

3.1.3 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 - 3.5, Table - 3.6 and Table - 3.7) as is presented in Table - 3.13, Table - 3.14 and Table - 3.15.

(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 - 3.8, using the MRH as regional unit.

Table - 3.8 Restriction and Distribution of Urban Population, in 2005 and 2015

No. and Name of MRH	2005		2015	
	%	Urban Population	%	Urban Population
MRH 268/Caritiba	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: Ponta Grossa, Telêmaco Borba and Castro will participate in MRH 273/Campos de Ponta Grossa and that other three municipalities: Londrina, Cambé and Arapongas participate in MRH 281/N. N. Londrina. The participation of these six municipalities, in the MRH to which they belong, is shown in Table - 3.9.

Table - 3.9 Participation of Urban Population of Six Municipalities in 2005 and 2015 by Alternative Case

YEAR		2005		2015	
		%	Urban Population	%	Urban Population
MRH 271/C. de Ponta Grossa		100.00	*(37,200)	100.00	(67,000)
39	Ponta Grossa	65.00	24,200	65.00	43,600
40	Telêmaco Borba	25.00	7,400	20.00	13,400
37	Castro	15.00	5,600	15.00	10,000
MRH 281/N. N. Londrina		100.00	(79,200)	100.00	(142,200)
124	Londrina	75.00	59,400	75.00	106,700
113	Cambé	15.00	11,900	15.00	21,300
109	Arapongas	10.00	7,900	10.00	14,200

2) Water Demand Projection

Based on the participation mentioned in Table - 3.9, the estimated water demand for urban population of Cascavel and Foz do Iguacu by Alternative Case in 2005 and 2015 is shown in Table - 3.10 and Table - 3.11, respectively.

Table - 3.10 Estimated Water Demand for Urban Population by Alternative Case in 2005

No. and Name of Municipality		Water Demand for urban Population					Total Urban Demand m ³ /day
		Urban Population in 2005	Residential Water		Non-Residential Water		
No.	Name		Unit Rate m ³ /d . p	Demand m ³ /day	Unit Rate m ³ /d . p	Demand m ³ /day	
39	Ponta Grossa	294,080	0.100	29,408	0.030	8,822	38,230
40	Telêmaco Borba	87,750	0.100	8,775	0.030	2,633	11,410
37	Castro	62,850	0.100	6,285	0.030	1,886	8,170
124	Londrina	547,790	0.135	73,952	0.040	21,912	95,860
113	Cambé	108,350	0.115	12,460	0.030	3,251	15,710
109	Arapongas	78,420	0.115	9,018	0.030	2,353	11,370

Remark: m³/d . p = m³/day . person

Table - 3.11 Estimated Water Demand for Urban Population by Alternative Case in 2015

No. and Name of Municipality		Water Demand for urban Population					Total Urban Demand m ³ /day
		Urban Population in 2015	Residential Water		Non-Residential Water		
No.	Name		Unit Rate m ³ /d . p	Demand m ³ /day	Unit Rate m ³ /d . p	Demand m ³ /day	
39	Ponta Grossa	350,320	0.125	43,790	0.035	12,261	56,050
40	Telêmaco Borba	113,220	0.125	14,153	0.035	3,963	18,120
37	Castro	81,080	0.125	10,135	0.035	2,830	12,970
124	Londrina	686,460	0.160	109,834	0.050	34,323	144,160
113	Cambé	140,070	0.145	20,310	0.040	5,603	25,910
109	Arapongas	92,820	0.145	13,549	0.040	3,713	17,170

Remark: m³/d . p = m³/day . person

Table - 3.12 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	
39	Ponta Grossa	35,080	38,230	3,150	49,080	56,050	6,970
40	Telêmaco Borba	10,450	11,410	960	15,970	18,120	2,150
37	Castro	7,440	8,170	730	11,370	12,970	1,600
124	Londrina	85,470	95,860	10,390	121,750	144,160	22,410
113	Cambé	13,990	15,710	1,720	21,970	25,910	3,940
109	Arapongas	10,230	11,370	1,140	14,550	17,170	2,620

Table - 3.13 Estimated Domestic Water Demand per Municipality in Tibagi River Basin - 1995 / Base Case

No. and Name of MRH	No. and Name of Municipality	Water Demand for Urban Population				Water Demand for Rural Population				Total Demand m3/day			
		Urban Area	Urban Population	Residential Water		Non-Residential Water		Rural Population	Area Involved (%)		Unit Rate m3 / d . p		
				Unit Rate m3 / d . p	Demand m3/day	Unit Rate m3 / d . p	Demand m3/day						
MARH 272 C. de LAPA		Y	15,221	0.085	1,294	0.020	304	14,533	81.78	0.070	330	2,430	
MARH 273 C. de PONTA GROSSA		N	0	0.000	0	0.000	0	0	26.02	0.070	20	20	
		Y	41,065	0.085	3,491	0.020	83	24,987	73.44	0.070	1,230	5,600	
		Y	12,568	0.085	1,068	0.020	251	1,320	6,964	0.070	340	1,660	
		Y	226,775	0.085	19,276	0.020	4,536	12,133	82.43	0.070	700	24,510	
		Y	57,538	0.085	4,891	0.020	1,151	6,040	100.00	0.070	660	6,700	
		Y	7,631	0.085	649	0.020	153	8,995	99.61	0.070	630	1,430	
		N	0	0.000	0	0.000	0	0	46.12	0.070	90	90	
MARH 276 Col. de IBAITI		Y	8,119	0.085	690	0.020	162	18,063	75.25	0.070	960	1,810	
		Y	32,420	0.085	2,756	0.020	648	16,180	15.57	0.070	180	3,580	
		Y	4,771	0.085	406	0.020	95	9,455	97.04	0.070	640	1,140	
MARH 277 ALTO IVAI		Y	3,345	0.070	234	0.015	50	5,532	99.97	0.070	670	950	
		N	0	0.000	0	0.000	0	0	34.80	0.070	200	200	
		Y	5,444	0.070	381	0.015	82	19,339	64.27	0.070	870	1,330	
		Y	7,753	0.070	543	0.015	116	17,333	31.39	0.070	380	1,040	
MARH 278 N. V. DE WENCESLAU B.		Y	4,380	0.070	307	0.015	66	6,274	62.19	0.070	270	480	
		Y	3,119	0.070	218	0.015	47	3,928	76.63	0.070	210	480	
MARH 279 N. V. JACAREZINHO		P	4,211	0.050	209	0.015	63	3,505	17.78	0.070	30	440	
		N	0	0.000	0	0.000	0	0	53.65	0.070	230	530	
		N	0	0.000	0	0.000	0	0	19.98	0.070	30	30	
		Y	1,880	0.080	150	0.015	28	180	100.00	0.070	150	330	
		N	0	0.000	0	0.000	0	0	35.99	0.070	60	60	
		Y	1,210	0.080	97	0.015	18	120	100.00	0.070	80	200	
		Y	4,941	0.080	395	0.015	74	470	1,707	52.33	0.070	60	530
MARH 280 ALG. DE ASSAI		Y	13,249	0.085	1,126	0.020	263	1,400	100.00	0.070	480	1,830	
		Y	8,565	0.085	728	0.020	171	900	100.00	0.070	130	1,030	
		Y	2,115	0.085	180	0.020	42	1,552	100.00	0.070	110	330	
		Y	3,365	0.085	286	0.020	67	350	1,105	100.00	0.070	80	430
		Y	2,639	0.085	224	0.020	53	280	2,141	100.00	0.070	150	430
		Y	5,234	0.085	445	0.020	105	550	7,795	99.95	0.070	550	1,100
		Y	4,859	0.085	413	0.020	97	510	3,316	100.00	0.070	230	740
		Y	9,360	0.085	796	0.020	187	980	3,766	100.00	0.070	260	1,240
MARH 281 N. N. LONDRINA		P	61,063	0.095	5,801	0.025	1,527	4,275	48.59	0.070	130	2,480	
		P	70,214	0.095	6,670	0.025	1,755	8,430	29.96	0.070	140	8,570	
		Y	32,425	0.095	3,080	0.025	811	4,079	100.00	0.070	290	4,180	
		Y	380,979	0.105	40,003	0.035	13,334	21,995	100.00	0.070	1,540	54,880	
		Y	9,922	0.095	943	0.025	248	1,190	38.41	0.070	50	1,240	
		N	0	0.000	0	0.000	0	0	12.11	0.070	60	60	
		Y	10,188	0.095	968	0.025	255	3,842	97.13	0.070	260	1,480	
MARH 284 N. N. APUCARANA		P	88,221	0.095	8,381	0.025	2,206	10,590	32.83	0.070	190	10,780	
		Y	4,646	0.070	325	0.015	70	400	74.27	0.070	130	530	
		N	0	0.000	0	0.000	0	0	39.51	0.070	130	130	
		P	3,068	0.070	217	0.015	46	260	31.27	0.070	30	290	
TOTAL OF BASIN			1,193,440		142,790		303,484				14,540	157,330	

Remark: 1) m3/d . p = m3/day . person; 2) Seven municipalities do not have figures in "Water Demand for Urban Population" because the urban area of these municipalities does not belong to the river basin

Table - 3.14 Estimated Domestic Water Demand per Municipality in Tibagi River Basin - 2005 / Base Case

No. and Name of MPRH	No. and Name of Municipality		Water Demand for Urban Population				Water Demand for Rural Population				Total Domestic Demand	Water Demand for Rural Population				Total Demand m3/day		
			Urban Area	Urban Population	Residential Water		Non-Residential Water		Rural Population	Area Involved (%)		Unit Rate m3 / d . p	Demand m3/day	Rural Population	Area Involved (%)		Unit Rate m3 / d . p	Demand m3/day
					Unit Rate m3 / d . p	Demand m3/day	Unit Rate m3 / d . p	Demand m3/day										
MPRH 272			Y	17,900	0.100	1,790	0.000	0	0.000	0	0	15,566	81,78	0.075	950	3,280		
C. da LAPA			N	0	0.000	0	0	0	0	0	0	1,380	28,02	0.075	30	90		
MPRH 273			Y	57,250	0.100	5,725	0.030	1,718	0.030	1,718	7,440	24,710	73,74	0.075	1,370	8,810		
C. de PONTA GROSSA			Y	15,000	0.100	1,500	0.030	452	0.030	452	1,900	6,130	70,59	0.075	330	2,290		
			Y	269,880	0.100	26,988	0.030	8,096	0.030	8,096	35,080	10,480	82,43	0.075	650	35,730		
			Y	80,350	0.100	8,035	0.030	2,411	0.030	2,411	10,450	4,990	100,00	0.075	370	10,820		
			Y	12,760	0.100	1,276	0.030	383	0.030	383	1,660	6,660	99,61	0.075	500	2,160		
			N	0	0.000	0	0	0	0	0	0	2,430	46,12	0.075	80	90		
MPRH 276			Y	9,970	0.100	997	0.030	299	0.030	299	1,300	18,650	75,55	0.075	1,000	2,350		
Col. de IRATI			Y	40,450	0.100	4,045	0.030	1,214	0.030	1,214	5,260	12,840	15,57	0.075	190	5,410		
			Y	6,330	0.100	633	0.030	190	0.030	190	820	8,680	97,04	0.075	630	1,450		
MPRH 277			Y	4,280	0.075	321	0.020	86	0.020	86	410	10,800	99,97	0.075	810	1,220		
ALTO IVAI			N	0	0.000	0	0.000	0	0.000	0	0	7,570	34,80	0.075	200	200		
			Y	5,670	0.075	425	0.020	113	0.020	113	540	8,500	64,27	0.075	410	950		
			Y	11,800	0.075	885	0.020	236	0.020	236	1,120	14,740	31,39	0.075	350	1,470		
MPRH 278			Y	7,290	0.075	547	0.020	140	0.020	140	690	4,820	62,19	0.075	230	920		
N. V. DE WENCESLAU B.			Y	5,000	0.075	375	0.020	100	0.020	100	480	2,370	76,62	0.075	140	620		
MPRH 279			P	5,700	0.095	542	0.025	145	0.025	145	680	1,960	17,78	0.075	34	710		
N. V. JACAREZINHO			P	48,000	0.115	5,527	0.035	1,682	0.035	1,682	7,210	3,050	59,65	0.075	120	7,330		
			Y	0	0.000	0	0.000	0	0.000	0	0	1,360	19,98	0.075	20	20		
			Y	2,370	0.095	225	0.025	59	0.025	59	280	1,360	100,00	0.075	100	380		
			N	0	0.000	0	0.000	0	0.000	0	0	1,310	35,99	0.075	40	40		
			Y	1,250	0.095	119	0.025	31	0.025	31	150	560	100,00	0.075	40	190		
			Y	5,460	0.095	519	0.025	137	0.025	137	660	970	52,35	0.075	40	700		
MPRH 280			Y	15,380	0.100	1,538	0.030	461	0.030	461	2,000	3,720	100,00	0.075	280	2,280		
ALG. DE ASSAI			Y	9,820	0.100	982	0.030	295	0.030	295	1,280	1,180	100,00	0.075	90	1,370		
			Y	2,170	0.100	217	0.030	65	0.030	65	280	1,040	100,00	0.075	80	360		
			Y	4,120	0.100	412	0.030	124	0.030	124	540	480	100,00	0.075	40	580		
			Y	2,670	0.100	267	0.030	80	0.030	80	350	1,200	100,00	0.075	90	440		
			Y	7,710	0.100	771	0.030	231	0.030	231	1,000	4,040	99,95	0.075	300	1,300		
			Y	7,470	0.100	747	0.030	224	0.030	224	970	2,280	100,00	0.075	170	1,140		
			Y	10,860	0.100	1,086	0.030	326	0.030	326	1,410	1,960	100,00	0.075	150	1,560		
MPRH 281			P	70,520	0.115	8,110	0.030	2,116	0.030	2,116	10,230	2,480	48,59	0.075	90	10,320		
N. N. LONDRINA			P	96,450	0.115	11,092	0.030	2,894	0.030	2,894	13,990	4,460	29,96	0.075	100	14,090		
			Y	45,790	0.115	5,259	0.030	1,372	0.030	1,372	6,630	2,000	100,00	0.075	150	6,780		
			Y	488,390	0.135	65,933	0.040	19,536	0.040	19,536	85,470	12,880	100,00	0.075	970	86,440		
			Y	11,340	0.115	1,304	0.030	340	0.030	340	1,640	640	38,41	0.075	20	1,660		
			N	0	0.000	0	0.000	0	0.000	0	0	3,370	12,11	0.075	30	30		
			Y	11,930	0.115	1,372	0.030	358	0.030	358	1,730	1,660	97,13	0.075	120	1,850		
MPRH 284			P	110,160	0.115	12,668	0.035	3,856	0.035	3,856	16,520	3,120	52,83	0.075	130	16,650		
N. N. APUCARANA			Y	5,950	0.090	536	0.025	149	0.025	149	680	1,430	74,27	0.075	80	760		
			N	0	0.000	0	0.000	0	0.000	0	0	2,850	39,51	0.075	80	80		
			P	3,830	0.090	345	0.025	96	0.025	96	440	1,010	31,27	0.075	20	460		
TOTAL OF THE BASIN				1,511,330						223,630	225,630				11,640	235,270		

Remark: 1) m3/d . p = m3/day . person. 2) Seven municipalities do not have figures in "Water Demand for Urban Population" because the urban area of these municipalities does not belong to the river basin.

Table - 3.15 Estimated Domestic Water Demand per Municipality in Tibagi 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		
		Urban Area	Urban Population	Residential Water		Domestic Demand	Rural Population	Area Involved (%)	Unit Rate m ³ /d.p		Demand m ³ /day	
				Unit Rate m ³ /d.p	Demand m ³ /day							
MRH 272	34 Palmeira	Y	20,230	0.125	2,529	0.035	708	3,240	15,340	81.78	1,660	4,240
C. da LAPA	35 Porto Amazonas	N	0	0.000	0	0.000	0	0	0	26.02	30	30
MRH 273	37 Castro	Y	71,080	0.125	8,883	0.035	2,488	11,370	22,520	73.74	1,330	12,700
C. de PONTA GROSSA	38 Pira do Sul	Y	17,190	0.125	2,149	0.035	602	2,750	5,000	70.59	0,880	280
	39 Ponta Grossa	Y	306,720	0.125	38,340	0.035	10,735	49,080	8,340	82.43	0,880	550
	40 Telmeco Borba	Y	99,820	0.125	12,478	0.035	3,404	15,970	2,710	100.00	0,880	220
	41 Tibagi	Y	17,150	0.125	2,144	0.035	600	2,740	4,310	99.61	0,880	340
	42 Ventania	N	0	0.000	0	0.000	0	0	0	46.12	70	70
MRH 276	49 Imbitava	Y	11,520	0.125	1,440	0.035	403	1,840	18,040	75.55	0,880	1,090
Col. de IRATI	50 Irati	Y	47,140	0.125	5,893	0.035	1,650	7,540	9,670	15.57	0,880	120
	55 Teixeira Soares	Y	7,630	0.125	954	0.035	267	1,220	7,650	97.04	0,880	590
MRH 277	57 Ipiranga	Y	3,050	0.080	404	0.025	126	530	10,430	99.97	0,880	830
ALTO IVAL	58 Iva	N	0	0.000	0	0.000	0	0	0	34.80	0,880	170
	59 Oruguera	Y	5,880	0.080	470	0.025	147	620	3,730	64.27	0,880	190
	60 Reserva	Y	15,110	0.080	1,209	0.025	378	1,620	10,720	31.39	0,880	270
MRH 278	63 Curitiba	Y	9,690	0.080	775	0.025	242	1,020	3,770	62.19	0,880	190
N. V. DE WENCESLAU B	75 Sarozema	Y	6,460	0.080	525	0.025	164	690	1,520	76.62	0,880	90
MRH 279	84 Congonhabas	P	6,990	0.115	804	0.035	242	1,050	1,000	17.78	0,880	70
N. V. JACAREZINHO	85 Comêdio Procripio	P	54,290	0.145	7,872	0.040	2,172	10,040	0	53.65	0,880	50
	89 Leopoldas	N	0	0.000	0	0.000	0	0	0	19.98	0,880	10
	90 N. Amélia da Coliza	Y	2,800	0.115	322	0.035	98	420	880	100.00	0,880	70
	91 Nova Fatima	N	0	0.000	0	0.000	0	0	0	35.99	0,880	20
	97 S. Antônio do Paraíso	Y	1,200	0.115	150	0.035	46	200	340	100.00	0,880	30
	98 Sertaneja	Y	5,910	0.115	680	0.035	207	890	680	52.35	0,880	30
MRH 280	99 Assa	Y	17,230	0.125	2,154	0.035	603	2,760	2,970	100.00	0,880	190
ALG. DE ASSAI	100 Jataizinho	Y	10,910	0.125	1,364	0.035	382	1,750	0	100.00	0,880	70
	101 N. Santa Barbara	Y	2,230	0.125	279	0.035	78	360	710	100.00	0,880	60
	102 Rancho Alegre	Y	4,780	0.125	598	0.035	167	770	250	100.00	0,880	20
	103 Santa Cecilia do Pavão	Y	2,700	0.125	338	0.035	94	430	780	100.00	0,880	60
	104 São Jerônimo Serra	Y	9,800	0.125	1,225	0.035	343	1,570	1,440	99.95	0,880	120
	105 S. Sebastião Amoreira	Y	9,680	0.125	1,210	0.035	339	1,550	1,620	100.00	0,880	130
	106 Urã	Y	12,170	0.125	1,521	0.035	426	1,950	1,200	100.00	0,880	100
MRH 281	109 Arapongas	P	78,620	0.145	11,400	0.040	3,145	14,350	1,220	48.59	0,880	50
N. N. LONDRINA	113 Camb	P	118,770	0.145	17,222	0.040	4,751	21,970	2,880	29.96	0,880	70
	119 Ipiror	Y	57,060	0.145	8,274	0.040	2,282	10,560	1,140	100.00	0,880	90
	124 Londrina	Y	579,760	0.160	92,762	0.050	26,988	121,750	8,330	100.00	0,880	670
	131 Príncipe de Mauro	Y	12,560	0.145	1,821	0.040	502	2,320	270	38.41	0,880	10
	132 Rolândia	N	0	0.000	0	0.000	0	0	0	12.11	0,880	20
	137 Sertãozinho	Y	13,420	0.145	1,946	0.040	537	2,480	840	97.13	0,880	70
MRH 284	184 Apucarana	P	129,880	0.140	18,183	0.040	5,195	23,380	2,610	32.83	0,880	70
N. N. APUCARANA	187 Califórnia	Y	7,120	0.115	819	0.030	214	1,030	910	74.27	0,880	50
	198 Marilândia do Sul	N	0	0.000	0	0.000	0	0	0	39.51	0,880	70
	200 Mauá da Serra	P	4,490	0.115	516	0.030	135	650	730	31.27	0,880	20
TOTAL OF BASIN			1,783,240					322,630	170,590		9,520	332,150

Remark: 1) m³/d. p = m³/day . person; 2) Seven municipalities do not have figures in "Water Demand for Urban Population" because the urban area of these municipalities does not belong to the river basin

3.2 Industrial Water

3.2.1 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.

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

Based on what was mentioned in Section - 3.2.1(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 - 3.16.

Table - 3.16 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

3.2.3 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 - 3.22.

(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 - 3.22.

3.2.4 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 - 3.21.

(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 - 3.17, using the MRH as regional unit.

Table - 3.17 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/Caritiba		100.00	(1,950.00)	(750.00)	100.00	(5,100.00)	(1,900.00)
MRH 271 C. Ponta Grossa		14.70	285.00	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 283 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: Ponta Grossa, Telémaco Borba and Castro will participate in MRH 273/Campos de Ponta Grossa and that other three municipalities: Londrina, Cambé and Arapongas participate in MRH 281/N. N. Londrina.. The participation of these six municipalities, in the MRH to which they belong, is shown in Table - 3.18.

Table - 3.18 Participation of GRDP (Secondary Sector and Tertiary Sector) and GRDP by Secondary Sector of six 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 273 C. Ponta Grossa	100.00	(285.00)	(110.00)	100.00	(735.00)	(275.00)
39 Ponta Grossa	65.00	185.00	70.00	65.00	480.00	180.00
40 Telémaco Borba	25.00	55.00	25.00	20.00	150.00	55.00
37 Castro	15.00	45.00	15.00	15.00	105.00	40.00
MRH 281 N. N. Londrina	100.00	(610.00)	(235.00)	100.00	(1,560.00)	(580.00)
124 Londrina	75.00	460.00	175.00	75.00	1,170.00	435.00
113 Cambé	15.00	90.00	35.00	15.00	235.00	90.00
109 Arapongas	10.00	60.00	25.00	10.00	155.00	55.00

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 - 3.19.

Table - 3.19 Estimated Industrial Water Demand per 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
39	Ponta Grossa	587.72	0.048	28,210	959.55	0.037	35,500
40	Telémaco Borba	296.21	0.048	14,220	469.72	0.037	17,380
37	Castro	255.52	0.048	12,260	509.30	0.037	18,840
124	Londrina	643.06	0.048	30,870	1,139.51	0.037	42,160
113	Cambé	268.62	0.048	12,890	506.82	0.037	18,750
109	Arapongas	159.00	0.048	7,630	283.20	0.037	10,480

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

The difference of water demand between Base Case and Alternative Case of the six municipalities mentioned above is shown in Table - 3.20, as the comparison.

Table - 3.20 Comparison of 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						
39	Ponta Grossa	24,850	28,210	3,360	28,840	35,500	6,660
40	Telémaco Borba	13,020	14,220	1,200	15,340	17,380	2,040
37	Castro	11,540	12,260	720	17,360	18,840	1,480
124	Londrina	22,470	30,870	8,400	26,070	42,160	16,090
113	Cambé	11,210	12,890	1,680	15,420	18,750	3,330
109	Arapongas	6,430	7,630	1,200	8,440	10,480	2,040

Table - 3.21 Estimated Industrial Water Demand per Municipality of Tibagi River Basin in 1993, 2005 and 2015 (Unit: US\$ million)

No. and Name of MURH	No. and Name of Municipality	1993				2005				2015			
		VA (Secondary Sector) US\$ million	Unit Rate m ³ /d. US\$ 1,000	Demand m ³ /day	VA (Secondary Sector) US\$ million	Unit Rate m ³ /d. US\$ 1,000	Demand m ³ /day	VA (Secondary Sector) US\$ million	Unit Rate m ³ /d. US\$ 1,000	Demand m ³ /day	VA (Secondary Sector) US\$ million	Unit Rate m ³ /d. US\$ 1,000	Demand m ³ /day
MURH 272	34 Palmeira	20.30	0.059	1,200	47.81	0.048	2,290	86.64	0.037	3,210			
MURH 273	35 Porto Amazonas	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
MURH 275	37 Castro	8.118	0.059	4,790	240.52	0.048	11,530	469.30	0.037	17,360			
	38 Pirai do Sul	16.53	0.059	980	44.54	0.048	2,140	84.70	0.037	3,130			
	39 Ponta Grossa	294.20	0.059	17,350	517.72	0.048	24,840	779.55	0.037	28,840			
	40 Telemaco Borba	8.120	0.059	8,120	271.21	0.048	13,020	414.72	0.037	15,340			
	41 Tibagi	0.81	0.059	50	2.13	0.048	100	3.91	0.037	140			
	42 Ventania	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
MURH 276	49 Imbituva	6.37	0.059	380	11.24	0.048	540	19.58	0.037	720			
	50 Irapu	32.81	0.059	1,940	61.20	0.048	2,940	107.00	0.037	3,960			
	55 Teixeira Soares	1.47	0.059	90	1.23	0.048	60	0.88	0.037	30			
MURH 277	57 Ipiranga	0.32	0.059	20	0.35	0.048	20	0.58	0.037	20			
	58 Iva	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
	59 Oruguazra	0.90	0.059	50	1.44	0.048	70	2.58	0.037	100			
	60 Reserva	0.56	0.059	30	1.04	0.048	50	2.00	0.037	70			
MURH 278	65 Curitiba	0.32	0.059	20	0.38	0.048	20	0.84	0.037	30			
N.V. Venâncio B.	75 Sapopema	0.31	0.059	20	0.55	0.048	30	0.99	0.037	40			
MURH 279	84 Congonhinhas	0.22	0.059	10	0.92	0.048	40	1.77	0.037	70			
N.V. Jataizinho	85 Cornélio Procopio	49.71	0.059	2,970	75.46	0.048	3,620	112.18	0.037	4,150			
	89 Leopoldo	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
	90 N. América Colina	1.90	0.059	110	4.89	0.048	230	9.01	0.037	330			
	91 Nova Fátima	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
	97 S. Antônio Paraiso	0.03	0.059	0	0.07	0.048	0	0.12	0.037	0			
MURH 280	98 Sertaneja	0.09	0.059	10	10.40	0.048	500	26.63	0.037	990			
	99 Assa	19.22	0.059	1,140	23.85	0.048	1,150	26.09	0.037	970			
Alg. Assa	100 Jataizinho	3.59	0.059	210	0.79	0.048	40	0.17	0.037	10			
	101 N. Santa Barbara	0.05	0.059	0	0.09	0.048	0	0.14	0.037	10			
	102 Rancho Alegre	4.96	0.059	290	8.98	0.048	490	13.43	0.037	500			
	103 Santa Cecilia Pardo	2.80	0.059	170	5.19	0.048	250	8.00	0.037	300			
	104 São Jerônimo Serra	0.18	0.059	10	0.23	0.048	10	0.32	0.037	10			
	105 S. Sebastião Amoreira	0.21	0.059	10	0.26	0.048	10	0.37	0.037	10			
	106 Ura	1.51	0.059	90	0.98	0.048	50	0.51	0.037	20			
MURH 281	109 Araxoengas	61.74	0.059	3,640	124.00	0.048	6,420	228.20	0.037	8,420			
N.N. Londrina	113 Camb	143.08	0.059	8,440	233.62	0.048	11,210	416.82	0.037	15,420			
	119 Ibipor	18.99	0.059	1,120	39.09	0.048	1,880	68.12	0.037	2,520			
	124 Londrina	274.81	0.059	16,210	468.06	0.048	22,470	704.51	0.037	26,070			
	131 Primeiro de Maio	0.52	0.059	30	1.29	0.048	60	3.34	0.037	120			
	132 Rolândia	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
	137 Sertãozinho	6.04	0.059	360	17.30	0.048	830	36.48	0.037	1,350			
MURH 284	184 Apucarana	75.71	0.059	4,270	172.41	0.048	8,280	286.04	0.037	10,380			
N.N. Apucarana	187 Califórnia	0.83	0.059	50	2.53	0.048	120	4.85	0.037	180			
	198 Marilândia do Sul	0.00	0.000	0	0.00	0.000	0	0.00	0.000	0			
	200 Maua da Serra	13.76	0.059	810	20.80	0.048	1,000	37.17	0.037	1,380			
	TOTAL OF THE MUNICIPALITIES OF THE BASIN			75,150			116,280			146,820			

Source: Fundo de Participação dos Municípios - Índices Provisórios - 95 (Municipalities Participation Fund - Preliminary Indices - 95) SIEFA
 Remark: 1) Values in US\$ were estimated by JICA Team 2) Figures of Porto Amazonas are listed in Iguape River Basin 3) According to JICA Team's criteria to define industrial water (refer to Section 3.2.1 (2)), six municipalities (Ventania, Ivaí, Leopoldo, Nova Fátima, Rolândia and Marilândia do Sul) were estimated as having "Industrial Water Demand" equal to zero

Table - 3.22 Estimated GRDP by Secondary Sector per Municipality in 1993, 2005 and 2015
Excluding Contribution of Hydroelectric Power Station / Tibagi River Basin

(Unit: US\$ million)

No. and Name of MRH	No and Name of Municipality	1993	2005	2015
MRH 272 Campos da Lapa	TOTAL of MRH	144.48	259.40	461.01
	34 Palmeira	20.30	47.81	86.64
	35 Porto Amazonas	0.00	0.00	0.00
	Subtotal of Municipalities of Basin	20.30	47.81	86.64
	Subtotal of Municipalities not of Basin	124.18	211.59	374.37
MRH 273 C. Ponta Grossa	TOTAL of MRH	530.69	1,076.90	1,753.81
	37 Castro	81.18	240.52	469.30
	38 Pirai do Sul	16.53	44.54	84.70
	39 Ponta Grossa	294.20	517.72	779.55
	40 Telmáco Borba	137.70	271.21	414.72
	41 Tibagi	0.81	2.13	3.91
	42 Ventania	0.27	0.77	1.63
	Subtotal of Municipalities of Basin	530.69	1,076.90	1,753.81
Subtotal of Municipalities not of Basin	0.00	0.00	0.00	
MRH 276 Col. Irati	TOTAL of MRH	53.75	102.17	179.22
	49 Imbituva	6.37	11.24	19.38
	50 Irati	32.81	61.20	107.00
	55 Teixeira Soares	1.47	1.23	0.88
	Subtotal of Municipalities of Basin	40.65	73.67	127.56
Subtotal of Municipalities not of Basin	13.10	28.50	51.96	
MRH 277 Alto Ivai	TOTAL of MRH	4.78	8.30	14.90
	57 Ipiranga	0.32	0.35	0.58
	58 Iva	2.08	3.30	5.64
	59 Ortigueira	0.90	1.44	2.58
	60 Reserva	0.56	1.04	2.00
	Subtotal of Municipalities of Basin	3.88	6.13	10.80
Subtotal of Municipalities not of Basin	0.92	2.17	4.10	
MRH 278 N.V. Wenceslau B.	TOTAL of MRH	10.44	29.97	61.31
	63 Curitiba	0.32	0.48	0.84
	75 Sapopema	0.31	0.55	0.99
	Subtotal of Municipalities of Basin	0.63	1.03	1.83
Subtotal of Municipalities not of Basin	9.81	28.94	59.38	
MRH 279 N.V. Jacarezinho	TOTAL of MRH	147.34	289.03	472.99
	84 Congonhinhas	0.22	0.92	1.77
	85 Cornélio Procopio	49.71	75.46	112.18
	89 Leopoldo	0.63	3.27	7.96
	90 N. América Colina	1.90	4.89	9.01
	91 Nova Fatima	0.28	0.42	0.48
	97 S. Antônio Paraíso	0.03	0.07	0.12
	98 Sertaneja	0.09	10.40	26.63
	Subtotal of Municipalities of Basin	52.86	95.42	158.15
Subtotal of Municipalities not of Basin	94.48	193.61	314.84	
MRH 280 Alg. Assai	TOTAL of MRH	32.52	40.37	49.03
	99 Assaí	19.22	23.85	26.09
	100 Jataizinho	3.59	0.79	0.17
	101 N. Santa Barbara	0.05	0.09	0.14
	102 Rancho Alegre	4.96	8.98	13.43
	103 Santa Cecília Pavão	2.80	5.19	8.00
	104 São Jerônimo Serra	0.18	0.23	0.32
	105 S. Sebastião Amoreira	0.21	0.26	0.37
	106 Ura	1.51	0.98	0.51
	Subtotal of Municipalities of Basin	32.52	40.37	49.03
	Subtotal of Municipalities not of Basin	0.00	0.00	0.00
MRH 281 N.N. Londrina	TOTAL of MRH	654.41	1,235.39	2,060.31
	109 Arapongas	61.74	134.00	228.20
	113 Cambé	143.08	233.62	416.82
	119 Ibiporã	18.99	39.09	68.12
	124 Londrina	274.81	468.06	704.51
	131 Primeiro de Maio	0.52	1.29	3.34
	132 Rolândia	48.92	113.31	204.10
	137 Sertãozinho	6.04	17.30	36.48
Subtotal of Municipalities of Basin	554.10	1,006.67	1,661.57	
Subtotal of Municipalities not of Basin	100.31	228.72	398.74	
MRH 284 N.N. Apucarana	TOTAL of MRH	152.55	359.04	632.91
	184 Apucarana	75.71	172.41	286.04
	187 Califórnia	0.83	2.53	4.85
	198 Marilândia do Sul	0.26	0.39	0.71
	200 Maua da Serra	13.76	20.80	37.17
	Subtotal of Municipalities of Basin	90.56	196.13	328.76
Subtotal of Municipalities not of Basin	61.99	162.91	304.15	
TOTAL OF THE MUNICIPALITIES OF THE BASIN		1,356.17	2,544.14	4,177.85

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 Porto Amazonas are listed in Iguçu River Basin

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