CHAPTER 8. PREDICTION OF LAND SUBSIDENCE

8.1 Future Pumping Scenarios

The future piezometric levels and land subsidence could be predicted by using the calibrated simulation model. Considering several assumptions, conditions and constraints, nine (9) future pumping scenarios were prepared as input to the model. A 25-year prediction period from year-1993 to year-2017 was considered. Each scenario was prepared based on the year-1992 pumpage estimates.

Before preparing each scenario, the trend of groundwater pumpage in the last five (5) years (1988-1992) was examined for the following categories:

Type of user

Private wells (DMR-registered wells)
Domestic, Institutional, Commercial, and Industrial
Public wells
ARD, DMR, DOH, IEAT, MWA, PWA, and PWD

Changwat

Bangkok, Nonthaburi, Pathum Thani, Samut Prakan, Samut Sakhon, Phra Nakhon Si Ayutthaya, and Nakhon Pathom

Area

Study Area, Outside Area, and Whole Area

The year-1992-pumpage database files were prepared by x and y coordinates, by aquifer units, and by the above categories. In preparing the scenarios, it was assumed that the present well locations (or well grids or simply grids) will not change in the future and that pumpage distribution by aquifer unit at each grid is proportional to the year-1992 pumpage estimates.

8.1.1 Scenario 1

The trend of the total groundwater pumpage by both private and public wells, except IEAT and MWA wells, from 1988 to 1992 was simply extrapolated to generate the 25-year future pumpage in Scenario 1.

Since each industrial estate controlled by IEAT has its own plan for future groundwater use, and also its groundwater supply facilities have limited capacities, the future pumpage may become constant after reaching these capacities. On the other hand, all MWA wells will be stepwise phased out by year-2007, according to the MWA's Master Plan of future water supply up to year-2017 (MWA, 1987). In consideration of this master plan, Scenario 1 assumes that MWA pumpage will decrease from year-1993 and that no more groundwater will be supplied after year-2007.

Figure 8.1.1 illustrates the 25-year future pumpage in the Study Area in Scenario 1. As shown in this figure, the pumpage increases linearly, and in year-2017 the pumpage volume in the Study Area will be 3.20 MCM/day, which is more than twice the year-1992 pumpage level. Table 8.1.1 lists the yearly future pumpage estimates in Scenario 1, by type of user and by area.

8.1.2 Scenario 2

This scenario considered entirely the MWA's Master Plan and the PWA's water supply expansion project in Pathum Thani. As in Scenario 1, all MWA wells will be phased out by year-2007 and replaced with piped water supply system. Therefore, pumpage by private wells in MWA's service area (Bangkok, Nonthaburi, and Samut Prakan) will decrease to 555,000 m^3/day by year-1997, 450,000 m^3/day by year-2007, and 335,000 m^3/day by year-2017.

The PWA plans to phase out all its Pathum Thani wells by year-2001 and replace groundwater with piped water starting from year-1997. Piped water supply will be 155,650 m^3/day from 1997 to 2001 and increased to 311,300 m^3/day from 2002 to 2017. The rest of the water demands will still be supplied by private wells. Scenario 2 assumes that pumpage in Pathum Thani will increase until 1996, following the trend between 1988 and 1992, and that pumpage after 1996 will be the same as in Scenario 1.

The IEAT's future pumpage is assumed the same as in Scenario 1. Also, pumpage volumes in Samut Sakhon, Ayutthaya and Nakhon Pathom are assumed the same as in Scenario 1.

Figure 8.1.2 illustrates the future pumpage in the Study Area in Scenario 2. From the year-1997 level, pumpage decreases to 1.52 MCM/day in year-2002. Pumpage will again increase after year-2002 and reach 1.77 MCM/day level in year-2017. The Scenario 2 yearly pumpage estimates by type of user and by area are shown in Table 8.1.2.

8.1.3 Scenario 3

This scenario considered the present critical zones 1 and 2 for pumpage regulation beginning year-1997. Figure 8.1.3 shows the present critical zones 1 and 2 as applied to the model grid, covering parts of Bangkok and Samut Prakan. Except for MWA wells, groundwater production of both private and public wells in these critical zones after 1997 will be regulated and maintained at the year-1997 pumpage level.

The MWA withdrawal is patterned to that in Scenario 1, while pumpage outside the critical zones follows the 1988-1992 pumpage trend.

As shown in Figure 8.1.4 and Table 8.1.3, the groundwater abstractions in Bangkok and Samut Prakan are almost constant after 1997, while the total withdrawal in the Study Area increases to 1.94 MCM/day in year-2000 and further to 2.70 MCM/day in year-2017 because groundwater abstractions outside the critical zones (Pathum Thani, Samut Sakhon, etc.) continue to increase.

8.1.4 Scenario 4

In this scenario, a regulation more strict than that in Scenario 3 is assumed in the present critical zones 1 and 2. Except for MWA wells, groundwater production of both private and public wells from year-1997 to year-2001 in these critical zones will be regulated and maintained at the year-1997 pumpage level. From year-2002, a stepwise reduction will be implemented, i.e.,. pumpage in year-2007 will be 50% less than the year-1997 pumpage level and 35% less in 2012. The year-2012 pumpage level will be maintained from year-2013 to year 2017.

Except for MWA wells, groundwater productions of both private and public wells in the present critical zone 3, which covers Bangkok, Nonthaburi, and Samut Prakan, are also regulated starting from year-2001. The pumpage from year-2001 to year-2017 is constant at year-2000 pumpage level.

The MWA's pumpage in Scenario 1 is also applied in this Scenario 4, while withdrawals outside the present critical zones are assumed the same as in Scenario 1.

As shown in Figure 8.1.5, the total groundwater pumpage in the Study Area decreases from 1.94 MCM/day in year-2002 to 1.78 MCM/day in year-2007, but again increases from year-2008 and then reaches 2.03 MCM/day in year-2017 because the pumpage in Pathum Thani, Samut Sakhon, etc. continues to increase. The Scenario 4's annual future pumpage by type of user and by area is shown in Table 8.1.4.

8.1.5 Scenario 5A

In this scenario, groundwater pumpage is regulated in a new critical zone, which is proposed by the Study Team. As shown in Figure 8.1.6, the new critical zone covers the heavily pumped areas in Pathum Thani and Samut Sakhon as well as the main parts of Bangkok, Samut Prakan, and Nonthaburi. This new critical zone was established, considering the rate of land subsidence from year-1991 to year-1993 and the distribution of piezometric levels of PD, NL, and NB Aquifers in year-1994.

This scenario assumes that the new critical zone will be established by year-2000. Pumpage up to year-2000 is assumed the same as in Scenario 1. Except for MWA wells, groundwater withdrawals in the new critical zone will be regulated from year-2001 at year-2000 pumpage volume.

The MWA's pumpage in Scenario 1 is also applied in this Scenario 5A, while withdrawals outside the proposed new critical zone are assumed the same as in Scenario 1.

In Figure 8.1.7, the total groundwater pumpage in the Study Area increases up to 2.02 MCM/day in year-2000. From year-2001, pumpage rate in the Study Area lowers because of the implementation of the pumpage regulation. Pumpage will be 2.08 MCM/day in year-2010 and 2.17 MCM/day in year-2017. The yearly future pumpage by type of user and by area are shown in Table 8.1.5

8.1.6 Scenario 5B

In this scenario, pumpage in the new critical zone is reduced from year-2001. All types of pumpage in year-2000 are the same as in Scenario 1. From year-2001 to year-2010, pumpage by private users and public agencies other than MWA is reduced gradually to 50% of the year-2000 pumpage level. From year-2011 to year-2017, pumpage will be kept constant at 50% of the year-2000 pumpage level.

The MWA's pumpage in Scenario 1 is also applied in this Scenario 5B, while withdrawals outside the proposed new critical zone are assumed the same as in Scenario 1.

Figure 8.1.8 illustrates the total pumpage in the Study Area in Scenario 5B. The pumpage increases up to 2.02 MCM/day in year-2000. It gradually decreases from year-2001 to 1.26 MCM/day in year-2010. After year-2010, pumpage slightly increases and finally becomes 1.35 MCM/day in year-2017. The yearly future pumpage by type of user and by area is shown in Table 8.1.6.

8.1.7 Scenario 5C

In this scenario, pumpage in the new critical zone is reduced from year-2001 at the rate smaller than that in Scenario 5B. By year-2000, pumpage level of all types of users are the same as in Scenario 1. From year-2001 to year-2010, this pumpage then except for MWA wells will be reduced gradually to 75% of the year-2000 pumpage level. From year-2011 to year-2017, pumpage will be kept constant at 75% of the year-2000 pumpage level.

The MWA's pumpage in Scenario 1 is also applied in this Scenario 5B, while withdrawals outside the proposed new critical zone are assumed the same as in Scenario 1.

In Figure 8.1.9, the yearly future pumpage in the Study Area in Scenario 5C is displayed. The pumpage increases up to 2.02 MCM/day in year-2000. It then decreases gradually to 1.67 MCM/day in year-2010. After year-2010, it slightly increases to 1.76 MCM/day in year-2017. The yearly future pumpage by type of user and by area is shown in Table 8.1.7.

8.1.8 Scenario 6

Scenarios 5A to 5C assume that the pumpage regulation in the new critical zone will be started from year-2001. However, pumpage from year-1993 up to year-2000 will be the same as in Scenario 1, which may cause considerable land subsidence before the start of regulations. In this Scenario 6, pumpage from 1995 to 2000 will be controlled at 50% of the Scenario 1's abstractions for the same period, and it will then be reduced from year-2001 to year-2010.

For all types of users, the year-1994 pumpage will be the same as in Scenario 1. From year-1995 to year-2000, the rate of increase of pumpage in the new critical zone however will be reduced to 50% of the assumed pumpage in Scenario 1, except for MWA wells. From there, pumpage will be stepwise reduced. The year-2010 pumpage will be 75% of the year-2000 level and will be maintained constant from year-2011 to year-2017.

The MWA's pumpage in Scenario 1 is also applied in Scenario 6, while withdrawals outside the proposed new critical zone are assumed the same as in Scenario 1.

Figure 8.1.10 shows the total future pumpage in the Study Area as assumed in Scenario 6. Pumpage increases up to 1.79 MCM/day in year-2000, which is about 88.79% of that in Scenario 5C. It starts to decrease from year-2001 and becomes 1.49 MCM/day in year-2010. After year-2010, pumpage will slightly increase and become 1.57 MCM/day in year-2017. The yearly future pumpage by type of user and by area is shown in Table 8.1.8.

8.1.9 Scenario 7

This scenario will not allow any increase in pumpage in the new critical zone from year-1995 and will still reduce it from year-2001 to year-2010. This makes this scenario the strictest among the nine (9) scenarios prepared for this Study.

For all types of users (except for MWA), the year-1994 pumpage will be the same as in Scenario 1, remain constant up to year-2000 in the new critical zone, and be reduced stepwise from year-2001 to year-2010. Pumpage in year-2010 will be 75% of the year-2000 pumpage and will be kept the same from year-2011 to year-2017.

The MWA's pumpage in Scenario 1 is also applied in Scenario 7, while withdrawals outside the proposed new critical zone are assumed the same as in Scenario 1.

Figure 8.1.11 shows the total future pumpage in the Study Area in Scenario 7. Pumpage increases up to 1.68 MCM/day in year-2000, which is about 83.18% of the pumpage for the same period in Scenario 5C. From year-2001 level, it reduces to 1.39 MCM/day in year-2010. After year-2010, pumpage will increase slightly and become 1.47 MCM/day in year-2017. The yearly furture pumpage by type of user and by area is shown in Table 8.1.9.

Table 8.1.1 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 1

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304646	320012	335378	350744	366110	381476	396842	412208	427574	442940	458306	473673	489039	504405	519771	535137	550503	565869	581236	596601	611967	627333	642699	658065	673431
		PUB.	48768	49671	50575	51479	52383	53286	54190	55094	55998	56902	57805	58709	59613	60517	61420	62324	63228	64132	65035	65939	66843	67747	68651	69554	70458
		COM.	78707	83164	87621	92078	96535	100993	105450	109907	114364	118821	123278	127736	132193	136650	141107	145564	150021	154479	158936	163393	167850	172307	176764	181221	185678
		IND.	757835	803156	848477	893799	939120	984441	1029763	1075084	1120405	1165727	1211048	1256369	1301691	1347012	1392333	1437655	1482976	1528297	1573619	1618940	1664261	1709583	1754904	1800225	1845547
	PRIVATE	TOTAL	1189955	1256004	1322052	1388100	1454149	1520197	1586245	1652293	1718342	1784390	1850438	1916486	1982535	2048583	2114631	2180680	2246728	2312776	2378824	2444873	2510921	2576969	2643017	2709066	2775114
		ARD	145	173	200	227	254	282	309	336	363	390	418	445	472	499	527	554	581	608	636	663	690	717	745	772	799
		DOH	152	168	184	200	215	231	247	263	279	295	311	327	343	358	374	390	406	422	438	454	470	486	501	517	533
		IEAT	80030	83457	86884	90310	93737	97164	100591	104018	105898	107778	109658	111539	113419	115299	117179	118653	120127	121600	121600	121600	121600	121600	121600	121600	121600
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32842	35159	37476	39793	42110	44427	46744	49061	51378	53695	56012	58329	60645	62962	65279	67596	69913	72230	74547	76864	79181	81498	83815	86132	88449
		PWD	135574	138708	141842	144976	148110	151244	154378	157512	160646	163780	166914	170048	173182	176316	179450	182584	185718	188853	191987	195121	198255	201389	204523	207657	210791
	PUBLIC	TOTAL	348143	350437	352731	355026	357320	359614	361909	364203	364950	365698	366446	367194	367941	368689	369437	369777	376745	383713	389207	394701	400195	405689	411183	416677	422172
	AREA	TOTAL	1538098	1606441	1674783	1743128	1811469	1879811	1948154	2016496	2083292	2150088	2216884	2283680	2350476	2417272	2484068	2550457	2623473	2696489	2768031	2839574	2911116	2982658	3054201	3125743	3197286
OUTSIDE		DOM.	26150	26600	27051	27501	27952	28403	28853	29304	29754	30205	30656	31106	31557	32007	32458	32909	33359	33810	34260	34711	35162	35612	36063	36513	36964
		PUB.	772	811	849	888	927	966	1005	1043	1082	1121	1160	1198	1237	1276	1315	1354	1392	1431	1470	1509	1547	1586	1625	1664	1703
		COM.	1849	2062	2275	2488	2700	2913	3126	3338	3551	3763	3976	4189	4401	4614	4827	5039	5252	5465	5677	5890	6103	6315	6528	6741	6953
		IND.	48648	54600	60551	66503	72454	78406	84357	90309	96260	102212	108163	114115	120066	126018	131969	137921	143872	149824	155775	161727	167678	173630	179581	185533	191484
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110687	117341	123994	130648	137301	143955	150608	157262	163915	170569	177222	183876	190530	197183	203837	210490	217144	223797	230451	237104
		ARD	1004	1081	1159	1236	1314	1392	1469	1547	1625	1702	1780	1857	1936	2013	2090	2168	2246	2323	2401	2478	2556	2634	2711	2789	2867
		DOH	3599	3958	4317	4676	5035	5394	5753	6112	6471	6831	7190	7549	7908	8267	8626	8985	9344	9703	10062	10422	10781	11140	11499	11858	12217
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	19700	21637	23573	25510	27447	29383	31320	31948	32576	33204	33832	34460	35088	35716	36344	36972	37600
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21685	22263	22840	23418	23995	24573	25150	25728	26305	26883	27460	28038	28615	29193	29770	30348	30925	31503	32080	32658	33235	33813	34390	34968
		PWD	205457	209609	213762	217914	222067	226219	230372	234524	238677	242829	246982	251134	255287	259439	263592	267744	271897	276049	280202	284354	288507	292659	296812	300964	305117
	PUBLIC	TOTAL	235375	242477	249580	256684	263787	270890	277994	285097	292201	299304	306407	313511	320614	327717	334821	340616	346410	352205	358000	363794	369589	375384	381178	386973	392768
	AREA	TOTAL	312795	326550	340307	354064	367821	381577	395334	409091	422848	436605	450362	464119	477876	491633	505390	517838	530286	542735	555183	567631	580079	592528	604976	617424	629872
WHOLE AREA		DOM.	330796	346613	362429	378246	394062	409879	425695	441512	457329	473145	488962	504779	520595	536412	552228	568045	583862	599678	615495	631312	647128	662945	678762	694578	710395
		PUB.	49540	50482	51425	52367	53310	54252	55195	56137	57080	58022	58965	59908	60850	61793	62735	63678	64620	65563	66505	67448	68390	69333	70276	71218	72161
		COM.	80556	85226	89896	94566	99236	103906	108575	113245	117915	122585	127255	131924	136594	141264	145934	150604	155273	159943	164613	169283	173953	178622	183292	187962	192632
		IND.	806483	857756	909029	960302	1011574	1062847	1114120	1165393	1216666	1267938	1319211	1370484	1421757	1473030	1524303	1575576	1626848	1678121	1729394	1780667	1831940	1883212	1934485	1985758	2037031
	PRIVATE	TOTAL	1267375	1340077	1412779	1485480	1558182	1630884	1703586	1776288	1848989	1921691	1994393	2067095	2139797	2212498	2285200	2357902	2430604	2503306	2576007	2648709	2721411	2794113	2866815	2939516	3012218
		ARD	1149	1254	1359	1464	1568	1673	1778	1883	1988	2093	2198	2302	2407	2512	2617	2722	2827	2932	3036	3141	3246	3351	3456	3561	3666
		DOH	3751	4126	4501	4876	5250	5625	6000	6375	6750	7125	7500	7876	8250	8625	9000	9375	9750	10125	10500	10875	11250	11625	12000	12375	12750
		IEAT	84236	89600	94964	100327	105691	111054	116418	121781	125598	129415	133232	137049	140866	144683	148499	150601	152703	154804	155432	156060	156688	157316	157944	158572	159200
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	59739	62633	65528	68422	71316	74211	77105	80000	82894	85789	88683	91577	94472	97366	100261	103155	106049	108944	111838	114733	117627	120522	123416
		PWD	341031	348318	355604	362891	370177	377464	384750	392037	399323	406610	413896	421183	428469	435756	443042	450328	457615	464902	472188	479475	486762	494048	501335	508621	515908
	PUBLIC	TOTAL	583518	592914	602312	611709	621107	630505	639902	649300	657151	665002	672853	680704	688556	696407	704258	710393	723156	735918	747207	758496	769784	781073	792362	803651	814940
	GRAND	TOTAL	1850891	1932991	2015090	2097190	2179289	2261389	2343488	2425588	2506141	2586693	2667246	2747799	2828352	2908905	2989458	3068295	3153760	3239224	3323214	3407205	3491195	3575186	3659177	3743167	3827158

(Unit: m^3/day)

Table 8.1.2 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 2

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304203	319126	334049	348971	326073	327736	330399	333062	335725	299587	302230	304883	307556	310219	312882	315102	317322	319541	321761	323981	326201	328421	330641	332860	335080
		PUB.	50151	52438	54725	57012	55543	55425	55308	55190	55072	51198	51081	50963	50846	50728	50610	50406	50201	49997	49792	49587	49383	49178	48974	48769	48564
		COM.	76079	81909	85739	89569	85402	85855	86308	86761	87213	79670	80123	80576	81029	81481	81934	82266	82596	82927	83257	83588	83919	84250	84581	84911	85242
		IND.	752959	793404	833849	874294	909662	922443	935224	948005	960786	768490	781271	794053	806834	819615	832396	844177	855958	867740	879521	891302	903083	914864	926645	938427	950208
	PRIVATE	TOTAL	1183392	1248876	1308360	1369845	1275679	1291459	1307238	1323017	1338797	1198926	1214705	1230475	1246264	1262043	1277823	1291950	1306077	1320204	1334331	1348459	1362586	1376713	1390840	1404967	1419095
		ARD	145	173	200	227	254	282	309	336	363	390	418	445	472	499	527	554	581	608	636	663	690	717	745	772	799
		DOH	152	168	184	200	215	231	247	263	279	295	311	327	343	358	374	390	406	422	438	454	470	486	501	517	533
		IEAT	80030	83457	86884	90310	93737	97164	100591	104018	105898	107778	109658	111539	113419	115299	117179	118653	120127	121600	121600	121600	121600	121600	121600	121600	121600
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32842	35159	37476	39793	35161	30509	25866	21224	16582	11940	12030	12120	12210	12300	12391	12481	12571	12661	12751	12841	12932	13022	13112	13202	13292
		PWD	135574	138708	141842	144976	148110	151244	154378	157512	160646	163780	166914	170048	173182	176316	179450	182584	185718	188853	191987	195121	198255	201389	204523	207657	210791
	PUBLIC	TOTAL	348143	350437	352731	355026	350361	345696	341031	336366	330155	323943	322464	320986	319508	318027	316549	314882	319403	324144	327411	330679	333946	337213	340481	343748	347015
	AREA	TOTAL	1533534	1597313	1661092	1724871	1626040	1637155	1648269	1659384	1668951	1522869	1537170	1551470	1565770	1580070	1594371	1606812	1625480	1644348	1661743	1679137	1696532	1713926	1731321	1748715	1766110
OUTSIDE		DOM.	26150	26600	27051	27501	27952	28403	28853	29304	29754	30205	30656	31106	31557	32007	32458	32909	33359	33810	34260	34711	35162	35612	36063	36513	36964
		PUB.	772	811	849	888	927	966	1005	1043	1082	1121	1160	1199	1237	1276	1315	1354	1392	1431	1470	1509	1547	1586	1625	1664	1703
		COM.	1850	2062	2275	2488	2700	2913	3126	3338	3551	3763	3976	4189	4401	4614	4827	5039	5252	5465	5677	5890	6103	6315	6528	6741	6953
		IND.	48649	54600	60551	66503	72454	78406	84357	90309	96260	102212	108163	114115	120066	126018	131969	137921	143872	149824	155775	161727	167678	173630	179581	185533	191484
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110687	117341	123994	130648	137301	143955	150608	157262	163915	170569	177222	183876	190530	197183	203837	210490	217144	223797	230451	237104
		ARD	1004	1081	1159	1236	1314	1392	1469	1547	1625	1702	1780	1857	1935	2013	2090	2168	2246	2323	2401	2478	2556	2634	2711	2789	2867
		DOH	3599	3958	4317	4676	5035	5394	5753	6112	6471	6831	7190	7549	7908	8267	8626	8985	9344	9703	10062	10422	10781	11140	11499	11858	12217
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	19700	21637	23573	25510	27447	29383	31320	31948	32576	33204	33832	34460	35088	35716	36344	36972	37600
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21685	22263	22840	23418	23995	24573	25150	25728	26305	26883	27460	28038	28615	29193	29770	30348	30925	31503	32080	32658	33235	33813	34390	34968
		PWD	205457	209609	213762	217914	222067	226219	230372	234524	238677	242829	246982	251134	255287	259439	263592	267744	271897	276049	280202	284354	288507	292659	296812	300964	305117
	PUBLIC	TOTAL	235373	242477	249580	256684	263787	270890	277994	285097	292201	299304	306407	313511	320614	327717	334821	340616	346410	352205	358000	363794	369589	375384	381178	386973	392768
	AREA	TOTAL	312793	326550	340307	354064	367821	381577	395334	409091	422848	436605	450362	464119	477876	491633	505390	517839	530286	542735	555183	567631	580079	592528	604976	617424	629872
WHOLE AREA		DOM.	330352	345726	361099	376472	353025	356138	359252	362365	365479	329772	332886	335989	339113	342226	345340	348010	350681	353351	356022	358692	361363	364033	366703	369374	372044
		PUB.	50923	53249	55574	57900	56470	56391	56312	56233	56154	52320	52241	52162	52083	52004	51925	51759	51594	51428	51262	51096	50930	50764	50599	50433	50267
		COM.	79929	83971	88014	92056	88102	88768	89433	90099	90764	83433	84099	84764	85430	86095	86761	87304	87848	88391	88935	89478	90022	90565	91109	91652	92196
		IND.	801607	848003	894400	940797	982116	900849	919581	938314	957047	870702	889435	908167	926900	945633	964365	982098	999831	1017563	1035296	1053029	1070761	1088494	1106227	1123959	1141692
	PRIVATE	TOTAL	1262811	1330949	1399087	1467225	1379713	1402146	1424579	1447011	1469444	1336227	1358660	1381093	1403526	1425959	1448392	1469172	1489953	1510734	1531515	1552295	1573076	1593857	1614637	1635418	1656199
		ARD	1149	1254	1359	1464	1569	1673	1778	1883	1988	2093	2198	2302	2407	2512	2617	2722	2827	2932	3036	3141	3246	3351	3456	3561	3666
		DOH	3751	4126	4501	4876	5250	5625	6000	6375	6750	7125	7500	7875	8250	8625	9000	9375	9750	10125	10500	10875	11250	11625	12000	12375	12750
		IEAT	84236	89600	94964	100327	105691	111054	116418	121781	125598	129415	133232	137049	140866	144683	148499	150601	152703	154804	155432	156060	156688	157316	157944	158572	159200
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	59739	62633	58568	54504	50439	46374	42309	38245	38912	39580	40248	40915	41583	42251	42918	43586	44254	44921	45589	46257	46924	47592	48260
		PWD	341031	348318	355604	362891	370177	377464	384750	392037	399323	406610	413896	421183	428469	435756	443042	450329	457615	464902	472189	479475	486762	494048	501335	508621	515908
	PUBLIC	TOTAL	583516	592914	602312	611709	614149	616586	619025	621463	622355	623247	628872	634496	640120	645745	651369	655278	665813	676349	685411	694473	703535	712597	721659	730721	739783
	GRAND	TOTAL	1846327	1923863	2001399	2078934	1993861	2018732	2043603	2068475	2091800	1959474	1987532	2015589	2043646	2071703	2099760	2124450	2155767	2187083	2216926	2246768	2276611	2306454	2336297	2366139	2395982

(Unit: m^3/day)

Table 8.1.3 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 3

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304648	320011	335378	350745	366110	376324	386538	396751	406965	417178	427393	437606	447820	458034	468247	478461	488675	498889	509103	519316	529530	539743	549958	560171	570385
		PUB.	48768	49672	50576	51480	52383	53073	53763	54453	55143	55832	56522	57212	57902	58592	59282	59971	60661	61351	62041	62731	63420	64110	64800	65490	66180
		COM.	78707	83185	87622	92060	96537	99820	103104	106388	109672	112955	116239	119523	122806	126090	129374	132657	135941	139225	142508	145792	149076	152360	155644	158927	162211
		IND.	757833	803153	848474	893794	939120	967284	995447	1023612	1051778	1079939	1108104	1136267	1164431	1192598	1220760	1248924	1277087	1305252	1333416	1361579	1389744	1417909	1446071	1474236	1502400
	PRIVATE	TOTAL	1189956	1256001	1322060	1388088	1454150	1496501	1538852	1581203	1623555	1666905	1708258	1750608	1792959	1835311	1877662	1920014	1962364	2004717	2047068	2089419	2131771	2174122	2216472	2258824	2301175
		ARD	145	173	200	227	254	282	309	336	363	391	418	445	472	500	527	554	581	609	636	663	690	718	745	772	799
		DOH	152	168	184	200	216	232	247	263	279	295	311	327	343	359	375	391	406	422	438	454	470	486	502	518	534
		IEAT	80030	83457	86884	90311	93737	94831	95924	96418	96825	97231	97638	98045	98451	98858	99265	99265	99265	99265	99265	99265	99265	99265	99265	99265	99265
		MWA	96359	92773	89146	79620	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32843	35159	37476	39793	42110	44427	46744	49061	51378	53696	56012	58329	60646	62963	65280	67596	69913	72230	74547	76864	79181	81498	83815	86132	88449
		PWD	136674	136706	141842	144978	148110	151043	153975	156908	159840	162773	165706	168638	171570	174505	177436	180368	183300	186233	189166	192098	195031	197963	200896	203828	206761
	PUBLIC	TOTAL	348143	360457	362732	366027	367520	368880	368440	366999	366072	364145	363217	362290	361362	360435	360608	360173	363486	364758	364081	360344	374837	379029	385222	390614	396007
	AREA	TOTAL	1538099	1606458	1674792	1743125	1811470	1865381	1906291	1937202	1979627	2020050	2061475	2102898	2144322	2186746	2227170	2280187	2315850	2363475	2411120	2449762	2506408	2554051	2601693	2649338	2696982
OUTSIDE		DOM.	26149	26600	27051	27501	27952	28403	28853	29304	29754	30206	30656	31108	31557	32007	32458	32908	33359	33810	34260	34711	35161	35612	36063	36513	36964
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1198	1237	1276	1316	1353	1392	1431	1470	1508	1547	1586	1625	1663	1702
		COM.	1850	2063	2275	2488	2701	2913	3126	3338	3551	3764	3977	4189	4402	4615	4827	5040	5253	5466	5678	5891	6104	6316	6529	6742	6954
		IND.	48649	54600	60552	66503	72455	78406	84358	90308	96261	102212	108163	114115	120067	126018	131970	137921	143873	149824	155776	161727	167679	173630	179582	185533	191486
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110888	117341	123984	130648	137302	143966	150809	157263	163818	170670	177223	183878	190530	197184	203837	210491	217144	223798	230451	237106
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3589	3958	4317	4676	5035	5395	5754	6113	6472	6831	7190	7549	7909	8268	8627	8986	9345	9704	10063	10422	10781	11141	11500	11860	12218
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	19700	21637	23573	25510	27447	29383	31320	31948	32576	33204	33832	34460	35088	35716	36344	36972	37600
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21685	22263	22840	23417	23995	24573	25150	25728	26305	26883	27460	28038	28615	29192	29770	30348	30926	31503	32080	32658	33236	33813	34390	34968
		PWD	206456	209810	213762	217914	222067	226220	230372	234526	238677	242829	246981	251135	255287	259439	263592	267745	271898	276050	280202	284354	288508	292660	296812	300965	305117
	PUBLIC	TOTAL	236373	242478	248661	254884	261788	270861	277984	286068	292202	298304	306407	313612	320815	327718	334822	340817	346411	352206	358001	363796	369591	375386	381180	386975	392770
	AREA	TOTAL	313793	326551	340308	354064	367822	381579	395336	409063	422850	436606	450363	464121	477978	491534	505382	517840	530287	542737	555186	567632	580082	592530	604978	617427	629875
WHOLE AREA		DOM.	330795	346611	362429	378246	394062	404726	415391	426055	436719	447383	458049	468712	479377	490041	500705	511370	522034	532699	543363	554027	564692	575356	586020	596684	607348
		PUB.	49540	50482	51425	52368	53310	54039	54767	55496	56224	56953	57682	58410	59139	59867	60598	61325	62053	62782	63510	64239	64967	65696	66426	67155	67882
		COM.	80557	85228	89897	94568	99237	102734	106230	109726	113223	116719	120216	123712	127209	130706	134201	137698	141194	144690	148187	151683	155180	158676	162172	165669	169166
		IND.	906482	957753	909025	960297	1011574	1045690	1079805	1113921	1148038	1182152	1216268	1250383	1284498	1318614	1352730	1386845	1420960	1455076	1489192	1523307	1557423	1591539	1625653	1659769	1693885
	PRIVATE	TOTAL	1267375	1340074	1412777	1486478	1558185	1607199	1656193	1706198	1754203	1803207	1852213	1901217	1950222	1999227	2048232	2097237	2146241	2195247	2244252	2293258	2342262	2391267	2440270	2489276	2538280
		ARD	1149	1254	1359	1464	1568	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2829	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3751	4126	4501	4876	5251	5628	6001	6378	6751	7128	7501	7878	8251	8628	9001	9378	9751	10126	10501	10878	11251	11626	12001	12376	12751
		IEAT	84237	89600	94964	100327	105691	108521	111361	114181	116525	118868	121211	123555	125898	128241	130586	131213	131841	132468	133097	133725	134353	134981	135609	136237	136865
		MWA	96359	92773	89146	79620	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	59739	62633	65528	68422	71317	74211	77105	80000	82894	85789	88683	91578	94472	97366	100261	103156	106050	108944	111838	114733	117628	120522	123416
		PWD	341130	348516	355904	362890	370179	377283	384347	391433	398518	405602	412686	419773	426857	433942	441028	448112	455197	462283	469368	476452	483538	490623	497707	504793	511879
	PUBLIC	TOTAL	582617	592915	602313	611710	621108	627772	634434	641087	647273	653448	659424	665802	671977	678162	684330	688790	710966	722062	733139	744228	755316	766415	777480	788578	
	GRAND	TOTAL	1850091	1932989	2015089	2097188	2179282	2234980	2290627	2346285	2401478	2456864	2511837	2567019	2622199	2677380	2732562	2786027	2846119	2906212	2966304	3026366	3086499	3146561	3206671	3266786	3326867

(Unit: m^3/day)

Table 8.1.4 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 4

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304646	320011	335378	350745	366110	376324	386538	396751	404621	397849	391079	384308	377537	370766	363994	366593	369191	371790	374389	376988	384867	392726	400585	408484	416333
		PUB.	48768	49672	50576	51480	52383	53073	53783	54453	55051	53150	51268	49374	47481	45588	43697	43390	43100	42802	42504	42206	42804	43403	44001	44600	45198
		COM.	78707	83165	87622	92080	96537	99820	103104	106388	108733	106928	105123	103318	101513	99708	97903	98754	99605	100456	101307	102158	104603	106848	109193	111538	113883
		IND.	757833	803153	848474	893794	939120	967284	995447	1023812	1045928	1032128	1018334	1004537	990740	976946	963149	972462	981776	991080	1000405	1009718	1032033	1054348	1076660	1098975	1121290
	PRIVATE	TOTAL	1189955	1256001	1322050	1388098	1454150	1496501	1538862	1581203	1614331	1590065	1565802	1541536	1517271	1493007	1468742	1481207	1493672	1506138	1518605	1531069	1564197	1597324	1630449	1663577	1696703
		ARD	145	173	200	227	254	282	308	336	363	391	418	445	472	500	527	554	581	608	636	663	690	718	745	772	799
		DOH	152	168	184	200	216	232	247	263	279	295	311	327	343	359	375	391	406	422	438	454	470	486	502	518	534
		IEAT	80030	83457	86884	90311	93737	94631	95524	96418	96825	92952	88480	84307	80135	75962	71790	70141	68493	66844	65196	63547	63547	63547	63547	63547	63547
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32843	35159	37476	39793	42110	44427	46744	49061	51378	53695	56012	58329	60646	62963	65280	67598	69913	72230	74547	76864	79181	81498	83815	86132	88449
		PWD	135574	138708	141842	144976	148110	151043	153975	156908	159093	159737	160481	161225	161969	162713	163457	165069	166682	168294	169906	171469	173654	175839	177724	179909	181994
	PUBLIC	TOTAL	348143	350437	352732	355027	357320	356880	356440	355999	354224	348529	338834	331139	323444	315749	308054	303741	306055	306369	310683	312997	317442	321887	326332	330777	335222
	AREA	TOTAL	1538098	1606438	1674782	1743125	1811470	1853381	1895291	1937202	1968555	1938594	1904636	1872675	1840715	1808756	1776796	1784947	1799727	1814507	1829287	1844066	1881639	1919211	1956782	1994355	2031925
OUTSIDE		DOM.	26149	26600	27051	27501	27952	28403	28853	29304	29754	30205	30656	31106	31557	32007	32458	32908	33359	33810	34260	34711	35161	35612	36063	36513	36964
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1198	1237	1276	1315	1353	1392	1431	1470	1509	1547	1586	1625	1663	1702
		COM.	1850	2063	2275	2488	2701	2913	3126	3339	3551	3764	3977	4189	4402	4615	4827	5040	5253	5466	5678	5891	6104	6316	6529	6742	6954
		IND.	48649	54600	60552	66503	72455	78406	84358	90309	96261	102212	108163	114115	120067	126018	131970	137921	143873	149824	155776	161727	167679	173630	179582	185533	191485
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110688	117341	123994	130648	137302	143955	150608	157263	163916	170570	177223	183876	190530	197184	203837	210491	217144	223798	230451	237105
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3599	3958	4317	4676	5035	5395	5754	6113	6472	6831	7190	7549	7908	8268	8627	8986	9345	9704	10063	10422	10781	11141	11500	11859	12218
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	19700	21637	23573	25510	27447	29383	31320	31948	32576	33204	33832	34460	35088	35716	36344	36972	37600
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21109	21686	22263	22840	23417	23995	24573	25150	25728	26306	26883	27460	28038	28615	29192	29770	30348	30926	31503	32080	32658	33236	33813	34390	34968
		PWD	205456	209610	213762	217914	222067	226220	230372	234525	238677	242829	246981	251136	255287	259439	263592	267745	271898	276050	280202	284354	288506	292660	296812	300965	305117
	PUBLIC	TOTAL	235373	242478	249581	256684	263788	270891	277994	285098	292202	299304	306407	313512	320615	327719	334822	340617	346411	352206	358001	363796	369591	375386	381180	386975	392770
	AREA	TOTAL	312793	326551	340308	354064	367822	381579	395335	409093	422850	436606	450362	464121	477878	491634	505392	517840	530287	542737	555185	567632	580082	592530	604978	617427	629875
WHOLE AREA		DOM.	330795	348611	362429	378246	394062	404726	415391	426055	434375	428054	421734	415413	409093	402773	396452	399501	402550	405600	408649	411698	420018	428338	436658	444977	453297
		PUB.	49540	50482	51425	52368	53310	54039	54767	55496	56133	54280	52426	50572	48718	46865	45011	44752	44492	44233	43973	43714	44351	44989	45626	46263	46901
		COM.	80557	85228	89897	94568	99237	102734	106230	109726	112284	110692	109100	107507	105915	104323	102730	103794	104858	105921	106985	108049	110606	113164	115722	118279	120837
		IND.	806482	857753	909026	960297	1011574	1045690	1079805	1113921	1142187	1134341	1126497	1118652	1110807	1102963	1095119	1110383	1125648	1140914	1156181	1171445	1198712	1227978	1256242	1284508	1312773
	PRIVATE	TOTAL	1267375	1340074	1412777	1485479	1558183	1607189	1656193	1705198	1744979	1727367	1709756	1692145	1674534	1656923	1639311	1658429	1677548	1696668	1715789	1734907	1774688	1814468	1854247	1894028	1933808
		ARD	1149	1254	1359	1464	1568	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2828	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3751	4126	4501	4876	5251	5626	6001	6376	6751	7126	7501	7876	8251	8626	9001	9378	9751	10126	10501	10876	11251	11626	12001	12376	12751
		IEAT	84237	89600	94964	100327	105691	108521	111351	114181	116525	114589	112053	109817	107581	105345	103110	102089	101069	100048	99028	98007	98635	99263	99891	100519	101147
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	59739	62633	65528	68422	71317	74211	77106	80000	82894	85789	88683	91578	94472	97366	100261	103155	106050	108944	111839	114733	117628	120522	123416
		PWD	341030	348318	355604	362890	370178	377263	384347	391433	397770	402566	407462	412360	417256	422151	427049	432803	438558	444314	450068	455822	462061	468299	474536	480774	487011
	PUBLIC	TOTAL	583517	592915	602313	611710	621108	627772	634434	641097	646426	645834	645241	644651	644059	643466	642876	644357	652466	660575	668684	676792	687033	697273	707512	717753	727992
	GRAND	TOTAL	1850891	1932989	2015089	2097189	2179292	2234960	2290627	2346295	2391405	2373201	2354998	2336796	2318593	2300390	2282188	2302787	2330014	2357244	2384472	2411699	2461721	2511741	2561759	2611781	2661800

(Unit: m^3/day)

Table 8.1.5 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 5A

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304846	320011	335378	350745	366110	381478	396842	412209	414646	417082	419518	421954	424391	426827	429264	431700	434137	436573	439010	441446	443882	446319	448755	451192	453628
		PUB.	48768	49672	50576	51480	52383	53287	54191	55094	55151	55207	55263	55320	55376	55432	55489	55545	55601	55657	55713	55770	55826	55882	55938	55995	56051
		COM.	78707	83165	87622	92080	96537	100994	105451	109909	111018	112127	113236	114346	115455	116564	117673	118782	119891	121001	122110	123219	124328	125438	126547	127656	128765
		IND.	757833	803153	848474	893794	939120	984441	1029761	1075082	1081187	1087292	1093398	1099503	1105607	1111713	1117818	1123923	1130028	1136134	1142239	1148344	1154449	1160554	1166659	1172764	1178870
	PRIVATE	TOTAL	1189955	1266001	1322050	1398098	1454150	1520197	1586244	1652294	1662001	1671707	1681415	1691122	1700829	1710536	1720243	1729950	1739657	1749364	1759072	1768779	1778486	1788192	1797900	1807606	1817314
		ARD	145	173	200	227	254	282	309	336	363	391	418	445	472	500	527	554	581	609	636	663	690	718	745	772	799
		DOH	152	168	184	200	216	232	247	263	279	295	311	327	343	359	375	391	406	422	438	454	470	486	502	518	534
		IEAT	80030	83457	86884	90311	93737	97164	100591	104018	104424	104831	105238	105644	106051	106458	106864	106864	106864	106864	106864	106864	106864	106864	106864	106864	106864
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32843	35159	37476	39793	42110	44427	46744	49061	49469	49877	50285	50693	51101	51508	51916	52324	52732	53140	53548	53956	54364	54772	55180	55588	55996
		PWD	136674	138708	141842	144976	148110	151244	154378	157512	159178	160843	162508	164173	165838	167503	169169	170834	172499	174164	175829	177494	179160	180825	182490	184155	185820
	PUBLIC	TOTAL	348143	350437	352732	355027	357320	359615	361909	364204	360100	355908	351692	347789	343585	339581	335478	330967	333083	335200	337316	339432	341548	343664	345780	347897	350013
	AREA	TOTAL	1538098	1606438	1674782	1743126	1811470	1879812	1948154	2016497	2022100	2027704	2033307	2038910	2044514	2050117	2055721	2060917	2072740	2084564	2096387	2108210	2120034	2131857	2143680	2155503	2167327
OUTSIDE		DOM.	26149	26600	27051	27501	27952	28403	28853	29304	29637	29971	30304	30637	30971	31304	31638	31971	32304	32638	32971	33305	33638	33972	34305	34638	34972
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1198	1237	1276	1315	1353	1392	1431	1470	1508	1547	1586	1625	1663	1702
		COM.	1850	2063	2276	2488	2701	2913	3126	3339	3547	3754	3962	4170	4378	4586	4794	5002	5210	5417	5625	5833	6041	6249	6457	6665	6873
		IND.	48649	54600	60552	66503	72455	78406	84358	90309	94763	99217	103671	108125	112579	117032	121486	125940	130394	134848	139302	143756	148210	152663	157117	161571	166025
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110688	117341	123994	129029	134063	139098	144130	149164	154198	159232	164266	169300	174334	179368	184402	189436	194470	199504	204537	209572
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3599	3958	4317	4676	5036	5395	5754	6113	6472	6831	7190	7549	7908	8268	8627	8986	9345	9704	10063	10422	10781	11141	11500	11859	12218
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	18391	19019	19647	20275	20903	21531	22159	22787	23415	24043	24671	25299	25927	26555	27183	27811	28439
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21686	22263	22840	23417	23995	24573	25150	25728	26305	26883	27460	28038	28615	29192	29770	30348	30926	31503	32080	32658	33236	33813	34390	34968
		PWD	205456	209610	213762	217914	222067	226220	230372	234526	238629	242732	246836	250941	255044	259148	263253	267357	271460	275565	279669	283772	287877	291981	296084	300188	304293
	PUBLIC	TOTAL	235373	242478	249581	256684	263788	270891	277994	285098	290844	296590	302336	308083	313829	319575	326322	331068	336814	342561	348307	354053	359800	365546	371292	377038	382784
	AREA	TOTAL	312793	326551	340308	354064	367822	381579	395335	409093	419873	430653	441432	452214	462993	473773	484554	495334	506114	516895	527675	538454	549236	560016	570796	581575	592356
WHOLE AREA		DOM.	330795	346611	362429	378246	394062	409878	425695	441512	444282	447052	449822	452592	455362	458132	460901	463671	466441	469211	471981	474751	477521	480290	483060	485830	488600
		PUB.	49540	50482	51425	52368	53310	54252	55195	56138	56233	56328	56423	56518	56613	56708	56803	56898	56993	57088	57183	57278	57373	57468	57563	57658	57753
		COM.	80557	85228	89897	94568	99237	103907	108577	113247	114564	115881	117198	118515	119833	121150	122467	123784	125101	126418	127735	129052	130369	131686	133004	134321	135638
		IND.	806482	857753	909026	960297	1011574	1062847	1114119	1165391	1175950	1186509	1197068	1207627	1218186	1228745	1239304	1249863	1260422	1270981	1281541	1292099	1302659	1313217	1323776	1334335	1344895
	PRIVATE	TOTAL	1267375	1340074	1412777	1485478	1558183	1630884	1703585	1776288	1791029	1805770	1820511	1835252	1849993	1864734	1879475	1894216	1908957	1923698	1938440	1953180	1967921	1982662	1997403	2012144	2026886
		ARD	1149	1254	1359	1464	1568	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2828	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3751	4126	4501	4876	5251	5628	6001	6376	6751	7126	7501	7876	8251	8626	9001	9376	9751	10126	10501	10876	11251	11626	12001	12376	12751
		IEAT	84237	89600	94964	100327	105691	111054	116418	121781	122815	123850	124885	125920	126954	127989	129024	129652	130280	130908	131536	132164	132792	133420	134048	134676	135304
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	59739	62633	65528	68422	71317	74211	75196	76182	77167	78153	79138	80123	81109	82094	83080	84065	85051	86036	87021	88007	88992	89978	90963
		PWD	341030	348318	355604	362890	370178	377464	384750	392037	397807	403575	409344	415114	420883	426651	432421	438190	443959	449729	455498	461266	467037	472806	478574	484344	490113
	PUBLIC	TOTAL	583517	592915	602313	611710	621108	630506	639903	649302	650944	652598	654228	655872	657514	659156	660799	662035	669897	677760	685622	693484	701348	709210	717072	724936	732797
	GRAND	TOTAL	1850891	1932989	2015089	2097188	2179292	2261391	2343489	2425590	2441973	2458358	2474739	2491124	2507507	2523890	2540275	2556251	2578854	2601459	2624062	2646664	2669269	2691873	2714476	2737079	2759683

(Unit: m^3/day)

Table 8.1.6 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 5B

			1993	1994	1995	1996	1997	1998	1999	2000	2001
STUDY AREA		DOM.	304646	320011	335378	350745	366110	381476	396842	412209	397318
		PUB.	48766	49672	50576	51480	52383	53287	54191	55094	52697
		COM.	78707	83165	87622	92080	96537	100994	105451	109909	106820
		IND.	757833	803153	848474	893794	939120	984441	1029761	1075082	1034696
	PRIVATE	TOTAL	1189955	1256001	1322060	1388098	1454150	1520197	1586244	1652294	1591231
		ARD	145	173	200	227	254	282	309	336	363
		DOH	152	168	184	200	216	232	247	263	279
		IEAT	80030	83457	86884	90311	93737	97164	100591	104018	98406
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386
		PWA	32843	35159	37476	39793	42110	44427	46744	49061	47562
		PWD	135574	138709	141842	144976	148110	151244	154378	157512	154946
	PUBLIC	TOTAL	348143	350437	352732	355027	357320	359615	361909	364204	348936
	AREA	TOTAL	1538098	1606438	1674792	1743125	1811470	1879812	1948154	2016497	1940066
OUTSIDE		DOM.	26149	26600	27051	27501	27952	28403	28853	29304	29474
		PUB.	772	811	849	888	927	966	1004	1043	1082
		COM.	1850	2063	2275	2488	2701	2913	3126	3339	3643
		IND.	48649	54600	60552	66503	72455	78406	84358	90309	93381
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110688	117341	123994	127481
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1626
		DOH	3599	3958	4317	4676	5035	5395	5754	6113	6472
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	17849
		MWA	0	0	0	0	0	0	0	0	0
		PWA	21109	21685	22263	22840	23417	23995	24573	25150	25728
		PWD	205456	209610	213762	217914	222067	226220	230372	234525	238152
	PUBLIC	TOTAL	235373	242478	249581	256684	263798	270891	277994	285098	289826
	AREA	TOTAL	312793	326551	340308	354064	367822	381579	395335	409093	417306
WHOLE AREA		DOM.	330795	346611	362429	378246	394062	409878	425695	441512	426792
		PUB.	49540	50482	51425	52368	53310	54252	55195	56136	53679
		COM.	80557	85228	89897	94568	99237	103907	108577	113247	110164
		IND.	806482	857753	909025	960297	1011574	1062847	1114118	1165391	1128077
	PRIVATE	TOTAL	1267375	1340074	1412777	1485478	1558183	1630884	1703586	1776288	1718712
		ARD	1149	1254	1359	1464	1569	1674	1779	1883	1989
		DOH	3751	4126	4501	4876	5251	5626	6001	6376	6751
		IEAT	84237	89600	94964	100327	105691	111054	116418	121781	117255
		MWA	99399	92773	86146	79520	72893	66266	59640	53013	46386
		PWA	53950	56844	59739	62633	65528	68422	71317	74211	73290
		PWD	341030	348319	355604	362890	370178	377464	384750	392037	393000
	PUBLIC	TOTAL	583517	592915	602313	611710	621108	630506	639903	649302	638661
	GRAND	TOTAL	1850891	1932989	2015089	2097188	2179292	2261391	2343489	2425590	2357372

			2002	2003	2004	2005	2006	2007	2008	2009	2010
STUDY AREA		DOM.	382428	367535	352644	337753	322862	307970	293079	278188	263297
		PUB.	50099	47602	45104	42607	40109	37612	35114	32617	30119
		COM.	103332	100045	96756	93469	90181	86893	83605	80317	77029
		IND.	994311	953928	913541	873155	832770	792384	751999	711613	671229
	PRIVATE	TOTAL	1530169	1469107	1408046	1346983	1285921	1224859	1163797	1102734	1041673
		ARD	391	418	445	472	500	527	554	581	609
		DOH	295	311	327	343	359	375	391	406	422
		IEAT	94795	90183	85572	80960	76348	71737	66719	61700	56682
		MWA	39760	33133	26507	19880	13253	6627	0	0	0
		PWA	46043	44534	43026	41518	40007	38499	36989	35490	33971
		PWD	152193	149519	146864	144189	141526	138860	136195	133531	130866
	PUBLIC	TOTAL	333486	318098	302729	287360	271992	256623	240846	231689	222550
	AREA	TOTAL	1863635	1787205	1710774	1634343	1557912	1481482	1404644	1334423	1264223
OUTSIDE		DOM.	29645	29816	29987	30158	30329	30500	30671	30842	31013
		PUB.	1121	1160	1198	1237	1276	1315	1353	1392	1431
		COM.	3748	3953	4157	4362	4567	4772	4976	5181	5386
		IND.	96453	99524	102596	105668	108740	111811	114883	117955	121027
	PRIVATE	TOTAL	130967	134453	137938	141425	144911	148397	151883	155369	158856
		ARD	1703	1780	1858	1936	2013	2091	2169	2246	2324
		DOH	6831	7190	7549	7908	8268	8627	8986	9345	9704
		IEAT	17936	18021	18108	18194	18280	18366	18452	18538	18624
		MWA	0	0	0	0	0	0	0	0	0
		PWA	26305	26883	27460	28038	28615	29192	29770	30348	30925
		PWD	241779	245406	249034	252661	256288	259916	263543	267170	270798
	PUBLIC	TOTAL	294553	299280	304008	308736	313463	318192	322919	327646	332375
	AREA	TOTAL	425520	433733	441946	450161	458374	466589	474802	483016	491230
WHOLE AREA		DOM.	412072	397351	382631	367911	353191	338470	323750	309029	294309
		PUB.	51220	48761	46302	43844	41385	38926	36467	34009	31550
		COM.	107080	103997	100914	97831	94747	91664	88581	85498	82414
		IND.	1090764	1053450	1016137	978823	941509	904196	866882	829568	792255
	PRIVATE	TOTAL	1661136	1603560	1545984	1488408	1430832	1373256	1315680	1258104	1200528
		ARD	2093	2198	2303	2408	2513	2618	2723	2828	2932
		DOH	7126	7501	7876	8251	8626	9001	9376	9751	10126
		IEAT	112730	108206	103679	99154	94628	90103	85170	80238	75306
		MWA	39760	33133	26507	19880	13253	6627	0	0	0
		PWA	72348	71417	70486	69554	68622	67691	66759	65828	64896
		PWD	393962	394924	395886	396850	397812	398776	399739	400701	401664
	PUBLIC	TOTAL	628019	617377	606736	596096	585455	574815	563767	559345	564925
	GRAND	TOTAL	2289155	2220937	2152721	2084504	2016287	1948071	1879447	1817449	1765453

			2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	265733	268170	270606	273042	275479	277915	280351
		PUB.	30175	30231	30288	30344	30400	30456	30513
		COM.	78136	79246	80357	81466	82576	83686	84794
		IND.	677333	683438	689544	695649	701754	707860	713964
	PRIVATE	TOTAL	1051380	1061087	1070794	1080501	1090208	1099915	1109622
		ARD	636	663	690	718	745	772	799
		DOH	438	454	470	486	502	518	534
		IEAT	56682	56682	56682	56682	56682	56682	56682
		MWA	0	0	0	0	0	0	0
		PWA	34379	34787	35195	35603	36011	36419	36827
		PWD	132531	134196	135862	137527	139192	140857	142522
	PUBLIC	TOTAL	224666	226783	228899	231016	233131	235248	237364
	AREA	TOTAL	1276046	1287869	1299693	1311516	1323339	1335162	1346986
OUTSIDE		DOM.	31346	31679	32013	32346	32680	33013	33347
		PUB.	1470	1508	1547	1586	1625	1663	1702
		COM.	5593	5801	6009	6217	6425	6633	6841
		IND.	125480	129834	134388	138942	143296	147750	152204
	PRIVATE	TOTAL	163899	168923	173957	178991	184025	189059	194093
		ARD	2401	2479	2557	2634	2712	2790	2867
		DOH	10063	10422	10781	11141	11500	11859	12218
		IEAT	19252	19880	20508	21136	21764	22392	23020
		MWA	0	0	0	0	0	0	0
		PWA	31503	32080	32658	33236	33813	34390	34968
		PWD	274902	279006	283111	287214	291318	295423	299526
	PUBLIC	TOTAL	338121	343867	349614	355360	361106	366853	372599
	AREA	TOTAL	502010	512790	523571	534351	545131	555912	566691
WHOLE AREA		DOM.	297079	299849	302619	305388	308158	310928	313698
		PUB.	31645	31740	31835	31930	32025	32120	32215
		COM.	83732	85049	86366	87683	89000	90317	91634
		IND.	802814	813373	823932	834491	845050	855609	866168
	PRIVATE	TOTAL	1215268	1230010	1244751	1259492	1274233	1288974	1303715
		ARD	3037	3142	3247	3352	3457	3562	3667
		DOH	10501	10876	11251	11626	12001	12376	12751
		IEAT	75934	76562	77190	77818	78446	79074	79702
		MWA	0	0	0	0	0	0	0
		PWA	65882	66857	67853	68838	69823	70809	71794
		PWD	407433	413202	418972	424741	430509	436280	442048
	PUBLIC	TOTAL	562787	570649	578513	586376	594237	602100	609962
	GRAND	TOTAL	1778056	1800659	1823284	1845867	1868470	1891074	1913677

(Unit: m^3/day)

Table 8.1.7 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 5C

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304848	320011	336378	350745	366110	381476	396842	412209	406982	388754	383527	367299	351072	374845	388617	382389	368162	349936	362372	364808	367244	369680	382117	384553	386990
		PUB.	48788	49872	50678	51480	52383	53287	54191	55094	53874	52653	51433	50212	48991	47771	46550	45329	44108	42888	42964	43001	43057	43113	43189	43226	43282
		COM.	78707	83166	87622	92080	96537	100994	105451	109908	108819	107730	106640	105551	104462	103372	102283	101194	100104	99015	100124	101233	102343	103452	104561	105670	106780
		IND.	757833	803153	848474	893794	939120	984441	1029761	1075082	1057942	1040802	1023662	1006521	989381	972241	955101	937961	920821	903681	908786	913891	918995	924100	934208	940311	946417
	PRIVATE	TOTAL	1189966	1256001	1322050	1388098	1454150	1520197	1586244	1652294	1626810	1600936	1575281	1549583	1523908	1498229	1472561	1446873	1421198	1396619	1406229	1414932	1424840	1434347	1444054	1453781	1463469
		ARD	145	173	200	227	254	282	309	336	363	391	418	445	472	500	527	554	581	609	636	663	690	718	745	772	799
		DOH	152	188	184	200	218	232	247	263	279	296	311	327	343	359	375	391	406	422	438	454	470	486	502	518	534
		IEAT	80030	83457	86884	90311	93737	97164	100591	104018	101915	99813	97710	95608	93506	91403	89301	86792	84282	81773	81773	81773	81773	81773	81773	81773	81773
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	38399	92773	96146	79620	72893	66266	59640	53013	48398	38780	33163	28507	19890	13263	9527	0	0	0	0	0	0	0	0	0	0
		PWD	32843	36159	37476	39793	42110	44427	46744	49061	49511	47960	47408	46856	46305	45758	45207	44657	44106	43556	43994	44372	44778	45187	45595	46003	46411
		TOTAL	136674	138709	141842	144878	148110	151244	154378	157512	157013	156513	156013	155513	155014	154514	154014	153515	153015	152515	154190	155845	157511	158176	160841	162508	164171
	PUBLIC	TOTAL	348143	360437	382732	366027	367320	369616	381909	384204	364467	344731	334995	326259	316523	308788	299050	289907	282291	278875	280991	283107	286224	287340	289458	291572	293689
	AREA	TOTAL	1538088	1606439	1674782	1743126	1811470	1879812	1948154	2016497	1991083	1945670	1910206	1874842	1839428	1804016	1786902	1732780	1703567	1674393	1686217	1698040	1709984	1721688	1733508	1745333	1757157
OUTSIDE		DOM.	26149	26800	27051	27501	27952	28403	28853	29304	29656	29908	30060	30312	30564	30817	31069	31321	31573	31826	32158	32492	32826	33159	33492	33826	34159
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1199	1237	1276	1315	1353	1392	1431	1470	1508	1547	1586	1625	1663	1702
		COM.	1950	2063	2276	2489	2701	2913	3126	3339	3545	3751	3958	4164	4370	4576	4783	4989	5196	5401	5609	5817	6025	6233	6441	6649	6857
		IND.	49849	54600	60552	66503	72456	78408	84358	90309	94072	97836	101597	105360	109123	112886	116648	120412	124174	127937	132991	138045	141299	146783	150207	154661	159114
	PRIVATE	TOTAL	77420	84073	90727	97380	104034	110686	117341	123984	128256	132516	136774	141036	145295	149666	153815	158075	162336	166696	171629	176883	181897	186731	191785	196798	201832
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3589	3958	4317	4676	5036	5395	5754	6113	6472	6831	7190	7549	7908	8268	8627	8986	9345	9704	10063	10422	10781	11141	11500	11858	12218
		IEAT	4207	6143	8080	10017	11953	13890	15827	17763	16120	18477	18834	19191	19548	19905	20263	20620	20977	21334	21992	22650	23218	23648	24474	25102	25730
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21885	22263	22640	23417	23995	24573	25150	25728	26306	26883	27460	28038	28615	29192	29770	30348	30925	31503	32080	32658	33236	33813	34390	34968
		PWD	205456	209610	213762	217914	222067	226220	230372	234525	238381	242236	246121	249986	253853	257719	261586	265450	269316	273182	277295	281389	285484	289598	293701	297808	301909
	PUBLIC	TOTAL	236373	242478	249681	256884	263798	270891	277984	285098	290336	296571	302808	309046	315283	321518	327757	328984	332230	337488	343214	348980	354707	360453	366199	371944	377691
	AREA	TOTAL	313793	326551	340308	354064	367832	381578	395326	409083	418592	428086	437582	447081	460977	449074	475572	485059	494566	504082	514842	525822	536403	547184	557983	568744	579524
WHOLE AREA		DOM.	330796	346811	362429	378246	394062	409878	425695	441512	436637	428662	423587	417611	411636	405661	399686	393710	387736	381760	394530	397300	390070	402839	395610	388379	401149
		PUB.	49560	50682	51426	52368	53310	54252	55195	56138	54956	53774	52592	51410	50228	49046	47865	46683	45501	44319	44414	44509	44604	44699	44794	44889	44984
		COM.	80657	85229	89897	94568	99237	103907	108577	113247	112364	111481	110598	109716	108832	107949	107066	106182	105299	104416	105733	107050	108368	109685	111002	112319	113636
		IND.	808482	857753	909026	960297	1011574	1062847	1114118	1165391	1152014	1138637	1125259	1111882	1098506	1085127	1071750	1058373	1044995	1031618	1042177	1052736	1063295	1073854	1084413	1094972	1105531
	PRIVATE	TOTAL	1267375	1340074	1412777	1485478	1558183	1630984	1703686	1776289	1754870	1733483	1712036	1690618	1669201	1647783	1626366	1604949	1583530	1562113	1578854	1591595	1606337	1621077	1635818	1650560	1665301
		ARD	1149	1254	1359	1464	1569	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2826	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3761	4126	4501	4878	5251	5628	6001	6378	6751	7126	7501	7878	8251	8626	9001	9376	9751	10126	10501	10878	11251	11626	12001	12376	12751
		IEAT	84237	89600	94964	100327	105691	111054	116418	121781	120036	118290	116545	114799	113054	111309	109563	107411	105268	103107	103735	104363	104991	105619	106247	106875	107503
		MWA	38399	92773	96146	79620	72893	66266	59640	53013	48398	38780	33163	28507	19890	13263	9527	0	0	0	0	0	0	0	0	0	0
		PWA	53960	56844	59739	62633	65628	68422	71317	74211	74238	74266	74292	74319	74346	74373	74400	74427	74454	74481	75496	76452	77437	78422	79408	80393	81378
		PWD	341030	348319	355604	362890	370179	377484	384760	392057	386405	380766	402134	406661	408967	412232	415586	419364	422330	426987	431496	437234	443006	448775	454542	460312	466081
	PUBLIC	TOTAL	583517	602915	622313	641710	661108	680506	699903	719302	694803	640303	636803	631305	626808	622306	617807	612901	614821	616343	624206	632067	638930	647783	655864	663618	671380
	GRAND	TOTAL	1850891	1932988	2015089	2097188	2179292	2261391	2343489	2425580	2386873	2373756	2347538	2321923	2299006	2270089	2244173	2217849	2198161	2178456	2201059	2223962	2246267	2269670	2291472	2314077	2338980

(Unit: m^3/day)

Table 8.1.8 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 6

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304646	320011	315984	324985	333786	342887	351569	360490	368556	350621	345687	340782	335819	330884	325649	321015	316080	311146	313582	316019	319455	320891	323328	325764	328201
		PUB.	48768	49672	49304	49786	50266	50745	51225	51706	50588	49433	48297	47161	46025	44889	43753	42617	41482	40346	40402	40458	40514	40571	40627	40683	40740
		COM.	78707	83165	82600	85384	88167	90950	93733	96516	95762	95007	94253	93498	92744	91989	91235	90480	89725	88971	90080	91189	92298	93406	94517	95626	96736
		IND.	757833	803153	789850	815343	841078	866791	892504	918217	904988	891780	878562	865343	852125	838906	825688	812469	799251	786032	792136	798242	804349	810453	816558	822663	828768
	PRIVATE	TOTAL	1189955	1256001	1237539	1275418	1313298	1351173	1389050	1426928	1408885	1388841	1366798	1348765	1326711	1305688	1286625	1266581	1246538	1226495	1236202	1245909	1255616	1265323	1275029	1284737	1294444
		ARD	145	173	200	227	254	282	309	336	363	391	418	445	472	500	527	554	581	609	636	663	690	718	745	772	799
		DOH	152	168	184	200	216	232	247	263	279	295	311	327	343	359	375	391	406	422	438	454	470	486	502	518	534
		IEAT	80030	83457	82353	84270	86187	88104	90020	91937	90137	88336	86536	84735	82935	81135	79334	77127	74920	72713	72713	72713	72713	72713	72713	72713	72713
		MWA	88390	92773	95448	91924	88398	84872	81347	77821	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32843	35159	34813	35976	37338	38700	40063	41425	41085	40706	40346	39986	39627	39267	38907	38548	38188	37829	38237	38644	39052	39460	39868	40276	40684
		PWD	135674	138706	139638	142038	144438	146838	149237	151637	151284	150931	150578	150226	149873	149520	149167	148814	148461	149108	149774	151439	153104	154769	156434	158099	159765
	PUBLIC	TOTAL	349143	350437	352438	354835	356830	359027	361223	363420	329615	320418	311322	302226	293129	284033	274937	265433	262567	259981	261787	263813	266030	268145	270262	272378	274494
	AREA	TOTAL	1539098	1606438	1589977	1630051	1670128	1710200	1750274	1790348	1736399	1707260	1678120	1648990	1619841	1590701	1561561	1532014	1509095	1486175	1497990	1509822	1521845	1533469	1545291	1557115	1568939
OUTSIDE		DOM.	26149	26600	26875	27267	27659	28051	28443	28836	29099	29363	29627	29890	30154	30418	30682	30946	31210	31474	31807	32140	32474	32808	33141	33474	33808
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1198	1237	1276	1315	1353	1392	1431	1470	1509	1547	1586	1625	1663	1702
		COM.	1860	2063	2269	2476	2689	2899	3109	3316	3526	3733	3940	4147	4353	4560	4767	4974	5180	5387	5595	5803	6011	6219	6426	6634	6842
		IND.	48649	54600	59305	63508	68710	73913	79116	84318	88231	92144	96056	99969	103882	107794	111707	115619	119532	123444	127898	132352	136806	141260	145714	150168	154621
	PRIVATE	TOTAL	77420	84073	89297	94141	98985	105829	111673	117518	121938	126360	130782	135204	139626	144048	148470	152892	157314	161736	166770	171804	176838	181872	186906	191939	196974
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3599	3958	4317	4676	5035	5395	5754	6113	6472	6831	7190	7549	7908	8268	8627	8986	9345	9704	10063	10422	10781	11141	11500	11859	12218
		IEAT	4207	5143	6117	7399	8682	9964	11246	12528	13017	13504	13992	14480	14968	15456	15944	16432	16920	17408	18036	18664	19292	19920	20548	21176	21804
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21686	22263	22840	23417	23995	24573	25150	25728	26306	26883	27460	28038	28615	29192	29770	30348	30925	31503	32080	32658	33236	33813	34390	34968
		PWD	205456	209610	213689	217817	221946	226074	230202	234331	238201	242071	245941	249813	253683	257553	261425	265295	269166	273036	277140	281243	285348	289452	293556	297660	301764
	PUBLIC	TOTAL	235373	242478	247545	253969	260395	266820	273244	279670	285042	290414	295786	301160	306533	311906	317279	322651	328023	333396	338142	344889	350636	356382	362127	367874	373620
	AREA	TOTAL	312793	326551	336842	348110	360380	372649	384918	397188	406980	416774	426568	436364	446159	455953	465749	475542	485337	495132	505912	516692	527473	538253	549033	559814	570593
WHOLE AREA		DOM.	330795	346611	342859	352152	361445	370738	380031	389325	384655	379984	375313	370643	365972	361302	356631	351960	347290	342620	345389	348159	350929	353699	356469	359238	362009
		PUB.	49540	50482	50154	50673	51192	51710	52229	52749	51651	50554	49456	48359	47262	46165	45068	43971	42874	41776	41872	41967	42062	42157	42252	42347	42442
		COM.	80567	85228	84866	87862	90865	93849	96842	99836	99288	98740	98192	97645	97097	96549	96001	95453	94906	94358	95675	96992	98309	99626	100943	102261	103578
		IND.	806482	857753	847956	878871	909789	940705	971620	1002536	993230	983924	974618	965312	956006	946700	937395	928089	918782	909477	920036	930594	941154	951713	962271	972831	983390
	PRIVATE	TOTAL	1267375	1340074	1326836	1369567	1413281	1457001	1500723	1544444	1528823	1513201	1497580	1481958	1466337	1450716	1435095	1419473	1403851	1388230	1402972	1417712	1432454	1447195	1461935	1476676	1491418
		ARD	1149	1254	1359	1464	1569	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2828	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3751	4126	4501	4876	5251	5626	6001	6376	6751	7126	7501	7876	8251	8626	9001	9376	9751	10126	10501	10876	11251	11626	12001	12376	12751
		IEAT	84237	88600	88470	91670	94869	98068	101267	104466	103153	101841	100528	99216	97903	96591	95278	93559	91840	90120	90748	91376	92004	92632	93260	93888	94516
		MWA	88390	92773	95448	91924	88398	84872	81347	77821	46386	39760	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	56876	58816	60755	62695	64636	66575	66793	67011	67229	67446	67664	67882	68100	68318	68536	68754	69739	70724	71710	72696	73681	74666	75652
		PWD	341030	348318	353328	359856	366384	372912	379439	385968	389485	393003	396520	400039	403556	407073	410592	414109	417626	421145	426914	432682	438453	444221	449990	455760	461529
	PUBLIC	TOTAL	583517	592915	599983	608604	617225	625847	634467	643089	614557	610833	607109	603386	599662	595938	592215	588084	580590	593077	600939	608801	616665	624527	632389	640252	648114
	GRAND	TOTAL	1850891	1932989	1925819	1978161	2030506	2082848	2135190	2187534	2143379	2124034	2104688	2085345	2065999	2046653	2027310	2007557	1984431	1981307	2003911	2026513	2049119	2071721	2094324	2116928	2139532

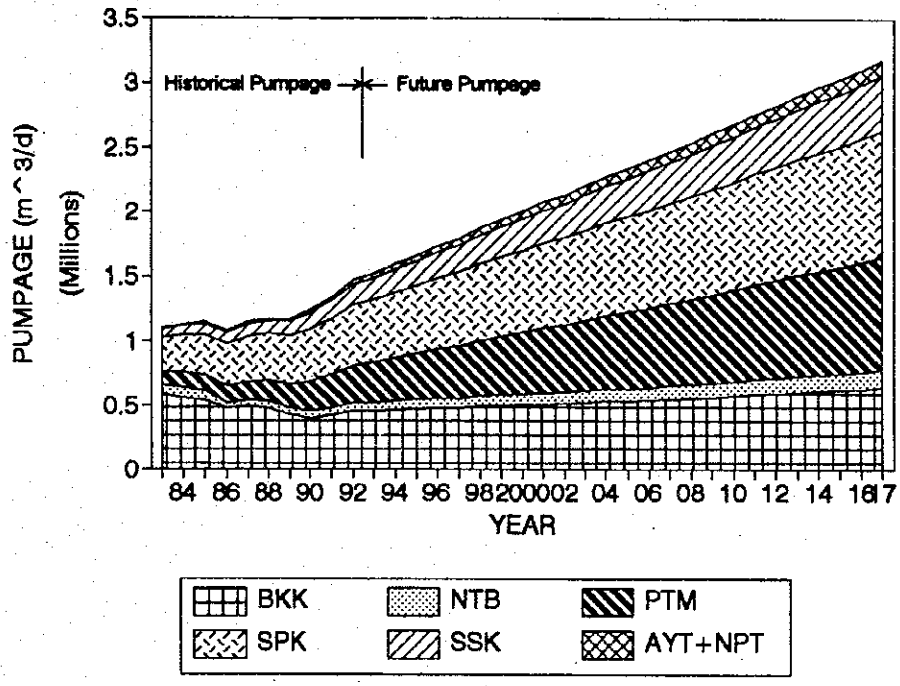
(Unit: m^3/day)

Table 8.1.9 FUTURE GROUNDWATER PUMPAGE BY SCENARIO 7

			1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
STUDY AREA		DOM.	304646	320011	322448	324894	327321	329757	332194	334630	330342	326054	321766	317478	313190	308902	304614	300326	296038	291751	294187	296624	299060	301496	303933	306369	308806
		PUB.	48768	49672	49728	49784	49841	49897	49953	50009	48916	47823	46729	45635	44542	43448	42355	41261	40168	39074	38131	38187	38243	38299	38356	38412	38468
		COM.	76707	83185	84274	85384	86493	87602	88711	89820	89233	88646	88059	87472	86885	86297	85710	85123	84536	83948	85058	86167	87277	88386	89496	90605	91714
		IND.	757833	809153	809258	815363	821469	827574	833679	839784	828626	817269	806011	794753	783495	772238	760980	749722	738486	727207	733312	739417	745522	751628	757732	763838	769943
	PRIVATE	TOTAL	1169956	1258001	1266708	1276418	1286122	1294929	1304537	1314243	1297017	1279791	1262566	1245339	1228112	1210886	1193660	1176433	1159207	1141981	1161886	1181396	1171102	1190809	1190516	1200223	1209930
		ARD	146	173	200	227	254	282	309	336	383	391	418	445	472	500	527	554	581	609	636	663	690	718	745	772	799
		DOH	152	168	184	200	216	232	247	263	279	295	311	327	343	359	375	391	408	422	438	454	470	486	502	518	534
		IEAT	90030	83457	83963	84270	84677	85083	85490	85897	84247	82598	80948	79299	77650	76000	74351	72296	70238	68182	68182	68182	68182	68182	68182	68182	68182
		MWA	98389	92773	92348	91924	91499	91075	90650	90226	46366	39790	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	32843	35159	35587	35978	36383	36791	37199	37607	37343	37079	36814	36550	36286	36022	35758	35493	35229	34965	36373	35781	36189	36597	37005	37413	37820
		PWD	135674	139708	140373	142039	143704	145369	147034	148699	148420	148140	147861	147582	147302	147023	146743	146464	146184	145905	147570	149236	150901	152566	154231	155896	157561
	PUBLIC	TOTAL	348143	350437	352638	354654	356732	358831	360829	363027	317038	306262	294486	280709	261933	273156	264380	255190	252840	260083	262189	264316	266432	268648	269884	282781	284987
	AREA	TOTAL	1518099	1608438	1619244	1630048	1641854	1653660	1665466	1677271	1614056	1586053	1557052	1526048	1510044	1484042	1458039	1431829	1411847	1382064	1403889	1415710	1427534	1439357	1451180	1483004	1474827
OUTSIDE		DOM.	26149	26800	26934	27267	27600	27934	28267	28601	28870	29140	29410	29680	29948	30219	30489	30758	31028	31298	31631	31965	32299	32632	32966	33299	33632
		PUB.	772	811	849	888	927	966	1004	1043	1082	1121	1160	1199	1237	1276	1315	1353	1392	1431	1470	1508	1547	1586	1625	1663	1702
		COM.	1950	2063	2270	2478	2686	2894	3102	3310	3517	3724	3931	4138	4345	4552	4759	4966	5173	5380	5589	5798	6003	6211	6419	6627	6836
		IND.	48949	54900	59064	63608	67982	72418	76870	81323	86311	90298	93286	97273	101261	105248	109236	113223	117210	121198	125662	130106	134550	139013	143487	147921	152375
	PRIVATE	TOTAL	77420	84573	89107	94141	98175	104209	109243	114277	118780	123283	127786	132289	136782	141296	145799	150300	154803	159308	164340	169374	174408	179442	184478	189510	194544
		ARD	1004	1082	1159	1237	1314	1392	1470	1547	1625	1703	1780	1858	1936	2013	2091	2169	2246	2324	2401	2479	2557	2634	2712	2790	2867
		DOH	3589	3958	4317	4678	5036	5395	5754	6113	6472	6831	7190	7549	7908	8268	8627	8986	9346	9704	10063	10422	10781	11141	11500	11859	12218
		IEAT	4207	6143	6771	7398	8027	8655	9283	9911	10465	11018	11571	12125	12678	13231	13785	14338	14891	15445	16073	16701	17329	17957	18585	19213	19841
		MWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		PWA	21108	21685	22283	22840	23417	23995	24573	25150	25729	26305	26883	27460	28038	28615	29192	29770	30348	30925	31503	32080	32658	33236	33813	34390	34968
		PWD	208458	209810	213714	217817	221922	226026	230129	234234	238107	241979	245852	249726	253599	257471	261345	265217	269090	272964	277087	281171	285278	289378	293483	297588	301691
	PUBLIC	TOTAL	238373	242478	248224	253998	259717	265483	271208	276966	282396	287836	293274	298717	304150	309588	315039	320479	325918	331361	337107	342852	348600	354348	360081	365839	371584
	AREA	TOTAL	312795	326951	337331	348110	357892	369692	380451	391292	401176	411119	421061	431006	440949	450892	460838	470799	480727	490667	501447	512227	523008	533788	544568	555349	566128
WHOLE AREA		DOM.	330795	346811	349381	352161	354921	357691	360461	363231	359212	355194	351176	347158	343140	339122	335103	331085	327067	323049	325819	328589	331360	334128	336898	339668	342438
		PUB.	49540	50482	50577	50673	50767	50863	50958	51053	49998	48943	47888	46834	45779	44724	43669	42615	41560	40505	40800	40895	40790	40885	40980	41075	41170
		COM.	80657	85228	86545	87862	89179	90496	91813	93130	92750	92370	91990	91610	91229	90848	90469	90089	89709	89329	90648	91963	93290	94597	95914	97232	98549
		IND.	806482	857763	868312	878871	889430	899989	910648	921107	913357	905667	898298	892028	884756	877486	870218	862945	855678	848406	858984	869623	880082	890641	901200	911759	922318
	PRIVATE	TOTAL	1267375	1340074	1354815	1369556	1384297	1399038	1413780	1428520	1418797	1409074	1398350	1387627	1376904	1362181	1339457	1326734	1314010	1301287	1318029	1330788	1345510	1360251	1374992	1389733	1404476
		ARD	1149	1254	1359	1464	1569	1674	1779	1883	1988	2093	2198	2303	2408	2513	2618	2723	2828	2932	3037	3142	3247	3352	3457	3562	3667
		DOH	3751	4126	4501	4878	5251	5628	6001	6378	6751	7126	7501	7878	8251	8626	9001	9378	9751	10126	10501	10876	11251	11626	12001	12378	12751
		IEAT	94237	89600	90636	91669	92704	93738	94773	95808	94712	93616	92520	91424	90327	89231	88135	86932	85130	83627	84255	84883	85511	86139	86767	87395	88023
		MWA	98389	92773	92348	91924	91499	91075	90650	90226	46366	39790	33133	26507	19880	13253	6627	0	0	0	0	0	0	0	0	0	0
		PWA	53950	56844	57870	58818	59800	60786	61771	62757	63070	63384	63697	64010	64323	64637	64950	65263	65577	65890	67878	67861	68848	69832	70817	71803	72788
		PWD	341030	349318	354087	359956	365626	371395	377163	382833	388527	390120	393713	397307	400901	404493	408088	411881	415274	419098	424938	430408	436176	441846	447714	453484	459252
	PUBLIC	TOTAL	589617	592915	600758	608603	616449	624293	632137	639983	599434	599098	592783	589428	589090	582783	579418	576678	576659	581444	599308	597188	605032	612864	620758	629819	636491
	GRAND	TOTAL	1856991	1932989	1955574	1979160	2000748	2023331	2046917	2068503	2018231	1998172	1983111	1967064	1950994	1934834	1918878	1902408	1892566	1882731	1905334	1927937	1950642	1973145	1995749	2018362	2040964

(Unit: m^3/day)

FUTURE PUMPAGE SCENARIO (1)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (1)
IN THE STUDY AREA BY USER TYPE

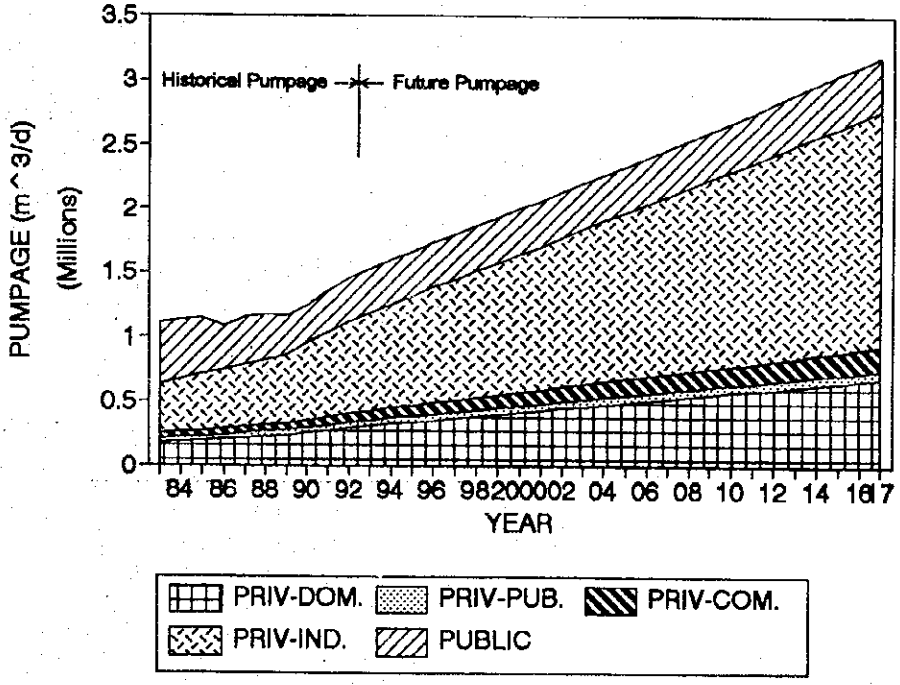
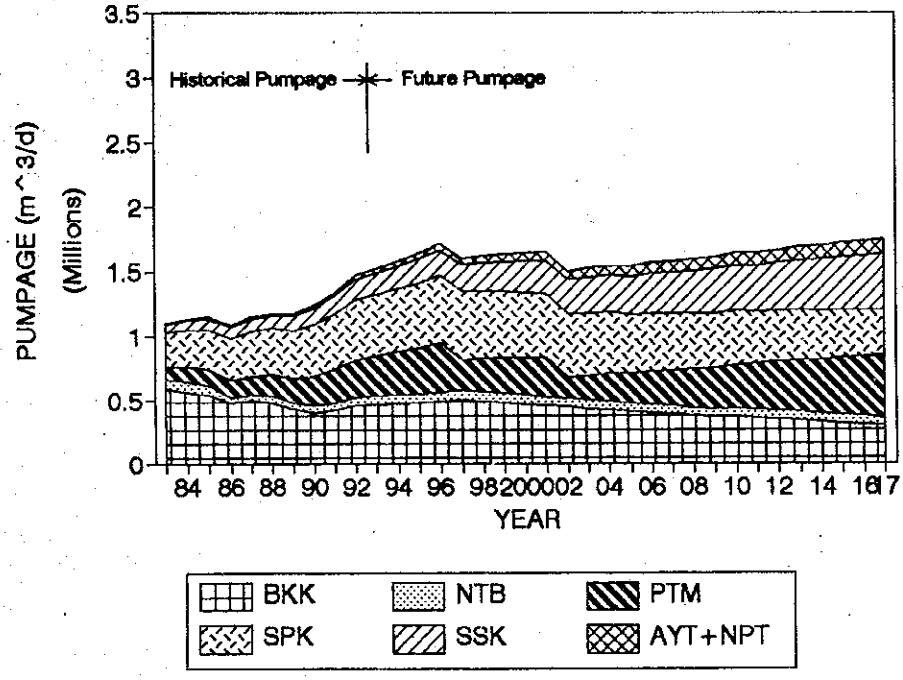


Figure 8.1.1	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 1
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (2).
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (2)
IN THE STUDY AREA BY USER TYPE

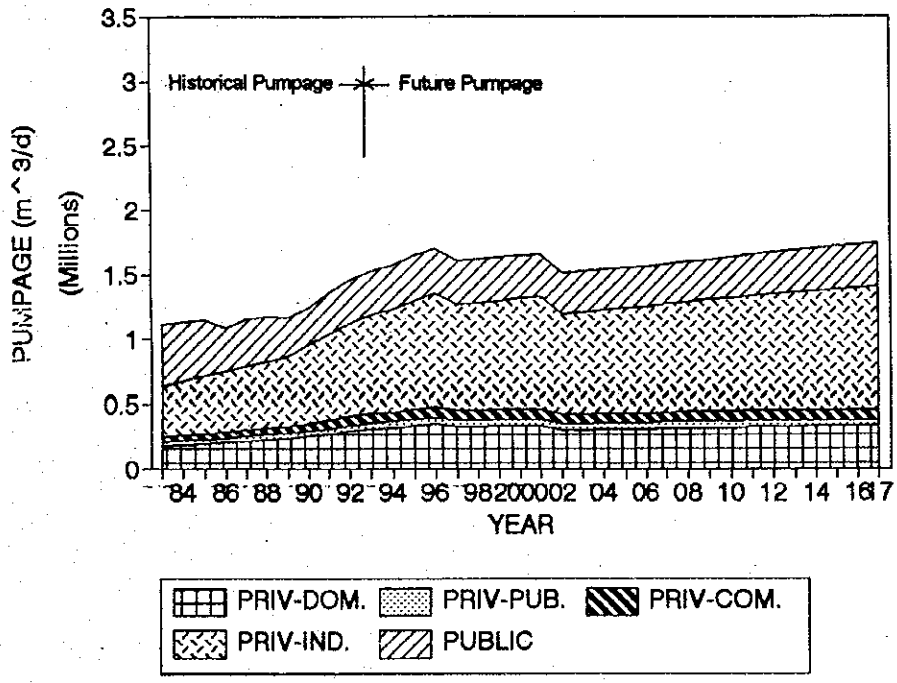
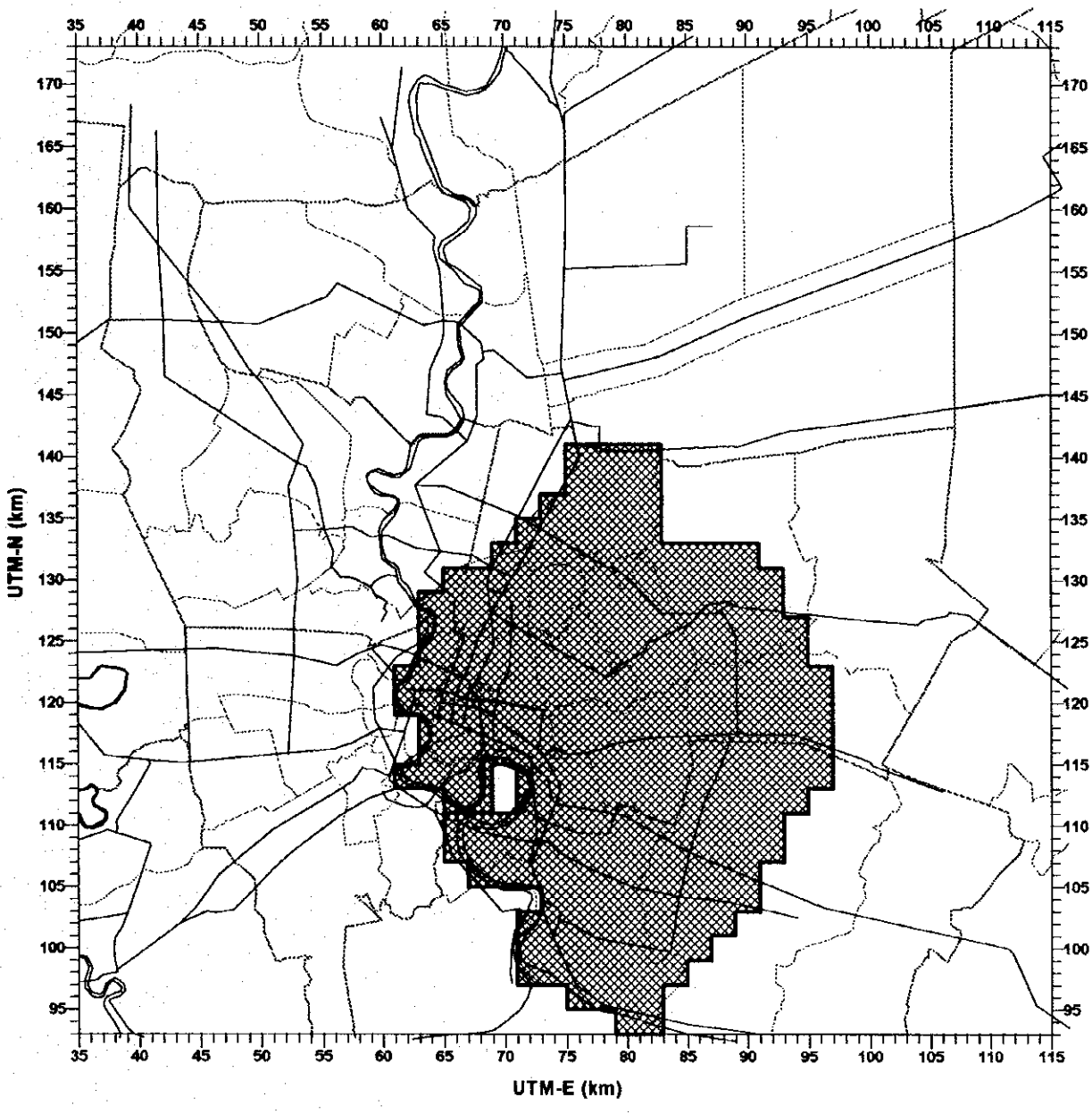


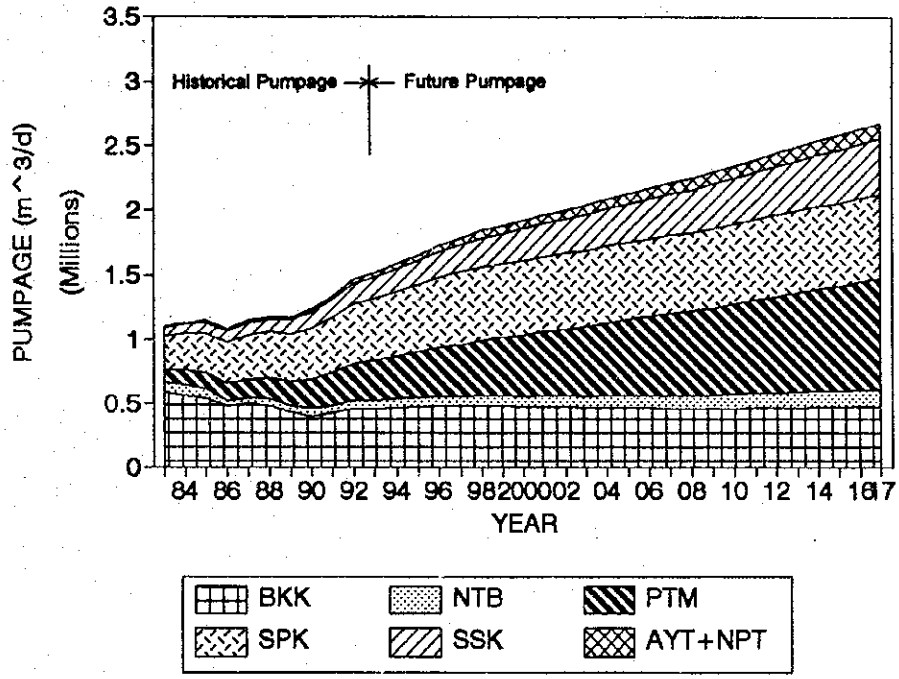
Figure 8.1.2	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 2
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.



PRESENT CRITICAL ZONES 1 & 2

Figure 8.1.3	PRESENT CRITICAL ZONES 1 & 2 USED IN THE MODEL
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (3)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (3)
IN THE STUDY AREA BY USER TYPE

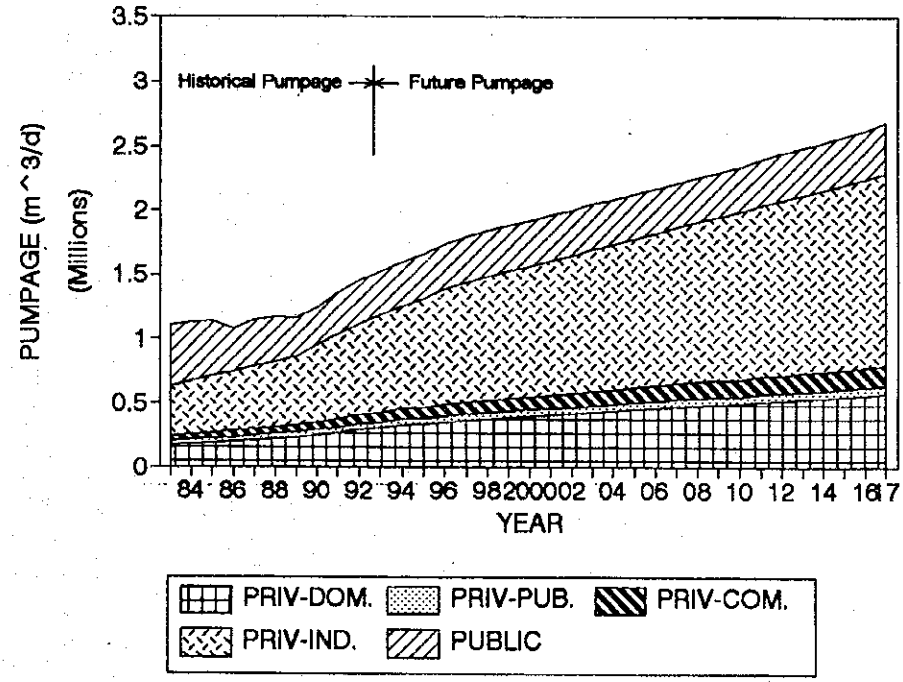
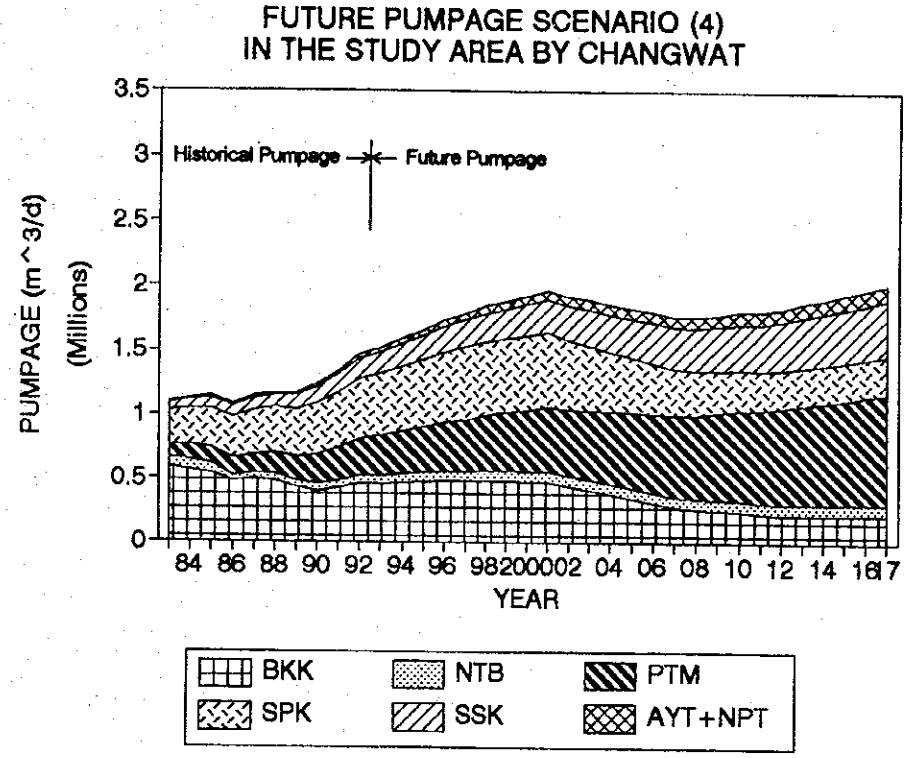


Figure 8.1.4	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 3
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.



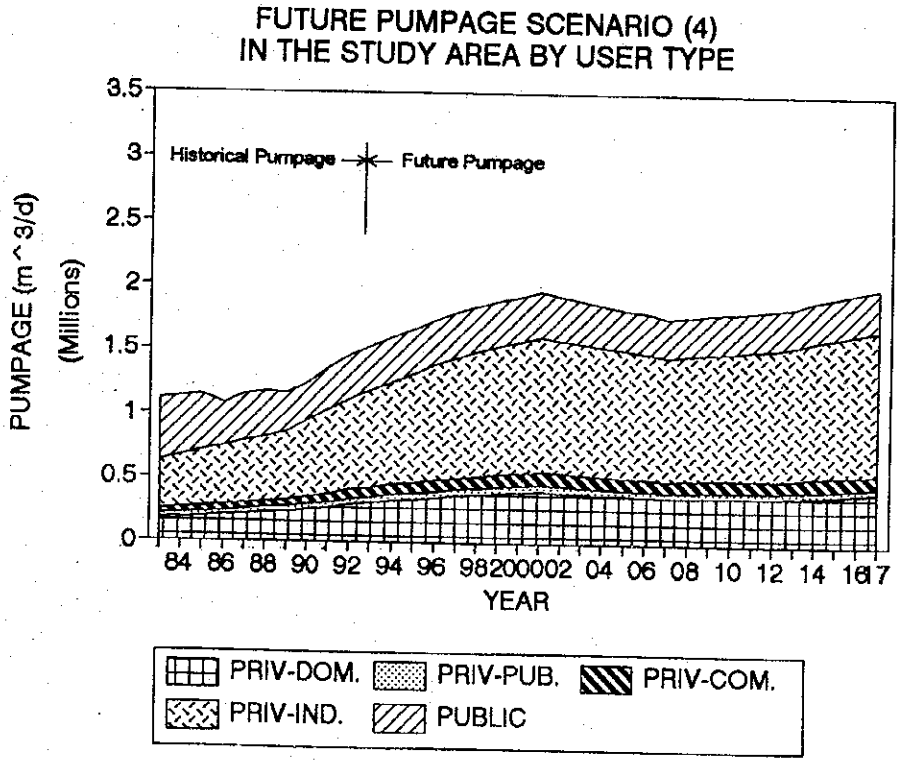
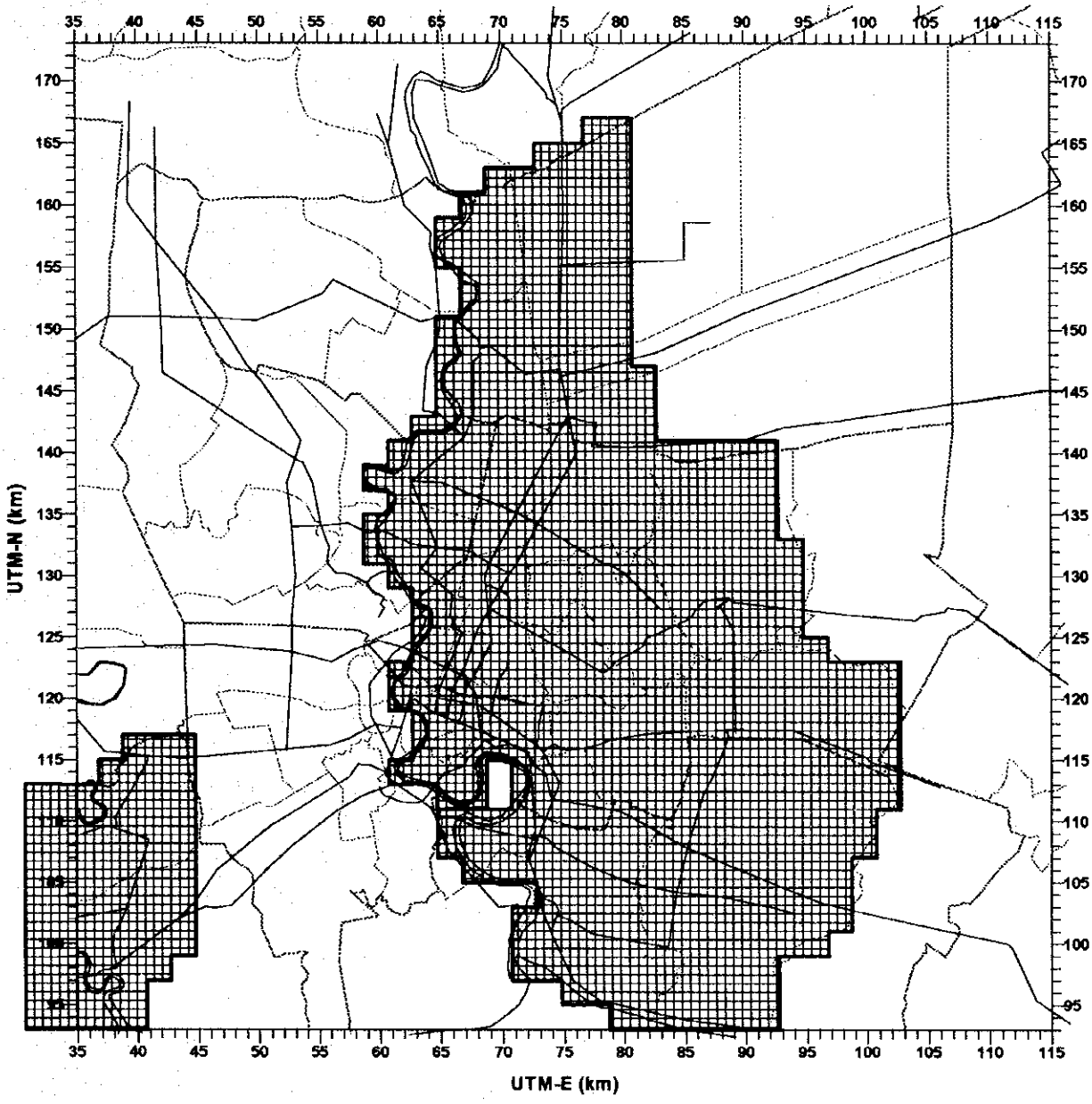


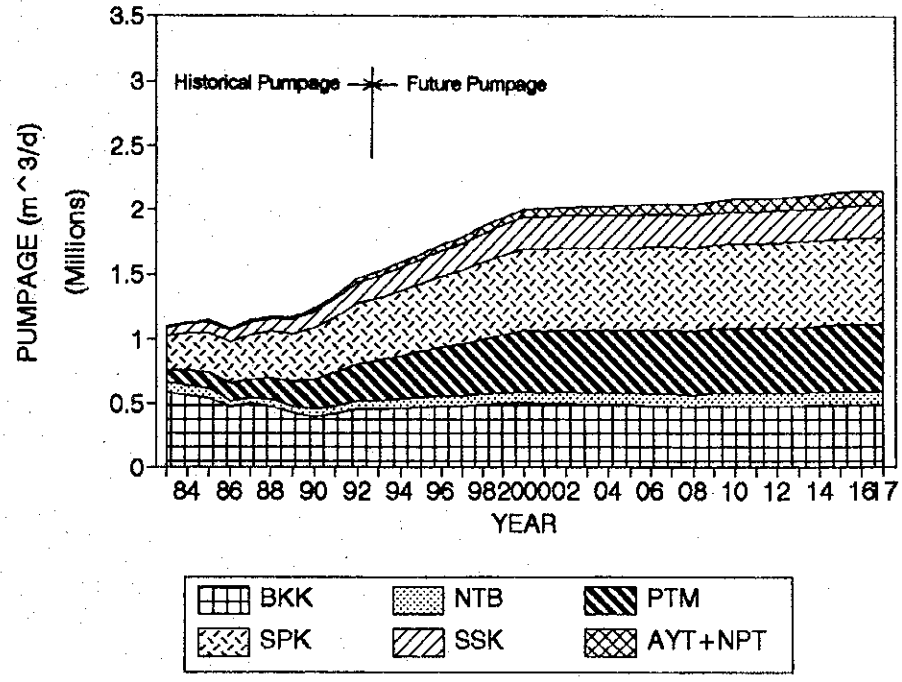
Figure 8.1.5	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 4
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.



PROPOSED NEW CRITICAL ZONE

Figure 8.1.6	PROPOSED NEW CRITICAL ZONE USED IN THE MODEL
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (5)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (5)
IN THE STUDY AREA BY USER TYPE

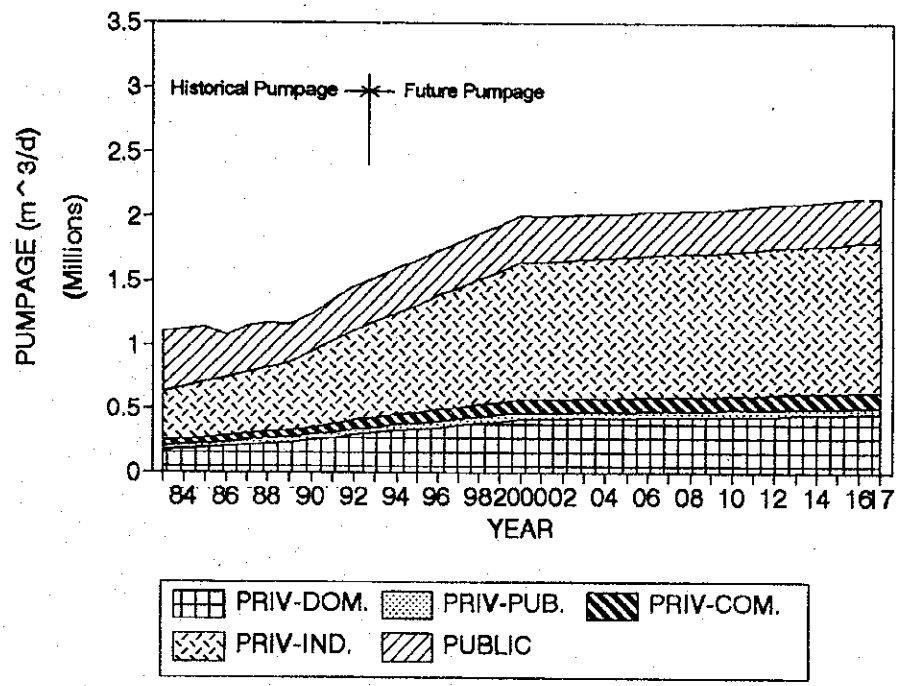
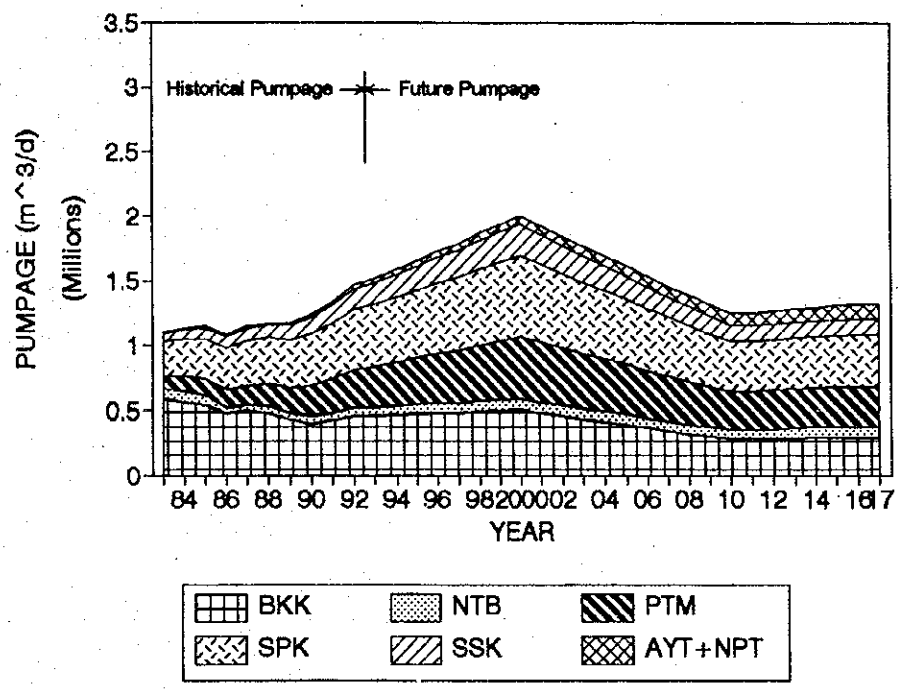


Figure 8.1.7	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 5A
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (5B)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (5B)
IN THE STUDY AREA BY USER TYPE

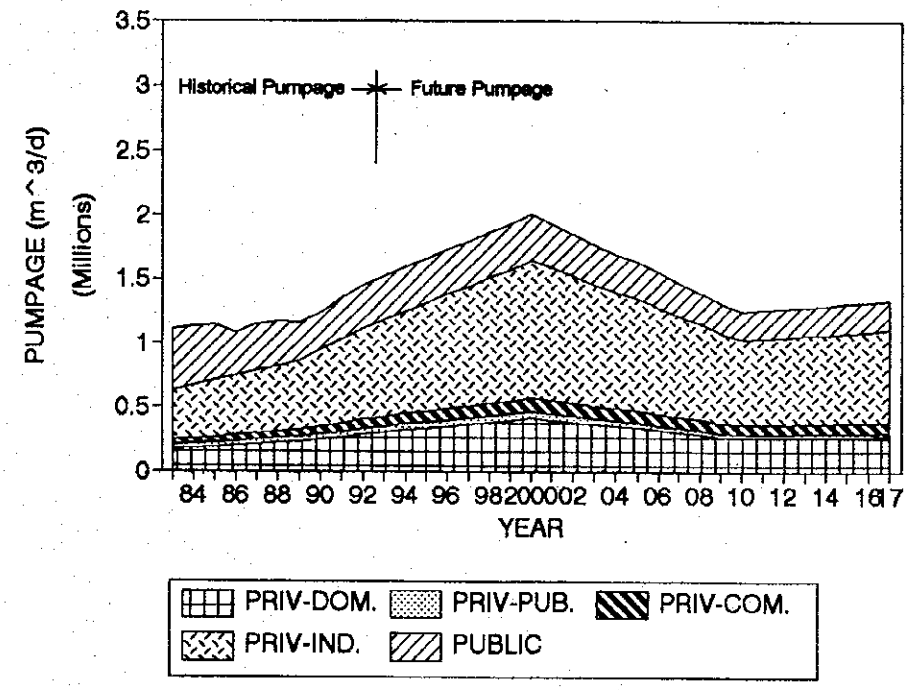
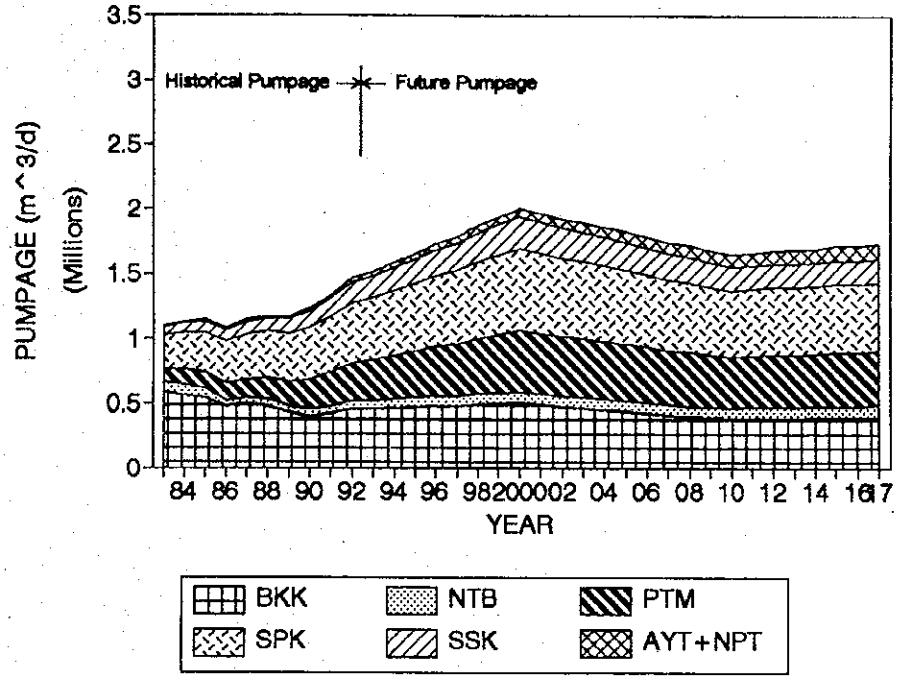


Figure 8.1.8	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 5B
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (5C)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (5C)
IN THE STUDY AREA BY USER TYPE

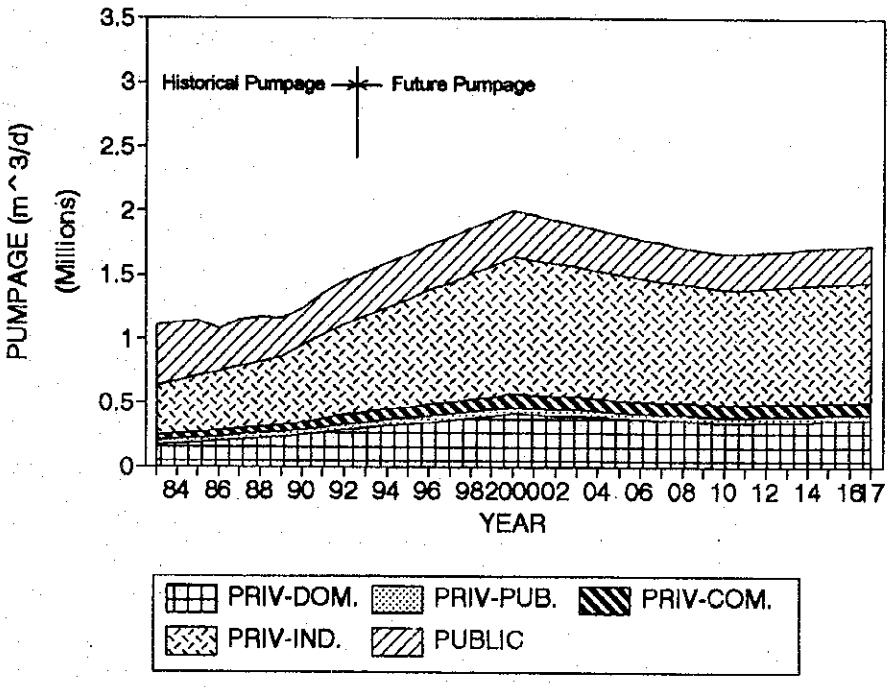
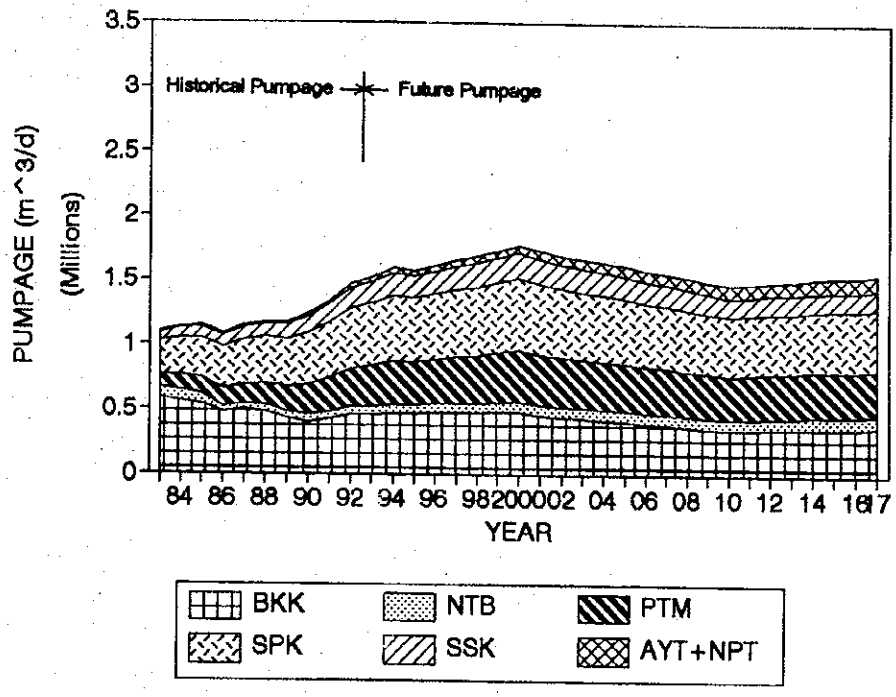


Figure 8.1.9	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 5C
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (6)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (6)
IN THE STUDY AREA BY USER TYPE

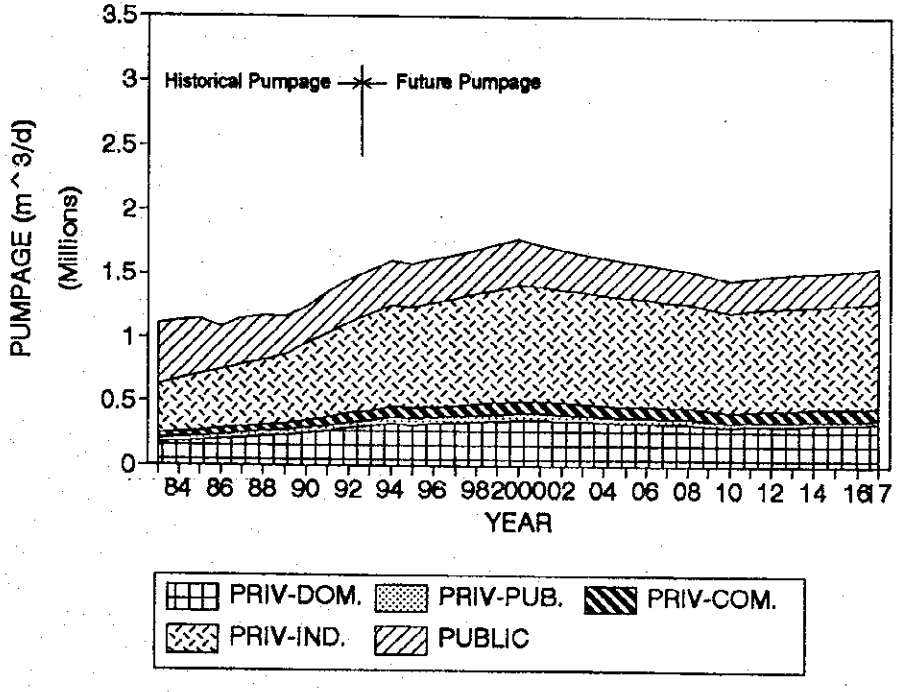
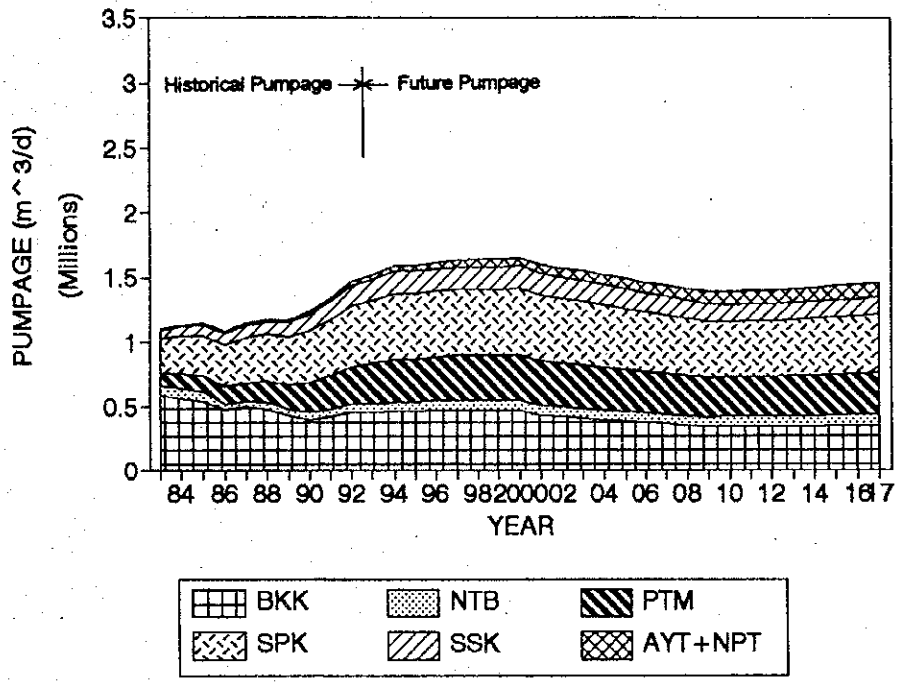


Figure 8.1.10	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 6
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.

FUTURE PUMPAGE SCENARIO (7)
IN THE STUDY AREA BY CHANGWAT



FUTURE PUMPAGE SCENARIO (7)
IN THE STUDY AREA BY USER TYPE

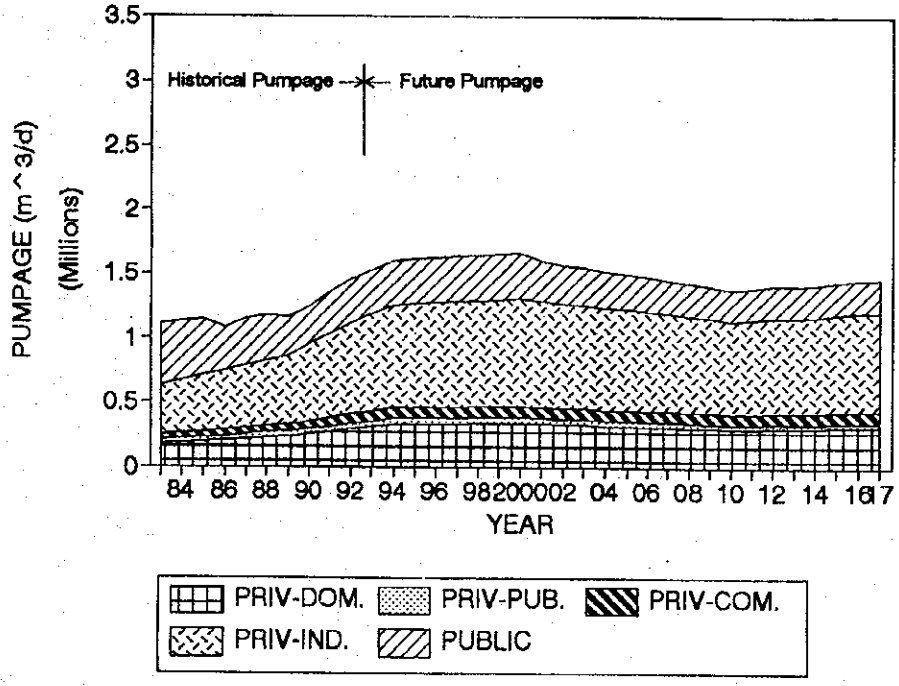


Figure 8.1.11	FUTURE PUMPAGE IN THE STUDY AREA BY SCENARIO 7
THE STUDY ON MANAGEMENT OF GROUNDWATER AND LAND SUBSIDENCE IN THE BANGKOK METROPOLITAN AREA AND ITS VICINITY	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	KOKUSAI KOGYO CO., LTD.