330	22,170	41,97	0,075	700
	352	Guaparuva	Y	154,360	15,436	0,100	4,631	0,030	20,070	29,050	81,95	0,075	1,790
	353	Inacio Martins	Y	2,850	285	0,100	86	0,030	370	14,660	98,04	0,075	1,080
	354	Laranjeiras do Sul	Y	19,380	1,938	0,100	581	0,030	2,520	7,850	89,02	0,075	520
	355	Nova Laranjeiras	Y	310	31	0,100	9	0,030	40	9,840	45,09	0,075	330
	356	Pinhão	Y	7,760	776	0,100	233	0,030	1,010	26,820	100,00	0,075	2,010
	357	Quedas do Iguaçu	Y	19,260	1,926	0,100	578	0,030	2,500	12,170	100,00	0,075	910
	358	Rio Bonito Iguaçu	Y	680	68	0,100	20	0,030	90	3,690	100,00	0,075	280
	360	Virmond	Y	600	60	0,100	18	0,030	80	2,330	100,00	0,075	180
	361	Bituruna	Y	8,510	851	0,100	255	0,030	1,110	6,030	100,00	0,075	450
MRH 291 Meio Iguaçu	362	Clevelândia	Y	13,450	1,345	0,100	404	0,030	1,750	4,410	100,00	0,075	330
	363	Cruz Machado	Y	3,160	316	0,100	95	0,030	410	14,530	100,00	0,075	1,090
	364	General Carneiro	Y	11,800	1,180	0,100	354	0,030	1,530	4,300	100,00	0,075	320
	365	Honório Serpa	Y	1,530	153	0,100	46	0,030	200	7,590	100,00	0,075	570
	366	Mangueirinha	Y	9,090	909	0,100	273	0,030	1,180	14,450	100,00	0,075	1,080
	367	Palmas	Y	35,420	3,542	0,100	1,063	0,030	4,610	6,630	100,00	0,075	500
	368	Paula Freitas	Y	3,200	320	0,100	96	0,030	420	2,410	100,00	0,075	180
	369	Paulo Frostin	Y	2,360	236	0,100	71	0,030	310	5,460	100,00	0,075	410
	370	Peto Vitória	Y	2,060	206	0,100	62	0,030	270	1,750	100,00	0,075	130
	371	União da Vitória	Y	41,120	4,112	0,100	1,234	0,030	5,350	3,340	100,00	0,075	250
	TOTAL OF BASIN				4,040,620	628,270		45,280		628,270	694,930		45,280

Remark: m3/d.p = m3/day . person

: Palmas/MRH 272 and Inati/MRH 276 were listed in Tiboga River Basin

Table - 2.15 (1) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2015 / Base Case

No. and Name of MRH	No. and Name of Municipality		Urban Area	Water Demand for Urban Population						Water Demand for Rural Population						Total Demand m ³ /day	
				Residential Water			Non-Residential Water			Total Domestic Demand	Rural Population	Area Involved %	Unit Rate m ³ /d.p	Total Rural Demand			
				Urban Population	Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day									
MRH 268																	
CURITIBA																	
	No.	Name		Urban Population	Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day	Total Domestic Demand	Rural Population	Area Involved %	Unit Rate m ³ /d.p	Total Rural Demand	Total Demand m ³ /day			
	1	Alt. Tamandar	Y	109.750	0,135	14.714	0,040	4.389	19.103	6.240	36,31	0,080	500	24.113			
	2	Anuana	Y	138.700	0,135	18.725	0,040	5.548	24.270	6.800	100,00	0,080	540	24.810			
	3	Balsa Nova	Y	5.810	0,135	784	0,040	162	946	4.170	99,32	0,080	330	1.350			
	5	Campina Grande do Sul	(PN)	61.440	0,135	8.294	0,040	2.458	10.750	4.980	14,28	0,080	60	10.810			
	6	Campo Largo	Y	85.590	0,135	11.555	0,040	3.424	14.980	13.520	23,53	0,080	260	15.240			
	7	Colombo	Y	283.000	0,135	38.205	0,040	11.320	49.530	5.750	67,29	0,080	310	49.840			
	8	Contenda	Y	6.890	0,135	930	0,040	276	1.206	3.690	100,00	0,080	300	1.510			
	9	Ouritiba	Y	1.717.150	0,170	291.916	0,050	85.858	377.770	0	100,00	0,080	0	377.770			
	10	Fazenda Rio Grande	Y	119.160	0,135	16.087	0,040	4.766	20.850	3.190	100,00	0,080	260	21.110			
	12	Mandirituba	Y	8.410	0,135	1.135	0,040	336	1.470	8.030	100,00	0,080	640	2.110			
	13	Pinbais	Y	125.690	0,135	16.968	0,040	5.028	22.000	3.810	100,00	0,080	310	22.310			
	14	Piraquara	Y	29.650	0,135	4.008	0,040	1.186	5.190	11.440	100,00	0,080	920	6.110			
	15	Quatro Barras	Y	25.810	0,135	3.484	0,040	1.032	4.520	1.120	54,32	0,080	50	4.570			
	17	S. Jose dos Pinbais	Y	284.590	0,135	38.420	0,040	11.384	49.800	12.660	73,60	0,080	750	50.550			
MRH 271																	
A. RIO NEGRO																	
	28	Agudos do Sul	Y	640	0,080	51	0,025	16	67	70	100,00	0,080	470	540			
	29	Pin	Y	4.770	0,080	382	0,025	119	500	6.820	100,00	0,080	550	7.370			
	30	Quitandinha	Y	3.910	0,080	313	0,025	98	410	12.910	100,00	0,080	1.030	1.440			
	31	Tijucas do Sul	Y	1.880	0,080	150	0,025	47	200	10.500	62,25	0,080	520	720			
MRH 272																	
C. DA LAPA																	
	32	Campo do Tenente	Y	5.310	0,125	664	0,035	180	850	3.510	100,00	0,080	280	1.130			
	33	Lapa	Y	28.970	0,125	3.621	0,035	1.014	4.640	18.010	100,00	0,080	1.440	6.080			
	34	Palmeira	Y	0	0,000	0	0,000	0	0	15.340	18,22	0,080	220	220			
	35	Porto Amazonas	Y	3.150	0,125	394	0,035	110	500	1.420	73,98	0,080	80	580			
	36	Rio Negro	Y	27.140	0,125	3.393	0,035	950	4.340	5.820	100,00	0,080	470	4.810			
MRH 275																	
S. MATEUS DO SUL																	
	46	Antônio Olinto	Y	1.490	0,125	186	0,035	52	240	7.000	100,00	0,080	560	800			
	47	São João Trunfo	Y	5.000	0,125	625	0,035	175	800	8.940	99,43	0,080	710	1.510			
	48	São Mateus do Sul	Y	25.010	0,125	3.126	0,035	875	4.000	17.160	100,00	0,080	1.370	5.370			
MRH 276																	
Col. de IRATI																	
	50	Irati	N	0	0,000	0	0,000	0	0	9.670	45,51	0,080	350	350			
	51	Mallet	Y	11.610	0,125	1.451	0,035	406	1.860	4.160	100,00	0,080	330	2.190			
	53	Rebouças	Y	8.190	0,125	1.024	0,035	287	1.310	7.280	98,85	0,080	580	1.890			
	54	Rio Azul	Y	4.090	0,125	511	0,035	143	650	10.010	100,00	0,080	800	1.450			
MRH 288																	
Exc. Ome Paranaense																	
	269	B. Vista Aparecida	Y	2.430	0,135	328	0,040	97	430	5.230	100,00	0,080	420	560			
	273	C. Leon. Marques	Y	5.440	0,135	734	0,040	218	950	960	100,00	0,080	80	1.030			
	274	Cascavel	P	303.280	0,135	41.042	0,045	13.648	60.660	5.890	55,57	0,080	260	60.920			
	275	Canudos	Y	7.180	0,135	969	0,040	287	1.260	100,00	100,00	0,080	200	1.460			
	276	Céu Azul	(PN)	7.210	0,135	973	0,040	288	1.260	3.090	79,09	0,080	200	1.460			
	282	Foz do Iguaçu	(PN)	479.380	0,165	79.098	0,050	23.969	103.070	330	65,58	0,080	20	103.090			
	284	Guaranicupu	(PN)	10.720	0,135	1.447	0,040	429	1.880	6.470	47,03	0,080	240	2.120			

(To be continued)

Table - 2.15 (2) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2015 / Base Case

No. and Name of MRH	No. and Name of Municipality		Water Demand for Urban Population				Water Demand for Rural Population				Total Demand m ³ /day			
	No.	Name	Urban Area	Urban Population	Residential Water		Non-Residential Water		Rural Population	Area Involved %		Unit Rate m ³ /d.p	Total Rural Demand	
					Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day						
MRH 288 Ext.Oeste Paranaense (cont)	285	Ibema	P	6,969	0,135	940	0,040	278	1,220	1,810	97,79	0,080	140	1,360
	290	Lindóeste	Y	290	0,135	39	0,040	12	50	2,000	100,00	0,080	160	210
	293	Matelândia	(P)N	10,400	0,135	1,404	0,040	416	1,820	960	98,37	0,080	80	1,900
	294	Medianeira	P	41,210	0,135	5,566	0,040	1,649	7,220	3,130	77,72	0,080	200	7,420
	305	Santa Lúcia	Y	1,740	0,135	235	0,040	70	310	640	100,00	0,080	50	360
	306	S. Tereza do Oeste	P	4,320	0,135	583	0,040	173	760	880	55,64	0,080	40	800
	307	S. Terezinha Itaipu	(P)N	19,880	0,135	2,684	0,040	795	3,480	970	55,94	0,080	40	3,520
	309	S. Miguel do Iguaçu	(P)N	14,900	0,135	2,012	0,040	596	2,610	2,210	45,70	0,080	80	2,690
	313	T. Barros Pavan	Y	3,830	0,135	517	0,040	153	670	3,890	100,00	0,080	310	980
	316	Ampere	Y	7,050	0,115	811	0,030	212	1,020	1,870	100,00	0,080	150	1,170
	317	Barralão	Y	9,410	0,115	1,082	0,030	282	1,370	2,010	100,00	0,080	160	1,530
	318	Boa Esperança do Iguaçu	Y	1,190	0,115	137	0,030	36	170	1,160	100,00	0,080	90	260
	319	Bom Sucesso do Sul	Y	1,570	0,115	181	0,030	47	230	2,040	100,00	0,080	160	390
	320	Capaneza	Y	6,760	0,115	777	0,030	203	980	2,040	100,00	0,080	160	1,140
321	Chopinzinho	Y	10,640	0,115	1,224	0,030	319	1,540	3,900	100,00	0,080	300	1,840	
322	Coronel Vivida	Y	15,260	0,115	1,755	0,030	488	2,210	5,350	100,00	0,080	450	2,640	
323	Cruzetiro do Iguaçu	Y	4,460	0,115	513	0,030	134	650	1,160	100,00	0,080	90	740	
324	Deus Vizinhas	Y	45,560	0,115	5,239	0,030	1,367	6,610	3,000	100,00	0,080	240	6,850	
325	Enxias Marques	Y	1,660	0,115	191	0,030	50	240	2,570	100,00	0,080	210	450	
326	Flor da Serra do Sul	Y	390	0,115	45	0,030	12	60	3,600	100,00	0,080	290	350	
327	Francisco Beltrão	Y	100,690	0,135	13,566	0,040	4,020	17,590	6,500	100,00	0,080	520	18,110	
328	Itaipava do Oeste	Y	5,000	0,115	575	0,030	150	730	1,850	100,00	0,080	150	880	
329	Mariópolis	Y	3,500	0,115	403	0,030	105	510	2,190	100,00	0,080	180	690	
330	Marmeleiro	Y	12,700	0,115	1,461	0,030	381	1,840	8,530	100,00	0,080	680	2,520	
331	N. Esperança do Sudoeste	Y	900	0,115	104	0,030	27	130	3,750	100,00	0,080	300	450	
332	N. Prata do Iguaçu	Y	4,120	0,115	474	0,030	124	600	1,950	100,00	0,080	160	760	
333	Pato Branco	Y	67,550	0,135	9,119	0,040	2,702	11,820	5,140	100,00	0,080	410	12,230	
334	Petrolia do Oeste	Y	3,240	0,115	373	0,030	97	470	2,030	100,00	0,080	160	630	
335	Pituaçu São Bento	Y	690	0,115	810	0,030	21	100	100,00	0,080	70	170	170	
336	Planalto	Y	4,190	0,115	482	0,030	126	610	2,530	100,00	0,080	200	810	
337	Pranchita	Y	4,500	0,115	518	0,030	135	650	1,120	100,00	0,080	90	740	
338	Realiza	Y	8,940	0,115	982	0,030	256	1,240	3,920	100,00	0,080	190	1,490	
339	Renasença	Y	1,850	0,115	213	0,030	56	270	3,920	100,00	0,080	310	580	
340	Salgado Filho	Y	2,380	0,115	274	0,030	71	350	5,180	100,00	0,080	410	760	
341	Salto do Lontra	Y	7,380	0,115	849	0,030	221	1,070	1,860	100,00	0,080	150	1,220	
342	S. Izabel do Oeste	Y	4,250	0,115	489	0,030	128	620	2,010	100,00	0,080	160	780	
343	S. Antônio Sudoeste	Y	10,540	0,115	1,212	0,030	316	1,530	2,010	100,00	0,080	160	1,690	

(To be continued)

Table - 2.15 (3) Estimated Domestic Water Demand per Municipality in IGUAÇU River Basin - 2015 / Base Case

No. and Name of MRH	No. and Name of Municipality		Urban Area	Residential Water				Non-Residential Water				Water Demand for Rural Population				Total Demand m ³ /day		
				Unit Rate m ³ /d.p		Demand m ³ /day		Unit Rate m ³ /d.p		Demand m ³ /day		Rural Population	Area Involved %	Unit Rate m ³ /d.p	Total Rural Demand			
				Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day	Unit Rate m ³ /d.p	Demand m ³ /day									
MRH 289	Sudoeste Paranaense(cont.)																	
344	São João	Y	6.630	0,1115	762	0,030	199	2.130	100,00	0,080	170	1.130						
345	São Jorge do Oeste	Y	2.880	0,1115	331	0,030	86	1.620	100,00	0,080	130	550						
346	Saúde do Iguaçu	Y	2.520	0,1115	290	0,030	76	1.670	100,00	0,080	130	500						
347	Sulina	Y	700	0,1115	81	0,030	21	1.340	100,00	0,080	110	210						
348	Ver	Y	4.420	0,1115	508	0,030	133	2.540	100,00	0,080	200	840						
349	Vitório	Y	3.380	0,1115	389	0,030	101	1.900	100,00	0,080	150	640						
MRH 290	C. de Guapiruvã																	
350	Candói	Y	2.520	0,125	315	0,035	88	400	19.790	100,00	0,080	1.580						
351	Catagalo	Y	39.360	0,125	4.920	0,035	1.378	6.300	21.960	41,97	740	7.040						
352	Guapiruvã	Y	179.920	0,125	22.490	0,035	6.297	28.790	81,95	0,080	1.890	30.680						
353	Início Martins	Y	2.830	0,125	354	0,035	99	450	14.520	98,04	1.140	1.590						
354	Laranjeiras do Sul	Y	17.020	0,125	2.128	0,035	596	2.720	5.750	89,02	410	3.130						
355	Nova Laranjeiras	Y	270	0,125	34	0,035	9	40	8.410	45,09	300	340						
356	Pinhão	Y	5.620	0,125	703	0,035	197	900	26.580	100,00	0,080	2.130						
357	Quedas do Iguaçu	Y	19.880	0,125	2.485	0,035	696	3.180	10.380	100,00	0,080	830						
358	Rio Benito Iguaçu	Y	600	0,125	75	0,035	21	100	3.150	100,00	0,080	250						
360	Vimond	Y	540	0,125	68	0,035	19	90	1.990	100,00	0,080	160						
MRH 291	Meio Iguaçu																	
361	Bituruna	Y	10.630	0,125	1.329	0,035	372	1.700	4.830	100,00	0,080	390						
362	Clevelândia	Y	13.400	0,125	1.675	0,035	469	2.140	3.920	100,00	0,080	310						
363	Cruz Machado	Y	3.650	0,125	456	0,035	128	580	13.920	100,00	0,080	1.110						
364	General Carneiro	Y	16.050	0,125	2.006	0,035	562	2.570	3.420	100,00	0,080	270						
365	Honório Serpa	Y	2.130	0,125	266	0,035	75	340	7.570	100,00	0,080	610						
366	Mangueirinha	Y	12.660	0,125	1.583	0,035	443	2.030	14.040	100,00	0,080	1.120						
367	Palmas	Y	45.210	0,125	5.651	0,035	1.582	7.230	3.800	100,00	0,080	300						
368	Paula Freitas	Y	4.990	0,125	561	0,035	157	720	1.760	100,00	0,080	140						
369	Paulo Frontin	Y	2.940	0,125	368	0,035	103	470	5.470	100,00	0,080	440						
370	Porto Vitória	Y	2.180	0,125	273	0,035	76	350	1.530	100,00	0,080	120						
371	União da Vitória	Y	41.460	0,125	5.183	0,035	1.451	6.630	2.840	100,00	0,080	230						
TOTAL OF BASIN				4.901.630		947.000		568.630		39.130		986.130						

Remark: m³/d.p = m³/day . person

: Patricia/MRCH 272 and Irai/MRCH 276 were listed in Tibagi River Basin

2.2 Industrial Water

2.2.1 Present Situation of Industrial Water Consumption

(1) Basic Data Concerning Industrial Water Consumption

The study for industrial water demand is to be done by using the following information:

- Present water consumption volume and water recovery rate of factories by industrial type.
- Value added of factories by industrial type.
- GRDP of Secondary Sector (Industrial Sector).

However, during the study of the "Master Plan for pilot River Basin(s)", complementary data regarding industrial water consumption was not collected, unfortunately.

(2) Criteria for Determination of Urban Area and Industrial Water

In this Study, it was considered that all industrial activity was located in the urban area. Therefore, some municipalities included in the study zoning, but with their urban area outside this river basin, were considered as having industrial water equal to zero.

2.2.2 Estimation of Unit Consumption Rate per Value Added (V.A.) per Municipality

Based on what was mentioned in Section - 2.2.1(1), the Team decided to use the same unit consumption rate used for the estimation of industrial water demand per MRH for the industrial water demand projection per municipality in 1993, 2005 and 2015, as shown below in Table - 2.16.

Table - 2.16 Average Unit Consumption Rate per Value Added (V.A.) - 1993, 2005 and 2015

Unit Rate - 1993 Unit Rate with Present recovery Rate m ³ /day . US\$ 1,000.00 (V.A.)	Unit Rate - 2005 Increase of Water Recovery Rate: 19% m ³ /day . US\$ 1,000.00 (V.A.)	Unit Rate - 2015 Increase of Water Recovery Rate: 37.50% m ³ /day . US\$ 1,000.00 (V.A.)
0.059	0.048	0.037

2.2.3 Gross Regional Domestic Product (GRDP) by Secondary Sector per Municipality

For the estimation of industrial water demand for the target years, GRDP by Secondary Sector per Municipality was estimated as follows:

(1) GRDP by Secondary Sector per Municipality in 1993

Based on the estimated GRDP by Secondary Sector per MRH (shown in Table - 5.10 of Main Report I) and on the Municipalities' Participation Fund - Preliminary Indexes/95 issued by SEFA, the GRDP by Secondary Sector of 101 municipalities in 1993 was estimated by excluding the contribution of hydroelectric power stations, and is presented in Table - 2.22 (1) and Table - 2.22 (2).

(2) GRDP by Secondary Sector per Municipality in 2005 and 2015

Based on the past trend of GRDP by Secondary Sector per Municipality during the years 1981 to 1991 (shown in Sectorial Report Vol. A) by excluding the contribution of hydroelectric

power stations in the values of 1989 and 1991, and on the one of 1993 mentioned above, the GRDP of the Secondary Sector per Municipality in 2005 and 2015 was estimated per each municipality, adjusting the estimated GRDP by Secondary Sector per MRH (shown in Table - 1.24) to the years to which they belong, and is presented also in Table - 2.22 (1) and Table - 2.22 (2).

2.2.4 Water Demand Projection

(1) Water Demand Projection for Base Case in 1993, 2005 and 2015

Water demand of industrial water per municipality was estimated by multiplying the average unit consumption rate per value added by GRDP by Secondary Sector per Municipality of each year mentioned above, and is presented in Table - 2.21 (1)/Table - 2.21 (3).

(2) Water Demand Projection for Alternative Case in 2005 and 2015

1) Alternative Development Plan

In Main Report I, the alternative regional development plan was estimated as shown below in Table -2.17, using the MRH as regional unit.

Table - 2.17 Restriction and Distribution of GRDP (Secondary and Tertiary Sector) and GRDP of Secondary Sector, in 2005 and 2015

YEAR	2005			2015			
	No. and Name of MRH	%	GRDP (2nd and 3rd Sector) million US\$	GRDP of 2nd Sector million US\$	%	GRDP (2nd and 3rd Sector) million US\$	GRDP of 2nd Sector million US\$
	MRH 268 Curitiba	100.00	(1,950.00)	(750.00)	100.00	(5,100.00)	(1,900.00)
	MRH 271 C. Ponta Grossa	14.70	265.00	110.00	14.40	735.00	275.00
	MRH 281 N.N. Londrina	31.30	610.00	235.00	30.60	1,560.00	580.00
	MRH 282 N.N. Maringá	18.30	355.00	140.00	18.40	935.00	350.00
	MRH 288 Extr. Oeste Paranaense	35.70	700.00	265.00	36.60	1,870.00	695.00

Remark: *% is percentage of distribution per MRH
: The values of GRDP of Secondary Sector and Tertiary Sector are in million US\$

According to the concept of the alternative development plan (described in Section - 1), it was considered that three municipalities: Cascavel, Foz do Iguaçu and Toledo participate in MRH 268/Extr. Oeste Paranaense. The participation of these three municipalities is shown in Table -2.18.

Table - 2.18 Participation of GRDP (Secondary Sector and Tertiary Sector) and GRDP by Secondary Sector of Three Municipalities in 2005 and 2015 by Alternative Case

YEAR	2005			2015			
		%	GRDP (2nd and 3rd Sectors) million US\$	GRDP of 2nd Sector million US\$	%	GRDP (2nd and 3rd Sectors) million US\$	GRDP of 2nd Sector million US\$
	MRH 268 Extr. Oeste Paranaense	100.00	(700.00)	(265.00)	100.00	(1,870.00)	(695.00)
	274 Cascavel	35.00	250.00	95.00	35.00	655.00	240.00
	282 Foz do Iguaçu	50.00	350.00	135.00	50.00	935.00	350.00
	312 Toledo *(1)	15.00	100.00	35.00	15.00	280.00	105.00

Remark: Toledo is located in other basin
The value of GRDP by Sector is in million US\$

2) Estimated Water Demand in 2005 and 2015

Based on the participation of three municipalities, the estimated water demand of Cascavel and Foz do Iguaçu by the alternative case in 2005 and 2015 is shown in Table - 2.19.

Table - 2.19 Estimated Industrial Water Demand for Municipality by Alternative Case in 2005 and 2015

No. and Name of Municipality		2005			2015		
		Industrial Water			Industrial Water		
		V.A. (Secondary Sector) million US\$	Unit Rate m ³ /day . US\$ 10 ³	Demand m ³ /day	V.A. (Secondary Sector) million US\$	Unit Rate m ³ /day . US\$ 10 ³	Demand m ³ /day
274	Cascavel	266.48	0.048	12,790	472.55	0.037	17,480
282	Foz do Iguaçu	166.55	0.048	7,990	392.79	0.037	14,530

3) Comparison of Water Demand between Base Case and Alternative Case

The difference of water demand between Base Case and Alternative Case of two municipalities mentioned above is shown in Table - 2.20, as the comparison.

Table - 2.20 Comparison of Industrial Water Demand between Base Case and Alternative Case

No. and Name of Municipality		2005			2015		
		Industrial Water Demand (m ³ /day)		Increase of Water Demand (m ³ /day)	Industrial Water Demand (m ³ /day)		Increase of Water Demand (m ³ /day)
		Base Case	Alternative Case		Base Case	Alternative Case	
No.	Name	Base Case	Alternative Case	Increase of Water Demand (m ³ /day)	Base Case	Alternative Case	Increase of Water Demand (m ³ /day)
274	Cascavel	8,230	12,790	4,560	8,600	17,480	8,880
282	Foz do Iguaçu	1,510	7,990	6,480	1,580	14,530	12,950

Table-2.21(1) Estimated Industrial Water Demand per Municipality in Iguacu River Basin in 1993, 2005 and 2015

No. and Name of MRR	1993				2005				2015			
	No. and Name of Municipality	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day		
MRR 268 Curitiba	TOTAL of MRR	4,761.84	0.059	251,450	7,743.53	0.048	371,690	12,844.63	0.037	475,250		
	1 Almirante Tamandare	27.86	0.059	1,640	53.18	0.048	2,550	95.10	0.037	3,520		
	2 Araucaria	1,152.47	0.059	68,000	1,308.39	0.048	62,800	1,800.25	0.037	66,610		
	3 Balsa Nova	52.32	0.059	3,090	99.02	0.048	4,750	175.85	0.037	6,510		
	5 Campina Grande do Sul	11.14	0.059	660	33.34	0.048	1,600	65.91	0.037	2,440		
	6 Campo Largo	110.76	0.059	6,530	252.93	0.048	12,140	415.65	0.037	15,380		
	7 Colombo	74.63	0.059	4,400	151.44	0.048	7,270	266.46	0.037	9,860		
	8 Contenda	1.44	0.059	80	2.66	0.048	130	5.06	0.037	190		
	9 Curitiba	2,390.16	0.059	141,020	4,815.82	0.048	231,160	8,196.53	0.037	303,270		
	10 Fazenda Rio Grande	4.48	0.059	260	9.19	0.048	440	17.29	0.037	640		
	12 Mandirituba	1.53	0.059	90	3.07	0.048	150	5.76	0.037	210		
	13 Pinhais	65.55	0.059	3,870	192.75	0.048	9,250	357.12	0.037	13,210		
	14 Paraguaçu	3.94	0.059	230	11.65	0.048	560	21.59	0.037	800		
	15 Quatro Barras	28.35	0.059	1,670	41.98	0.048	2,020	67.79	0.037	2,510		
	17 Sao Jose dos Pinhais	212.77	0.059	12,550	573.91	0.048	27,550	1,040.71	0.037	38,510		
	Subtotal of Municipalities of Basin	4,137.40	0.059	244,090	7,569.32	0.048	362,370	12,531.06	0.037	463,660		
	Subtotal of Municipalities not of Basin	124.44	0.059	7,360	194.21	0.048	9,320	313.57	0.037	11,590		
MRR 271 Alto Rio Negro	TOTAL of MRR	6.77	0.059	400	12.89	0.048	620	24.16	0.037	890		
	28 Agudos do Sul	0.14	0.059	10	0.37	0.048	20	0.69	0.037	30		
	29 Piren	4.22	0.059	240	6.95	0.048	330	12.34	0.037	450		
	30 Quitandinha	0.43	0.059	30	0.98	0.048	50	1.89	0.037	70		
	31 Tijucas do Sul	1.98	0.059	120	4.61	0.048	220	9.24	0.037	340		
	Subtotal of Municipalities of Basin	6.77	0.059	400	12.89	0.048	620	24.16	0.037	890		
	Subtotal of Municipalities not of Basin	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0		
MRR 272 Campos da Lapa	TOTAL of MRR	144.48	0.059	8,520	259.40	0.048	12,450	461.01	0.037	17,060		
	32 Campo do Tenente	0.30	0.059	20	0.18	0.048	10	0.23	0.037	10		
	33 Lapa	14.23	0.059	840	18.09	0.048	870	28.49	0.037	1,050		
	34 Palmeira	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0		
	35 Porto Amazonas	0.88	0.059	50	2.51	0.048	120	4.75	0.037	180		
	36 Rio Negro	108.77	0.059	6,420	190.81	0.048	9,160	340.92	0.037	12,610		
	Subtotal of Municipalities of Basin	124.18	0.059	7,230	211.59	0.048	10,160	374.37	0.037	13,350		
	Subtotal of Municipalities not of Basin	20.30	0.059	1,190	47.81	0.048	2,290	86.64	0.037	3,210		
MRR 275 Sao Marcos do Sul	TOTAL of MRR	30.25	0.059	1,790	48.95	0.048	2,350	91.88	0.037	3,400		
	46 Antonio Olinto	0.26	0.059	20	0.53	0.048	30	0.85	0.037	30		
	47 Sao Joao do Triunfo	0.46	0.059	30	0.25	0.048	10	0.21	0.037	10		
	48 Sao Marcos do Sul	29.53	0.059	1,740	48.16	0.048	2,310	90.82	0.037	3,360		
	Subtotal of Municipalities of Basin	30.25	0.059	1,790	48.95	0.048	2,350	91.88	0.037	3,400		
	Subtotal of Municipalities not of Basin	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0		
MRR 276 Colonial Irai	TOTAL of MRR	53.75	0.059	3,170	102.17	0.048	4,900	179.22	0.037	6,630		
	50 Irai	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0		
	51 Mallet	4.19	0.059	250	9.86	0.048	470	17.47	0.037	650		
	53 Reboucas	1.12	0.059	70	2.05	0.048	100	3.09	0.037	110		
	54 Rio Ariz	2.08	0.059	120	4.05	0.048	190	7.50	0.037	280		
	Subtotal of Municipalities of Basin	7.39	0.059	440	15.96	0.048	760	28.06	0.037	1,040		
	Subtotal of Municipalities not of Basin	46.36	0.059	2,730	86.21	0.048	4,140	151.16	0.037	5,590		

(To be continued)

Table-2.21(2) Estimated Industrial Water Demand per Municipality in Iguacu River Basin in 1993, 2005 and 2015

No. and Name of Municipality	1993				2005				2015			
	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day
MRH												
MRH 288	424.10	0.059	25,020	626.89	0.048	30,090	850.15	0.037	31,460			
Extremo Oeste Paranaense												
TOTAL of MRH												
269 Boa Vista da Aparecida	0.27	0.059	20	0.35	0.048	20	0.48	0.037	20			
273 Capilao Leonidas Marques	0.58	0.059	30	0.84	0.048	40	1.14	0.037	40			
274 Cascavel	147.45	0.059	8,700	171.48	0.048	8,230	232.55	0.037	8,600			
275 Calandivas	0.41	0.059	20	0.68	0.048	30	0.93	0.037	30			
276 Ceu Azul	14.74	0.059	870	27.20	0.048	1,310	36.89	0.037	1,360			
282 Foz do Iguacu	20.18	0.059	1,190	31.55	0.048	1,510	42.79	0.037	1,580			
284 Guaraniacu	0.58	0.059	30	0.81	0.048	40	1.10	0.037	40			
285 Iberna	4.16	0.059	250	6.15	0.048	300	8.34	0.037	310			
290 Lindoeste	0.10	0.059	10	0.15	0.048	10	0.20	0.037	10			
293 Matolandia	2.25	0.059	130	4.33	0.048	210	5.88	0.037	220			
294 Medianeira	12.55	0.059	740	23.33	0.048	1,120	31.64	0.037	1,170			
305 Santa Lucia	0.09	0.059	10	0.10	0.048	0	0.14	0.037	10			
306 Santa Teresa do Oeste	0.36	0.059	20	0.71	0.048	30	0.96	0.037	40			
307 Santa Terezinha de Itaipu	1.45	0.059	90	1.77	0.048	90	2.40	0.037	90			
309 Sao Miguel do Iguacu	5.86	0.059	350	7.09	0.048	340	9.61	0.037	360			
313 Tres Barras do Parana	0.55	0.059	30	0.68	0.048	30	0.92	0.037	30			
Sudoeste Paranaense												
Subtotal of Municipalities of Basin	211.58	0.059	12,490	277.24	0.048	13,310	375.98	0.037	13,970			
Subtotal of Municipalities not of Basin	212.52	0.059	12,530	349.65	0.048	16,780	474.17	0.037	17,550			
MRH 289	168.98	0.059	9,970	400.32	0.048	19,230	746.02	0.037	21,600			
Sudoeste Paranaense												
316 Ampere	6.65	0.059	400	12.44	0.048	600	23.19	0.037	860			
317 Barraco	0.34	0.059	20	0.79	0.048	40	1.47	0.037	50			
318 Boa Esperanca do Iguacu	0.03	0.059	0	0.06	0.048	0	0.11	0.037	0			
319 Bom Sucesso do Sul	0.07	0.059	0	0.12	0.048	10	0.22	0.037	10			
320 Capanema	1.09	0.059	60	2.27	0.048	110	4.23	0.037	160			
321 Chopazinho	2.18	0.059	130	6.28	0.048	300	11.71	0.037	430			
322 Coronel Vivida	4.23	0.059	250	11.86	0.048	570	22.10	0.037	820			
323 Cruzeiro do Iguacu	3.43	0.059	200	13.59	0.048	200	25.33	0.037	940			
324 Dois Vizinhos	45.50	0.059	2,690	123.23	0.048	5,970	229.66	0.037	8,500			
325 Eneas Marques	0.15	0.059	10	0.30	0.048	10	0.56	0.037	20			
326 Fior da Serra do Sul	0.07	0.059	0	0.20	0.048	10	0.37	0.037	10			
327 Francisco Beltrao	73.34	0.059	4,340	142.24	0.048	6,840	265.08	0.037	9,800			
328 Itapejara do Oeste	2.08	0.059	120	4.04	0.048	190	7.54	0.037	280			
329 Maripolis	1.02	0.059	60	2.54	0.048	120	4.73	0.037	180			
330 Marmeleiro	1.32	0.059	80	4.29	0.048	210	7.99	0.037	300			
331 Nova Esperanca do Sudoeste	0.06	0.059	0	0.09	0.048	0	0.17	0.037	10			
332 Nova Prata do Iguacu	0.35	0.059	20	1.14	0.048	50	2.13	0.037	80			
333 Pato Branco	12.47	0.059	750	41.23	0.048	1,980	76.84	0.037	2,840			
334 Perola do Oeste	0.37	0.059	20	0.83	0.048	40	1.54	0.037	60			
335 Pinhal Sao Bento	0.02	0.059	0	0.03	0.048	0	0.06	0.037	0			
336 Planalto	0.40	0.059	20	0.89	0.048	40	1.63	0.037	60			
337 Pranchita	0.42	0.059	20	1.50	0.048	70	2.80	0.037	100			
338 Realeza	1.53	0.059	90	4.19	0.048	200	7.80	0.037	290			

(To be continued)

Table-2.21(3) Estimated Industrial Water Demand per Municipality in Iguacu River Basin in 1993, 2005 and 2015

No. and Name of Municipality	1993				2005				2015			
	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day	VA (Secondary Sector) USS million	Unit Rate m ³ /d. USS 1,000	Demand m ³ /day
MURH 289 (cont.)												
Sudoeste Paranaense	1.83	0.059	110	4.62	0.048	220	8.60	0.037	320	0.037	40	30
339 Remašoca	0.25	0.059	10	0.58	0.048	30	1.08	0.037	40	0.037	50	30
340 Salgado Filho	0.29	0.059	20	0.72	0.048	30	1.35	0.037	50	0.037	50	30
341 Saito de Lontra	0.40	0.059	20	0.79	0.048	40	1.48	0.037	60	0.037	70	40
342 Santa Izabel do Oeste	1.28	0.059	80	3.24	0.048	160	6.05	0.037	220	0.037	220	200
343 Santo Antonio do Sudoeste	0.46	0.059	30	1.00	0.048	50	1.87	0.037	70	0.037	80	70
344 Sao Joao	1.25	0.059	70	3.35	0.048	140	7.16	0.037	260	0.037	260	260
345 Sao Jorge do Oeste	4.66	0.059	270	9.38	0.048	450	17.49	0.037	650	0.037	650	650
346 Saude do Iguacu	0.40	0.059	20	0.97	0.048	50	1.80	0.037	70	0.037	70	70
347 Sulina	0.54	0.059	30	1.34	0.048	60	2.50	0.037	90	0.037	90	90
348 Vere	1.68	0.059	90	4.62	0.048	180	8.60	0.037	320	0.037	320	320
349 Vitonino	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0	0.037	0	0
Subtotal of Municipalities of Basin	180.50	0.059	10,650	315.38	0.048	15,140	600.43	0.037	22,220	0.037	22,220	22,220
Subtotal of Municipalities not of Basin	3.84	0.059	230	5.05	0.048	200	9.62	0.037	360	0.037	360	360
MURH 290	1.89	0.059	110	4.16	0.048	200	7.92	0.037	290	0.037	290	290
Campo de Guarapuava	99.44	0.059	5,870	183.56	0.048	8,310	349.47	0.037	12,930	0.037	12,930	12,930
350 Candi	5.17	0.059	310	8.41	0.048	400	16.00	0.037	590	0.037	590	590
351 Cantagalo	0.78	0.059	50	1.37	0.048	70	2.61	0.037	100	0.037	100	100
352 Guarapuava	12.78	0.059	750	14.89	0.048	710	28.35	0.037	1,050	0.037	1,050	1,050
353 Inacio Martins	24.51	0.059	1,450	46.82	0.048	2,250	89.14	0.037	3,300	0.037	3,300	3,300
354 Laranjeiras do Sul	7.75	0.059	460	10.80	0.048	520	20.56	0.037	760	0.037	760	760
355 Nova Laranjeiras	0.72	0.059	40	1.29	0.048	60	2.46	0.037	90	0.037	90	90
356 Pinhao	162.41	0.059	9,600	284.35	0.048	13,640	541.36	0.037	20,030	0.037	20,030	20,030
357 Quedas do Iguacu	18.09	0.059	1,050	31.03	0.048	1,500	59.07	0.037	2,190	0.037	2,190	2,190
358 Rio Bonito Iguacu	147.33	0.059	8,690	260.32	0.048	12,520	523.05	0.037	11,950	0.037	11,950	11,950
359 Virmond	10.99	0.059	650	24.83	0.048	1,190	31.88	0.037	1,180	0.037	1,180	1,180
Subtotal of Municipalities of Basin	14.72	0.059	870	21.37	0.048	1,030	17.95	0.037	660	0.037	660	660
Subtotal of Municipalities not of Basin	3.35	0.059	200	17.42	0.048	840	24.20	0.037	900	0.037	900	900
MURH 291	9.88	0.059	580	19.67	0.048	940	24.75	0.037	920	0.037	920	920
Meio Iguacu	0.30	0.059	20	0.30	0.048	10	0.40	0.037	10	0.037	10	10
361 Bitoruna	21.92	0.059	1,290	25.26	0.048	1,210	34.16	0.037	1,260	0.037	1,260	1,260
362 Clevelandia	34.95	0.059	2,050	53.91	0.048	2,590	71.84	0.037	2,660	0.037	2,660	2,660
363 Cruz Machado	0.30	0.059	20	0.46	0.048	20	0.62	0.037	20	0.037	20	20
364 General Carneiro	0.44	0.059	30	0.89	0.048	40	1.14	0.037	40	0.037	40	40
365 Homono Serra	0.36	0.059	20	2.03	0.048	100	1.74	0.037	60	0.037	60	60
366 Mangueirinha	50.12	0.059	2,960	94.66	0.048	4,550	114.35	0.037	4,240	0.037	4,240	4,240
367 Palmas	17.23	0.059	8,690	260.32	0.048	12,520	523.05	0.037	11,950	0.037	11,950	11,950
368 Paula Freitas	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0	0.037	0	0
369 Paulo Frontin	4,996.29	0.059	294,800	9,081.44	0.048	415,851	15,035.94	0.037	556,330	0.037	556,330	556,330
370 Porto Vitoria	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0	0.037	0	0
371 Uniao da Vitoria	0.00	0.059	0	0.00	0.048	0	0.00	0.037	0	0.037	0	0
Subtotal of Municipalities of Basin	180.50	0.059	10,650	315.38	0.048	15,140	600.43	0.037	22,220	0.037	22,220	22,220
Subtotal of Municipalities not of Basin	3.84	0.059	230	5.05	0.048	200	9.62	0.037	360	0.037	360	360
TOTAL OF THE MUNICIPALITIES OF THE BASIN	184.34	0.059	10,880	320.43	0.048	15,340	610.05	0.037	22,580	0.037	22,580	22,580

Source: Fundo de Participação dos Municípios-Índices Provisórios-95 (Municipalities Participation Fund-Preliminary Indexes-95) SEFA

Remark: Values in USS were estimated by JICA Team

: Figures of Palmas and Itati are listed in Tibagi River Basin

Table - 2.22 (1) Estimated GRDP by Secondary Sector per Municipality in 1993, 2005 and 2015 - Excluding Contribution of Hydroelectric Power Station/Iguaçu River Basin

		(Unit: US\$ million)			
No. and Name of MRH	No. and Name of Municipality	1993	2005	2015	
MRH 268 Curitiba	TOTAL of MRH	4,261.84	7,743.53	12,844.63	
	1 Almirante Tamandare	27.86	53.18	95.10	
	2 Araucaria	1,152.47	1,308.39	1,800.25	
	3 Balsa Nova	52.32	99.02	175.85	
	5 Campina Grande do Sul	11.14	33.34	65.91	
	6 Campo Largo	110.76	252.93	415.65	
	7 Colombo	74.63	151.44	266.46	
	8 Contenda	1.44	2.66	5.06	
	9 Curitiba	2,390.16	4,815.82	8,196.53	
	10 Fazenda Rio Grande	4.48	9.19	17.29	
	12 Mandirituba	1.53	3.07	5.76	
	13 Pinhais	65.55	192.75	357.12	
	14 Piraquara	3.94	11.65	21.59	
	15 Quatro Barras	28.35	41.98	67.79	
	17 São Jose dos Pinhais	212.77	573.91	1,040.71	
	Subtotal of Municipalities of Basin		4,137.40	7,549.32	12,531.06
	Subtotal of Municipalities not of Basin		124.44	194.21	313.57
	MRH 271 Alto Rio Negro	TOTAL of MRH	6.77	12.89	24.16
		28 Agudos do Sul	0.14	0.37	0.69
29 Pien		4.22	6.93	12.34	
30 Quitandinha		0.43	0.98	1.89	
31 Tijucas do Sul		1.98	4.61	9.24	
Subtotal of Municipalities of Basin		6.77	12.89	24.16	
Subtotal of Municipalities not of Basin	0.00	0.00	0.00		
MRH 272 Campos da Lapa	TOTAL of MRH	144.48	259.40	461.01	
	32 Campo do Tenente	0.30	0.18	0.23	
	33 Lapa	14.23	18.09	28.49	
	34 Palmeira	0.00	0.00	0.00	
	35 Porto Amazonas	0.88	2.51	4.73	
	36 Rio Negro	108.77	190.81	340.92	
	Subtotal of Municipalities of Basin	124.18	211.59	374.37	
Subtotal of Municipalities not of Basin	20.30	47.81	86.64		
MRH 275 Sao Mateus do Sul	TOTAL of MRH	30.25	48.95	91.88	
	46 Antonio Olinto	0.26	0.53	0.85	
	47 Sao Joao do Triunfo	0.46	0.25	0.21	
	48 Sao Mateus do Sul	29.53	48.16	90.82	
	Subtotal of Municipalities of Basin	30.25	48.95	91.88	
Subtotal of Municipalities not of Basin	0.00	0.00	0.00		
MRH 276 Colonial Irati	TOTAL of MRH	53.75	102.17	179.22	
	50 Irati	0.00	0.00	0.00	
	51 Mallet	4.19	9.86	17.47	
	53 Reboucas	1.12	2.05	3.09	
	54 Rio Azul	2.08	4.05	7.50	
	Subtotal of Municipalities of Basin	7.39	15.96	28.06	
Subtotal of Municipalities not of Basin	46.36	86.21	151.16		
MRH 288 Extremo Oeste Paranaense	TOTAL of MRH	424.10	626.89	850.15	
	269 Boa Vista da Aparecida	0.27	0.35	0.48	
	273 Capita Leonidas Marques	0.58	0.84	1.14	
	274 Cascavel	147.45	171.48	232.55	
	275 Catanduvas	0.41	0.68	0.93	
	276 Ceo Azul	14.74	27.20	36.89	
	282 Foz do Iguaçu	20.18	31.55	42.79	
	284 Guaraniçú	0.58	0.81	1.10	
	285 Ibema	4.16	6.15	8.34	
	290 Lindoeste	0.10	0.15	0.20	
	293 Matelândia	2.25	4.33	5.88	
	294 Medianeira	12.55	23.33	31.64	
	305 Santa Lucia	0.09	0.10	0.14	
	306 Santa Tereza do Oeste	0.36	0.71	0.96	
	307 Santa Terezinha de Itaipu	1.45	1.77	2.40	
	309 São Miguel do Iguaçu	5.86	7.09	9.61	
313 Três Barras do Parana	0.55	0.68	0.92		
Subtotal of Municipalities of Basin	211.58	277.24	375.98		
Subtotal of Municipalities not of Basin	212.52	349.65	474.17		

(to be continued)

Table - 2.22 (2) Estimated GRDP by Secondary Sector per Municipality in 1993, 2005 and 2015 - Excluding Contribution of Hydroelectric Power Station/Iguaçu River Basin

		(Unit: US\$ million)			
No. and Name of MRH	No. and Name of Municipality	1993	2005	2015	
MRH 289 Sudoeste Paranaense	TOTAL OF MRH	163.98	400.32	746.02	
	316 Ampere	6.65	12.44	23.19	
	317 Barracao	0.34	0.79	1.47	
	318 Boa Esperanca do Iguaçu	0.03	0.06	0.11	
	319 Bom Sucesso do Sul	0.07	0.12	0.22	
	320 Capanema	1.09	2.27	4.23	
	321 Chopinzinho	2.18	6.28	11.71	
	322 Coronel Vivida	4.23	11.86	22.10	
	323 Cruzeiro do Iguaçu	3.43	13.59	25.33	
	324 Dois Vizinhos	45.50	123.23	229.66	
	325 Eneas Marques	0.13	0.30	0.56	
	326 Flor da Serra do Sul	0.07	0.20	0.37	
	327 Francisco Beltrao	73.34	142.24	265.08	
	328 Itapejara do Oeste	2.08	4.04	7.54	
	329 Mariópolis	1.02	2.54	4.73	
	330 Marmeleiro	1.32	4.29	7.99	
	331 Nova Esperanca do Sudoeste	0.06	0.09	0.17	
	332 Nova Prata do Iguaçu	0.35	1.14	2.13	
	333 Pato Branco	12.47	41.23	76.84	
	334 Perola do Oeste	0.37	0.83	1.54	
	335 Pinhal Sao Bento	0.02	0.03	0.06	
	336 Planaltina	0.40	0.89	1.65	
	337 Franchita	0.42	1.50	2.80	
	338 Realeza	1.53	4.19	7.80	
	339 Renascença	1.83	4.62	8.60	
	340 Salgado Filho	0.25	0.58	1.08	
	341 Salto do Lontra	0.29	0.72	1.35	
	342 Santa Izabel do Oeste	0.40	0.79	1.48	
	343 Santo Antonio do Sudoeste	1.28	3.24	6.05	
	344 Sao Joao	0.46	1.00	1.87	
	345 Sao Jorge do Oeste	0.52	1.16	2.16	
	346 Saudade do Iguaçu	1.25	2.35	4.37	
	347 Sulina	4.66	9.38	17.49	
348 Vere	0.40	0.97	1.80		
349 Vitorino	0.54	1.34	2.50		
	Subtotal of Municipalities of Basin	168.98	400.32	746.02	
	Subtotal of Municipalities not of Basin	0.00	0.00	0.00	
MRH 290 Campos de Guarapuava	TOTAL OF MRH	180.50	315.38	600.43	
	350 Candió	3.84	5.05	9.62	
	351 Cantagalo	1.89	4.16	7.92	
	352 Guarapuava	99.44	183.56	349.47	
	353 Inacio Martins	5.53	8.00	15.23	
	354 Laranjeiras do Sul	5.17	8.41	16.00	
	355 Nova Laranjeiras	0.78	1.37	2.61	
	356 Pinhao	12.78	14.89	28.35	
	357 Quedas do Iguaçu	24.51	46.82	89.14	
	358 Rio Bonito Iguaçu	7.75	10.80	20.56	
	360 Virmond	0.72	1.29	2.46	
		Subtotal of Municipalities of Basin	162.41	284.35	541.36
		Subtotal of Municipalities not of Basin	18.09	31.03	59.07
MRH 291 Medio Iguaçu	TOTAL OF MRH	147.33	260.82	323.05	
	361 Bituruna	10.99	24.83	31.88	
	362 Clevelandia	14.72	21.37	17.95	
	363 Cruz Machado	3.35	17.42	24.20	
	364 General Carneiro	9.88	19.67	24.75	
	365 Honorio Serpa	0.30	0.30	0.40	
	366 Mangueirinha	21.92	25.26	34.16	
	367 Palmas	34.95	53.91	71.84	
	368 Paula Freitas	0.30	0.46	0.62	
	369 Paulo Frontin	0.44	0.89	1.14	
	370 Porto Vitoria	0.36	2.03	1.74	
371 Uniao da Vitoria	50.12	94.66	114.35		
	Subtotal of Municipalities of Basin	147.33	260.82	323.05	
	Subtotal of Municipalities not of Basin	0.00	0.00	0.00	
TOTAL OF THE MUNICIPALITIES OF THE BASIN		4,996.29	9,061.44	15,035.94	

Source: Fundo de Participação dos Municípios-Índices Provisórios-95 (Municipalities Participation Fund-Preliminary Indexes-95)/SEFA

Remark: Values in US\$ were estimated by JICA Team

: Figures of Palmeira/MRH 272 and Irati/MRH 276 are listed in Tibagi River Basin

3 MASTER PLAN FOR TIBAGI RIVER BASIN

3.1 Domestic Water

3.1.1 Present Situation of Domestic Water Consumption

(1) General

1) Regional Unit and Zoning of the Study

According to the regional unit of collected data concerning the socio-economic area and the domestic water consumption, it was decided to use the municipalities as a regional unit. Therefore, the zoning lines for the Study were drawn following the boundary lines of the municipalities. However, as the Study should be made by river basin, it was decided to use the following criteria for inclusion (or exclusion) of municipalities that straddle other river basins, in the zoning of the Study:

- All municipalities that have their urban center located within the river basin, regardless if only a part of the urban area is inside the river, were included in the zoning.
- If the urban center of the municipality is not included in this basin, but there is a chance that this municipality will start to use a small river that belongs to this river basin in the future, the municipality is included in the zoning.
- In the case of only a small part of the rural area of the municipality, approximately less than 10% of total area, be included in this river basin, the municipality is excluded of the zoning.
- Recommendations of the Counterpart Team were considered as to the inclusion of municipalities in the zoning, in accordance to the criteria, such as water supply system of undertakers.

The zoning for this river basin is composed of 43 municipalities, and is presented in Figure - 3.1.

2) Average Unit Consumption Rate of Paraná State and Unit Consumption Rate per MRH - 1993, 2005 and 2015

As described in Section - 1, the presented average unit consumption rate of Paraná state and the present unit consumption rate per MRH, and future unit consumption rate regarding what was mentioned above, were estimated as shown in Table - 3.1, Table - 3.2 and Table - 3.3.

Table - 3.1 Average Unit Consumption Rate of Paraná State - 1993, 2005 and 2015

	Average Unit Consumption Rate (l / person . day)								
	Residential Water			Non-Residential Water			Total Domestic Water		
	1993	2005	2015	1993	2005	2015	1993	2005	2015
Urban Population	90	115	140	25	30	40	115	145	180
Rural Population	70	75	80	0	0	0	70	75	80

Remark: Unit rate of residential water for rural population was estimated as unit rate of the 3rd Category of the classification of MRH (shown in Table-3.2 and Table - 3.3)

Table - 3.2 Unit Consumption Rate per MRH - 1993

	Classification	No. of MRH	Unit Consumption Rate (l / person . day)		
			Residential Water	Non-Residential Water	Total Domestic Water
Urban Population	1st Category	MRH 268, 281, 282	100	30	130
	2nd Category	MRH 269, 270 MRH 272 to MRH 276, MRH 279 to MRH 280 MRH 283 to MRH 286 MRH 288 to MRH 291	85	20	105
	3rd Category	MRH 271, 277, 278, 287	70	15	85
Rural Population	----	All MRH	70	---	70

Table - 3.3 Unit Consumption Rate per MRH - 2005 and 2015

	Classification	No. of MRH	Unit Consumption Rate (l / person . day)					
			Residential Water		Non-Residential Water		Total Domestic Water	
			2005	2015	2005	2015	2005	2015
Urban Population	1st Category	MRH 268, 281, 282, 288	125	155	35	45	160	200
	2nd Category	MRH 269, 270, MRH 272 to MRH 276, MRH 279 to MRH 280, MRH 283, MRH 285 to MRH 286, MRH 289 to MRH 291	100	125	30	35	130	160
	3rd Category	MRH 271, 277, 278, 284, 287	75	80	20	25	95	105
Rural Population	----	All MRH	75	80	---	---	75	80

(2) Present Unit Consumption Volume per Municipality

The 43 municipalities in the Study Zoning were related to 09 MRH, and each MRH was composed of municipalities with different sizes in terms of population and GRDP, therefore the Team collected the data of present unit consumption volume of residential water of some large-medium size municipalities in this river basin. Based on the information provided by ABC/SANEPAR, the unit consumption volume of 12 selected municipalities is presented in Table - 3.4.

Table - 3.4 Present Unit Consumption Volume of Large and Medium Size Municipalities - 1993

No. and Name of MRH	No. and Name of Municipality		Average Consumption Volume per Month (m ³)	Service Population Estimated by SANEPAR	Estimated Consumption Volume per Capita (l/day)
MRH 273 C. Ponta Grossa	39	Ponta Grossa	564,134	223,790	84.03
MRH 276 Colonial Irati	50	Irati	64,754	29,747	73.68
MRH 279 N. V. Jacarezinho	85	Corneílio Procópio	132,239	43,651	100.98
	87	Jacarezinho	91,976	31,262	98.07
MRH 281 N. N. Londrina	124	Londrina	1,309,459	420,143	103.89
MRH 284 N. N. Apucarana	184	Apucarana	250,610	89,737	93.09

Source: APC/SANEPAR

Municipalities in the Tibagi River Basin

No.	Name	Urban Area
34	Palmeiras	Y
35	Ponte Assaí	N
37	Campos de Piraia	Y
38	Piraia do Sul	Y
39	Ponte Grossa	Y
40	Tibagi	Y
41	Tibagi	Y
42	Verdinho	N
49	Imbuiz	Y
50	Imbuiz	Y
55	Traissas Soares	Y
57	Ipatinga	Y
58	Imbuiz	N
59	Orizânia	Y
60	Imbuiz	Y
63	Campos	Y
75	Supacama	Y
84	Conceição	P
85	Conceição Prudente	P
89	Luzópolis	N
90	N. América Colares	Y
91	Nova Fátima	N
97	S. Antônio Paraisópolis	Y
98	Serra Nova	Y
99	Alta	Y
100	Justiça	Y
101	N. Santa Bárbara	Y
102	Paraisópolis	Y
103	Santa Carolina	Y
104	São Jerônimo	Y
105	S. Sebastião Amantim	Y
106	União	Y
109	Araruama	P
113	Camê	P
119	Beaufort	Y
124	Luzópolis	Y
131	Princesa de Moço	Y
132	Baldonia	N
137	Serra Nova	Y
138	Araruama	P
187	Califórnia	Y
196	Munizópolis de São	N
200	Maid de São	P

Source: IPARDES

Remark: Urban Area
 Y: Urban Area in the River Basin
 P: Part of the Urban Area in River Basin
 N: Urban Area not included in the River Basin

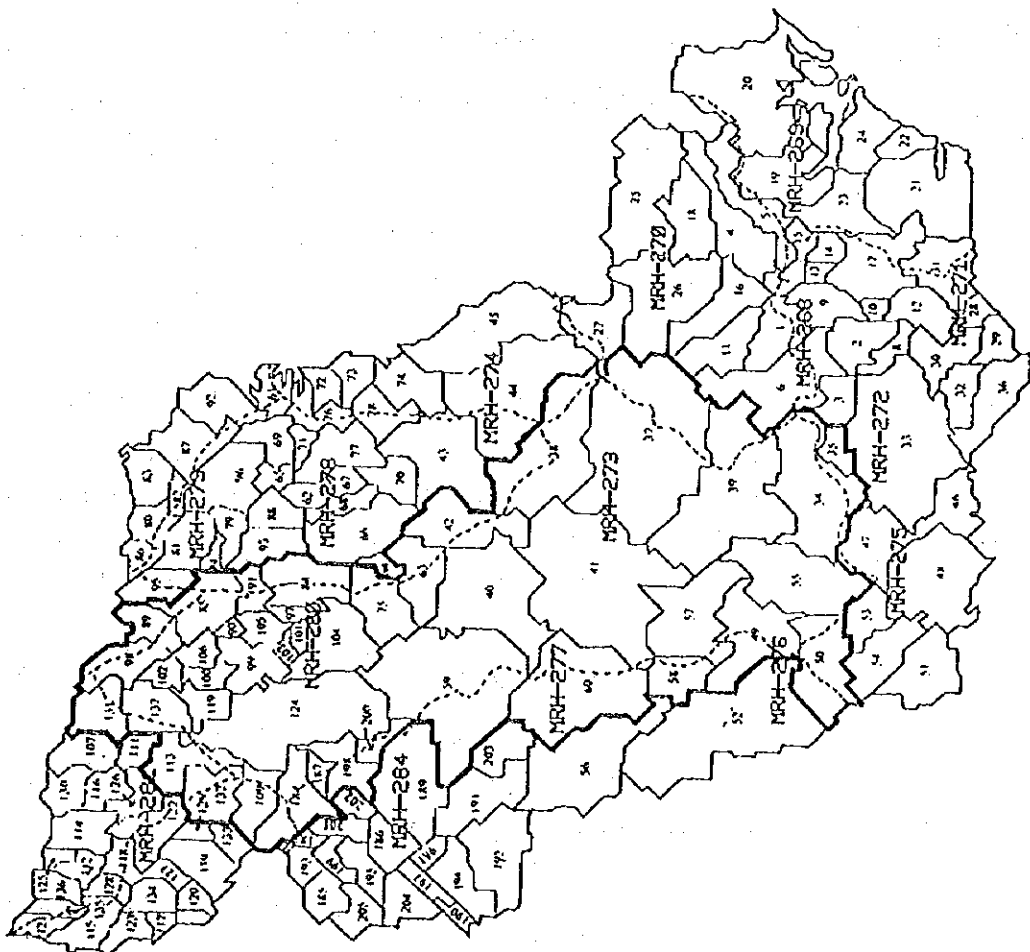


Figure - 3.1 Zoning of the Study / Tibagi River Basin

3.1.2 Estimation of Unit Consumption Rate per Municipality

(1) Present Unit Consumption Rate per Municipality

1) Unit Consumption Rate per Municipality of Residential water for Urban Population

According to Table - 3.2 and Table - 3.4, this unit rate was estimated tentatively between unit rate of large-medium size municipalities and other municipalities, by adjusting it to the total water demand per MRH to which they belong, calculated by multiplying the unit rate per MRH by the urban population per MRH.

2) Unit Consumption Rate per Municipalities of Non-Residential Water for Urban Population

This unit was estimated by the same method mentioned above, approximately in the same proportion between the unit rate of residential water and non-residential water of the MRH to which they belong.

3) Unit Consumption Rate per Municipality for Rural Population

This unit rate was estimated using the same figure of the unit consumption rate per MRH and average unit consumption rate of Paraná State. It means that the same unit rate was applied to all municipalities.

According to what was mentioned above, present unit consumption rate per municipality for urban population and rural population is shown in Table - 3.5.

(2) Future Unit Consumption Rate per Municipality

1) Unit Consumption Rate per Municipality of Residential water for Urban Population

Based on the unit consumption rate per MRH in 2005 and 2015 (shown in Table - 3.3) and present unit consumption rate per municipality (shown in Table - 3.4), this unit rate was estimated by the same method mentioned in the previous Section, approximately in the same proportion of present unit consumption rate between large-medium size municipalities and other municipalities.

2) Unit Consumption rate per Municipality of Non-Residential Water for Urban Population

Based on the unit consumption rate per MRH in 2005 and 2015, this unit rate was estimated by the same method of present unit consumption rate per municipality.

3) Unit Consumption Rate per Municipality for Rural Population

This unit in 2005 and 2015 was estimated using the same figure of the unit consumption rate per MRH in 2005 and 2015, respectively.

According to what was mentioned above, the unit consumption rate per municipality in 2005 and 2015 is shown in Table - 3.6 and Table - 3.7, respectively.

Table - 3.5 Present Unit Consumption Rate per Municipality of Domestic Water - 1993

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l/person . day)			
			Urban Population			Rural Population
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water
1st Category	MRH 281/N. N. Londrina	Londrina	105	35	140	
		Other Municipalities	95	25	120	70
2nd Category	MRH 272/Campos da Lapa MRH 273/C. Ponta Grossa	All Municipalities	85	20	105	70
		MRH 276/Col. Irati				
	MRH 279/N. V. Jacarezinho	Cornélio Procopio	100	25	125	
		Other Municipalities	80	15	95	70
	MRH 280/Algodoeira Assai	All Municipalities	85	20	105	70
	MRH 284/N. N. Apucarana	Apucarana	95	25	120	
3rd Category	MRH 277/Alto Ivaí MRH 278/N. V. Wenceslau Braz	Other Municipalities	70	15	85	70
		All Municipalities	70	15	85	70

Source: APO/SANEPAR

Remark: Jacarezinho in MRH 279 does not belong to the Basin but is estimated in the same way as Cornélio Procopio

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification

Table - 3.6 Future Unit Consumption Rate per Municipality of Domestic Water - 2005

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l/person . day)			
			Urban Population			Rural Population
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water
1st Category	MRH 281/N. N. Londrina	Londrina	135	40	175	
		Other Municipalities	115	30	145	75
2nd Category	MRH 272/Campos da Lapa MRH 273/C. Ponta Grossa	All Municipalities	100	30	130	75
		MRH 276/Col. Irati				
	MRH 279/N. V. Jacarezinho	Cornélio Procopio	115	35	150	
		Other Municipalities	95	25	120	75
	MRH 280/Algodoeira Assai	All Municipalities	100	30	130	75
	MRH 284/N. N. Apucarana	Apucarana	115	35	150	
3rd Category	MRH 277/Alto Ivaí MRH 278/N. V. Wenceslau Braz	Other Municipalities	90	25	115	75
		All Municipalities	75	20	95	75

Remark: Jacarezinho in MRH 279 does not belong to the Basin but is estimated in the same way as Cornélio Procopio

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification

Table - 3.7 Future Unit Consumption Rate per Municipality of Domestic Water - 2015

Classification of MRH	No. and Name of MRH	Classification of Municipality	Unit Consumption Rate (l/person . day)			
			Urban Population			Rural Population
			Residential Water	Non-Residential Water	Total Domestic Water	Domestic Water
1st Category	MRH 281/N. N. Londrina	Londrina	160	50	210	
		Other Municipalities	145	40	185	80
2nd Category	MRH 272/Campos da Lapa MRH 273/C. Ponta Grossa	All Municipalities	125	35	160	80
		MRH 276/Col. Irati				
	MRH 279/N. V. Jacarezinho	Cornélio Procopio	145	40	185	
		Other Municipalities	115	35	150	80
	MRH 280/Algodoeira Assai	All Municipalities	125	35	160	80
	MRH 284/N. N. Apucarana	Apucarana	140	40	180	
3rd Category	MRH 277/Alto Ivaí MRH 278/N. V. Wenceslau Braz	Other Municipalities	115	30	145	80
		All Municipalities	80	25	105	80

Remark: Jacarezinho in MRH 279 does not belong to the Basin but is estimated in the same way as Cornélio Procopio

Unit rate of Residential Water for rural population was estimated as the same figure as the unit rate of the 3rd Category of MRH Classification