Thailand Water Account

(2005-2007)

Water Resources System Research Unit

Water Resources Engineering Department

Faculty of Engineering Chulalongkorn University

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Preface

The technical report on "Thailand Water Account (2005-2007) " was first introduced in Thailand to present the status of water use and supply (in physical terms) for the whole country, estimate according to its sources and usage. The study was done under the framework of SEEAW, UN. The report consists of two parts: water account and benchmarking renewable water resources in ASEAN countries. Part 1 illustrates a water account, as a part of report on "the System of Integrated Environment and Economic Accounting in water sector". It shows the completed processes of estimating the use and supply of water resources and how they are balanced. Part II illustrates water use and renewable water resources situations of Thailand when compared with other countries in the ASEAN region based on FAO database.

It is hoped that the report will help policy makers in determining water supply and use as a whole and also which sectors consume large amounts of water and whether they need to be promoted or not when linking with production, and illustrate the water usage situations in Thailand when compared with other countries in ASEAN.

Due to limitations on available data, there is a lot of room for improving the analysis in the future work and if more data become available, more aspects especially those link to economical value can be further studied. During the study, many water agencies provided valuable data, thus, Thanks to NESDB and many data providers (such as MWA, PWA, DWR, DGR, RID etc.) for their kind contribution and comments. Thanks to the Thailand Research Fund (TRF) for supporting publishing expense.

Sucharit Koontanakulvong
Piyatida Hoisangwan
Winai Chaowivat

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Abbreviation	Organization
CWA	Concession Water Authority
DIW	Department of Industrial Works, Ministry of Industry
DGR	Department of Groundwater Resources, Ministry of Natural Resources and Environment
DWR	Department of Water Resources, Ministry of Natural Resources and Environment
IEAT	Industrial Estate Authority of Thailand, Ministry of Industry
LDD	Land Development Department, Ministry of Agriculture and Cooperatives
MWA	Metropolitan Waterworks Authority, Ministry of Interior
NESDB	Office of the National Economic and Social Development Board
OAE	Office of Agricultural Economics
PCD	Pollution Control Department, Ministry of Natural Resources and Environment
PEA	Provincial Electricity Authority, Ministry of Interior
PWA	Provincial Waterworks Authority, Ministry of Interior
RID	Royal Irrigation Department, Ministry of Agriculture and Cooperatives
SEEAW	System of Environmental-Economic Accounting for Water
UN	United Nation
VWA	Village water authority, Ministry of Interior
WMA	Wastewater Management Authority, Ministry of Natural Resources and Environment

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It is important to realize that Gross Domestic Product (GDP), a well-known measuring method of the national economic growth is not actually a comprehensive approach to describe all aspects of national economic status. It is because a GDP does not take into account the costs of the negative impacts to natural resources that result from the over-exploitation of development projects. A high GDP does not represent a suitable and sustainable development when a large amount of natural resources are consumed and deteriorated as time goes by. At present, integrating the environment with the economy of a country to measure its economic growth is acceptable worldwide. Besides GDP or the nation's account, the environment account, or a satellite account, is an important way to integrate an environment with an economy and provides reliable information in measuring the growth of a country. There are approximately 44 countries that integrate their economies with their environment regarding water issue (UN-EMWIS, 2009). In Thailand, the Satellite System of Integrated Environment and Economic Accounting was established by Ramangul, et.al. (2008), and it focuses only on forests and some major types of natural resources. Later, more natural resources such as fresh surface water, and groundwater are established by NESDB.

This report introduces the initially established water account in the physical unit in Thailand, which is a part of the report submitted to NESDB (Chulalongkorn, 2010). The Water Account shows the analyses of the water balance between the use and supply of each water resource in physical terms. The components of this water account are water resources, water managers, water providers, water users, and water regulators in all kinds of activities such as household, industrial, agricultural, tourism, hydropower, and ecological balance consumption. In addition, this report expands its scope to benchmark water use and renewable water resources compared to other countries in the world and ASEAN countries.

Objectives

The objectives of this report are as follow:

1. To investigate and evaluate the water supply in various water sources i.e. rainfalls, runoffs and reservoirs,
2. To estimate water use in different sectors such as households, industries, and agriculture, including waste water and reused water,
3. To establish the water account for evaluating Thailand's Physical Water Stock,
4. To benchmark water use and renewable water resources within ASEAN countries.

Methodologies and scope of work

1. Collect information and data that are related to water use and water budget such as rainfall data, runoff data, cultivating areas, water storage and water allocation of large and medium reservoirs etc., from the year 2005 (dry water year), 2006 (flood water year) and 2007 (normal water year),
2. Classify water use from water manager and water provider into each category including allocation/production/distribution in domestic or consumptive use, allocation for irrigation and industry by determining in terms of water extraction and supply to water user in water basin and provincial level. The database includes water production and sale of the provincial water supply authority, raw water supply in industrial sector and water for irrigation of Royal Irrigation Department,
3. Evaluate water use in each category in terms of water use amount, water supply amount and water allocating efficiency,
4. Summarize the potential of water supply of both surface and groundwater resources,
5. Set up the water account for evaluating physical water stock that can be linked with the GDP of Thailand in the future,
6. Collect world water use and renewable water resources data and benchmark with Thailand case

Study Area

The study area covers the 9 groups of River Basins in Thailand; namely (i) Mekhong Group River Basin, (ii) Salween Group River Basin, (iii) Chaophya-Thachin Group River Basin, (iv) Mae Klong Group River Basin, (v) Bang Pakong Group River Basin, (vi) Eastern Siam Gulf Coast Group River Basin, (vii) Western Siam Gulf Coast Group River Basin, (viii) Southeast Coast Group River Basin, and (ix) Southwest Coast Group River Basin.

Data collection

In the analysis, two main datasets were collected as follows:

Water supply data consisting of surface and groundwater resources

- Surface water data include:
  - Large reservoirs data by EGAT and RID such as water storage, inflow, and release,
  - Medium and small reservoirs data estimated from water storage and evaporation,
  - Pond storage estimate based on LDD database such as water storage,

  - Pipe water supply by PWA and MWA such as water pumping and water sale.
- Groundwater data include:
  - Water pumping from private wells estimated based on DGR database.
  - Water pumping from public wells estimated based on DGR database.
  - Concession pipe water supply estimated by based on PWA database.
  - Village pipe water supply estimated based on database of the Department of Provincial Administration

Water use data consisted of domestic, agriculture and industry use.

- Domestic water use was estimated from a number of populations in municipal and rural areas recorded by Registrar Department and water use rate estimated in this study based on water use rate in each province from PWA database.
- Industrial water use was estimated by general data of inside and outside of industrial estate from IEAT and Department of Industrial Works and water use rate was reviewed from the Report of Groundwater Potential and Demand Study for Groundwater Management in the Northern Part of Lower Central Plain, 2002.
- Agricultural water use was estimated from irrigated areas in large, medium, and small irrigation projects from RID and rainfed areas from OAE such as rainy season rice, dry season rice, sugarcane, corn, and cassava.

The river basins in Thailand are divided into nine group river basins, namely (i) Mekong Group River Basin, (ii) Salween Group River Basin, (iii) Chaophya-Thachin Group River Basin, (iv) Mae Klong Group River Basin, (v) Bang Pakong Group River Basin, (vi) Eastern Siam Gulf Coast Group River Basin, (vii) Western Siam Gulf Coast Group River Basin, (viii) Southeast Coast Group River Basin, and (ix) Southwest Coast Group River Basin. They are delineated into 25 main river basins as illustrates below.

1. Mekong Group River Basin

The Mekong River forms the border with Lao PDR in the North and East. Around 18 percent of its total area is located in Thailand. It is divided into 5 main river basins, namely: Khong, Chi, Mun, Kok, and Tonelesab. The area is surrounded by mountain ranges in the upper part, and the middle area is an alluvial plain.

2. Salween Group River Basin

The Salween River is in the northwestern border with Myanmar. Salween River Basin comprises of merely Salween River Basin that is located in the Northwest of Thailand. It is a short river that flows from the East, the Dan Loa Mountain and joins Salween and Moei Rivers in the West.

3. Chaophya-Thachin Group River Basin

Chao Phraya- Tha Chin Group River Basin is the most important and the largest group river basin in Thailand and consists of 8 main river basin; namely of Ping, Wang, Yom, Nan, Sa Kae Krang, Tha Chin, Chao Phraya, and Pasak. It covers the major areas in central and northern Thailand. The upper part consists of steep mountains with plains along the banks. A large low flat alluvial plain called the Delta Plain whose major area is located in the Chao Phraya River Basin and Tha Chin River Basin that are very fertile.

4. Mae Klong Group River Basin

It is located in western Thailand. Its major part stretches from Kanchanaburi to Tak Province. It comprises merely of Mae Klong River Basin. The landscape is enclosed by steep mountains and has two rivers: Khwae Yai and Khwae Noi.

5. Bang Pakong Group River Basin

Bang Pakong River Basin is a river in eastern Thailand. It consists of 2 main river basins:Bang Pakong River Basin and Prachinburi River Basin. Its main tributaries are Nakhon Nayok River and Prachinburi River. Its major area runs from Nakhon Nayok to Sa Khew, and Prachinburi. The rivers flow from the North and East to West through the plain in the lower part of Chacheng sao Province and flows into the Gulf of Thailand.

6. East Coast Gulf Group River Basin

This river basin is located in the eastern region of Thailand. It has only the East Coast Gulf River Basin for its main basin and it comprises of a number of unconnected rivers, the Rayong River (Klong Yai), The Prasae River, The Klong Tanod Rivern, The Chantaburi River, The Muang Trat River, that flow into the Gulf of Thailand.

7. Western Coast Gulf Group River Basin

The group consists of the 2 main river basins: Phetchaburi River Basin and Phacheukiri khun River Basin. It also comprises of a series of short streams that flow into the Gulf of Thailand. The area is mainly along the Gulf of Thailand coasts.

8. Southeastern Coast (Gulf of Thailand)

The area is a narrow plain that runs from Chumporn to Narathiwas Provinces. The group basin consists of 4 major basins that are the Southeast Coast, Tapee, Songkha, and Pattani. Tapee River Basin covers the areas in Nakon Sri Thamarat, Suratthani. Its sources are in the West and South, and its water flows into the Gulf of Thailand in the East. Songkla River Basin covers Songkha, Pattalung and Nakorn Sri Thamarat Provinces. Its main tributaries is Au Taplo whose its source is Sadao and flows to Songkha River Basin. Pattani River Basin covers the areas in Yala and Pattani. It flows from the South to the North and to the Gulf of Thailand. Southeast Coast River Basin comprises of a series of short streams in the East Coast that flow into the Gulf of Thailand.

9. Southwestern Coast (Andaman)

The group basin is along the Andaman Coast. The only Phuket Mountain runs from Ranong to Phangnga Province. It comprises of a series of short streams that originates from the East and flows into Andaman Coastal plain in the West. The basin has only the Southwestern Coast River Basin. Most of its area is from subside land. The subside, that consists of coastal areas small bodies of waters and mini islands and wetlands, runs from Phungnga to Satun Provinces.

Meteorological and Hydrological data

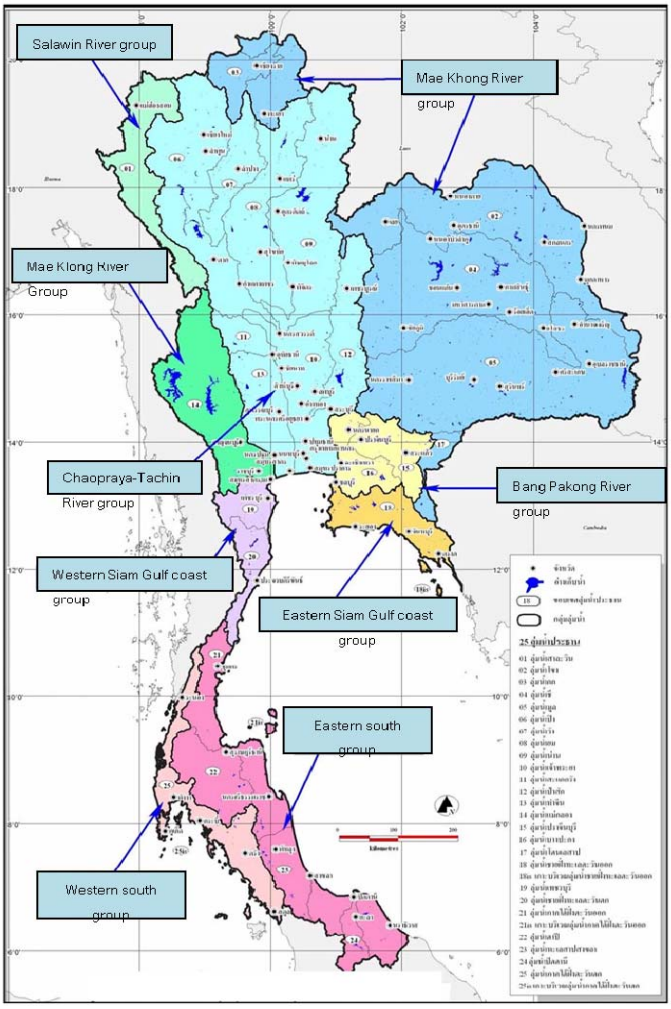
1. Rainfall

Monthly rainfall data were collected from 1,504 stations, in which 1,245 stations are from RID and 259 stations are from TMD. In 2005, the average annual rainfall of Thailand was 1,400.6 mm, with wet season rainfall of 1,041.5 mm and dry season rainfall of 359.2 mm. Table 1 shows monthly rainfall in the main river basins of Thailand.

2. Runoff

Monthly runoff data were collected from 177 stations from RID. The runoff in each catchment was estimated from rational method by using specific yield from RID. The runoff of catchment was calculated from the amount of rainfall multiply with monthly runoff

coefficient. In 2005, the average annual runoff of Thailand was 202,985 MCM, in which 188,912 MCM was wet season runoff and 14,073 MCM was dry season runoff. Table 2 shows monthly runoff in the main river basins of Thailand.



Source: National Economic and Social Advisory Board (2004)

Figure 1 Boundary of 9 main river basin group of Thailand

Water Budget

1. Surface water

In the study period, there were 32 large and medium reservoirs that were operated by RID and EGAT in year 2005. The total amount of water storage capacity of large and medium reservoirs was 65,506 MCM, the total catchment area was 120,946 km^2, the average annual inflow was 40,837 MCM/year and the effective storage was 43,199.7 MCM/year, which is about 66% of the total storage. The top three biggest reservoirs are Srinakarin Reservoir, Bhumibol Reservoir and Sirikit Reservoir respectively.

Table 1 Summary of monthly rainfall in the main river basins of Thailand

River basin group	Average monthly rainfall, mm												Wet Season	Dry Season	Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(mm)	(mm)	(mm)
1. Mae Khong basin group	0.86	1.52	30.62	64.92	139.46	185.19	224.86	215.14	291.18	78.86	49.36	14.47	1184.06	112.40	1296.46
2. Salawin basin group	0.20	1.09	14.60	42.02	120.42	207.77	240.06	280.15	288.52	88.48	40.60	19.65	1266.01	77.56	1343.56
3. Chao Phraya-Tachin basin group	2.70	4.39	29.62	77.74	99.71	134.90	140.28	133.80	285.28	102.08	62.49	11.02	958.54	125.47	1084.01
4. Mae Khlong basin group	1.93	7.49	46.84	82.65	139.88	143.52	258.95	168.79	338.56	206.89	50.91	18.75	1307.50	157.66	1465.16
5. Bang Prakong basin group	4.13	3.70	34.10	69.05	100.47	91.83	151.24	132.32	350.23	108.60	98.29	25.18	1032.98	136.16	1169.14
6. Eastern coast basin group	18.85	5.98	50.10	100.43	153.32	268.44	281.17	249.26	397.54	137.98	101.79	48.80	1589.51	224.17	1813.68
7. Western coast basin group	10.71	5.37	37.95	46.70	121.89	62.40	112.44	102.30	176.86	336.99	113.79	39.91	1026.67	140.65	1167.32
8. Eastern south basin group	17.01	7.61	59.30	56.59	141.86	154.50	120.08	130.68	144.10	299.40	346.19	605.44	1959.25	123.50	2082.75
9. Western sough basin group	3.84	3.59	39.46	93.11	263.73	309.08	257.13	193.85	279.59	263.97	216.03	312.07	2099.30	136.15	2235.45
Whole country	6.69	4.53	38.07	70.36	142.30	173.07	198.47	178.48	283.54	180.36	119.94	121.70	1380.42	137.08	1517.50

Table 2 Summary of monthly runoff in the main river basins of Thailand

River basin group	Average monthly runoff, mm												Wet Season	Dry Season	Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(MCM)	(MCM)	(MCM)
1. Mae Khong basin group	241	139	243	876	2,357	5,568	10,188	8,667	26,591	10,231	2,895	1,016	66,497	2,516	69,013
2. Salawin basin group	131	93	71	97	218	484	852	1,359	1,799	638	572	319	5,921	711	6,632
3. Chao Phraya-Tachin basin group	786	756	820	1,327	1,952	3,056	3,871	5,099	12,258	5,682	2,853	1,145	34,771	4,834	39,605
4. Mae Khlong basin group	261	397	496	523	681	552	1,067	918	1,846	2,245	1,321	419	8,631	2,098	10,728
5. Bang Prakong basin group	138	204	134	96	178	284	383	852	1,366	697	111	197	3,870	769	4,639
6. Eastern coast basin group	272	187	98	144	375	833	1,369	1,410	1,644	777	202	186	6,610	887	7,496
7. Western coast basin group	40	49	89	76	219	140	235	336	331	778	660	111	2,700	365	3,065
8. Eastern south basin group	745	380	572	587	1,714	2,245	2,131	1,959	4,213	5,284	8,251	14,208	40,750	1,539	42,289
9. Western sough basin group	66	47	82	226	899	1,629	1,649	3,017	6,395	3,090	1,161	1,257	19,162	355	19,517
Whole country	2,680	2,252	2,605	3,952	8,592	14,791	21,746	23,617	56,444	29,421	18,025	18,859	188,912	14,073	202,985

Table 3 Summary of water allocation of the large reservoirs in Thailand

Dam	Province	Water allocation (MCM/month)												Wet	Dry	Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(MCM)	(MCM)	(MCM)
Northern region																
1. Bhumibol Dam	Tak	446.56	409.56	466.51	388.30	421.09	463.60	279.36	237.06	79.79	103.68	308.11	498.49	1,892.69	2,209.42	4,102.11
2. Sirikit Dam	Uttraradit	875.64	838.88	948.78	744.81	806.71	420.03	406.08	215.16	101.06	229.24	298.79	683.28	2,477.07	4,091.39	6,568.46
3. Mae Ngad Dam	Cheingmai	22.59	42.28	51.27	49.70	47.86	15.48	17.86	38.82	110.01	114.49	46.53	34.57	391.05	200.41	591.46
4. Mae Kwang Dam	Cheingmai	20.66	17.95	13.54	9.53	5.07	2.51	10.06	2.23	5.77	20.17	6.12	8.56	51.93	70.24	122.17
5. Keaw Lom Dam	Lampang	25.77	24.71	26.60	18.92	14.52	24.76	39.79	92.23	452.24	200.16	118.40	74.40	942.10	170.40	1,112.50
Total of Northern region		**1,391.22**	**1,333.38**	**1,506.70**	**1,211.26**	**1,295.25**	**926.38**	**753.15**	**585.50**	**748.87**	**667.74**	**777.95**	**1,299.30**	**5,754.84**	**6,741.86**	**12,496.70**
North-Eastern region																
1. Mun bon Dam	Nakornsrithamrat	0.87	1.29	1.71	0.56	0.41	0.29	4.37	8.80	0.91	8.43	2.41	2.22	25.62	6.65	32.27
2. Lam Takhong Dam	Nakornsrithamrat	5.22	4.90	5.72	4.23	4.19	4.82	5.17	7.42	3.35	8.98	5.00	12.00	38.93	32.07	71.00
3. Lam Praploeng Dam	Nakornsrithamrat	0.03	0.05	0.07	0.10	0.09	0.04	2.58	2.21	11.58	16.15	11.68	2.14	44.33	2.39	46.72
4. Chulaporn Dam	Chaiyaphum	11.37	4.93	4.95	0.60	0.54	7.12	5.38	8.88	0.08	0.70	0.01	7.82	22.71	29.67	52.38
5. Huay Ghum Dam	Chaiyaphum	12.88	0.88	4.89	-	-	11.37	1.25	13.76	13.70	5.19	2.34	3.46	47.61	22.11	69.72
6. Nam Pung Dam	Sakonnakorn	0.16	4.06	5.95	15.73	17.96	16.95	18.42	17.79	55.99	36.01	11.21	6.02	174.33	31.92	206.25
7. Nam Uoon Dam	Sakonnakorn	31.58	28.11	28.18	11.55	-	-	28.20	36.13	95.55	143.33	5.11	31.20	308.32	130.62	438.94
8. Ubonrat Dam	Konkean	153.01	121.24	139.67	134.56	86.62	45.97	139.70	101.44	30.10	129.28	52.36	45.39	585.47	593.87	1,179.34
9. Huay Luang Dam	Udornthani	3.58	3.14	9.67	1.89	0.86	1.93	11.02	5.91	3.63	10.05	0.35	1.90	33.75	20.18	53.93
10. Lam Pao Dam	Karnrasin	128.74	113.32	104.12	97.67	5.27	44.23	266.50	219.11	298.46	415.94	58.83	59.08	1,308.34	502.93	1,811.27
11. Lam Nang Rong Dam	Burirum	0.56	0.74	0.70	0.10	0.05	-	2.53	6.56	0.29	0.80	-	0.23	10.23	2.33	12.56
12. Sirinthom Dam	Ubonratchathani	55.97	66.05	87.59	35.97	52.39	47.84	61.06	33.97	38.05	14.72	31.10	62.68	279.13	308.26	587.39
Total of North-Eastern region		**403.97**	**348.71**	**393.22**	**302.96**	**168.38**	**180.56**	**546.18**	**461.98**	**551.69**	**789.58**	**180.40**	**234.14**	**2,878.77**	**1,683.00**	**4,561.77**

Table 3 Summary of water allocation of the large reservoirs in Thailand (con't)

Dam	Changwat	Water allocsation (MCM/month)												Wet	Dry	Total
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(MCM)	(MCM)	(MCM)
Central region																
1. Tup Salao Dam	Uthaithani	10.90	4.33	0.34	0.23	0.46	0.28	0.33	0.24	-	-	-	20.87	1.31	36.67	37.98
2. Kraseaw Dam	Suphanburi	0.54	9.11	8.89	0.50	0.51	0.50	0.51	0.88	1.94	12.60	11.57	25.45	28.51	44.49	73.00
3. Sri Nakarin Dam	Karnchanaburi	331.69	457.83	550.76	565.69	487.40	375.57	258.44	125.71	178.34	17.28	208.43	181.79	1,651.17	2,087.76	3,738.93
4. Wachiralongkorn Dam	Karnchanaburi	310.51	454.34	531.53	500.54	408.19	227.91	213.29	138.14	201.03	83.64	322.50	239.33	1,594.70	2,036.25	3,630.95
5. Thathungna Dam	Karnchanaburi	317.48	453.77	526.23	514.30	463.10	366.32	251.99	132.25	171.60	55.90	211.91	180.91	1,653.07	1,992.69	3,645.76
6. Kangkracharn Dam	Petchaburi	27.74	42.35	31.13	38.29	33.84	33.56	68.94	82.14	68.06	25.91	29.33	22.68	341.78	162.19	503.97
7. Parnburi Dam	Prachupkirikan	18.32	17.97	17.21	12.35	16.46	13.58	15.15	16.76	32.50	29.62	29.50	25.37	153.57	91.22	244.79
8. Pasak Cholasit Dam	Lopburi	81.06	101.47	109.83	63.64	72.50	29.62	28.87	45.78	41.63	67.85	43.04	34.65	329.29	390.65	719.94
Total of Central region		**1,098.24**	**1,541.17**	**1,775.92**	**1,695.54**	**1,482.46**	**1,047.34**	**837.52**	**541.90**	**695.10**	**292.80**	**856.28**	**731.05**	**5,753.40**	**6,841.92**	**12,595.32**
Eastern region																
1. Bangpra Dam	Cholburi	2.26	2.05	2.35	2.51	2.74	2.92	2.81	3.85	3.86	4.26	3.89	3.94	24.33	13.11	37.44
2. Dok Krai Dam	Rayong	8.29	10.34	14.06	10.55	9.85	6.94	5.19	3.92	4.77	5.39	5.79	6.82	41.85	50.06	91.91
3. Nong Plalai Dam	Rayong	11.38	18.52	15.65	14.57	11.74	8.26	10.17	9.52	115.87	3.83	5.29	5.06	164.68	65.18	229.86
4. Map Prachan Dam	Cholburi	1.04	0.90	1.02	0.97	0.84	0.66	0.60	0.29	0.34	0.52	0.51	0.55	3.76	4.48	8.24
5. Nong Kor Dam	Cholburi	1.08	1.10	1.12	1.25	1.71	1.45	0.83	0.93	0.64	1.02	1.36	1.59	7.94	6.14	14.08
6. Kiritharn Dam	Chanthaburi	4.74	4.34	5.53	3.21	2.76	1.81	1.86	7.73	10.56	6.16	3.56	3.10	34.44	20.92	55.36
Total of Eastern region		**28.79**	**37.25**	**39.73**	**33.06**	**29.64**	**22.04**	**21.46**	**26.24**	**136.04**	**21.18**	**20.40**	**21.06**	**277.00**	**159.89**	**436.89**
Southern region																
1. Ratcha Prapa Dam	Surathani	103.57	256.27	97.85	172.39	118.47	72.80	53.90	35.45	98.04	225.13	68.60	40.65	816.61	526.51	1,343.12
2. Banglang Dam	Yala	110.27	172.22	109.36	128.09	115.37	160.88	124.78	73.80	59.81	86.25	51.26	167.42	949.84	409.67	1,359.51
Total of Southern region		**213.84**	**428.49**	**207.21**	**300.48**	**233.84**	**233.68**	**178.68**	**109.25**	**157.85**	**311.38**	**119.86**	**208.07**	**1,766.45**	**936.18**	**2,702.63**
Whole country		**3,136.06**	**3,689.00**	**3,922.78**	**3,543.30**	**3,209.57**	**2,410.00**	**2,336.99**	**1,724.87**	**2,289.55**	**2,082.68**	**1,954.89**	**2,493.62**	**16,430.46**	**16,362.85**	**32,793.31**

For small reservoir, there were 11,811 projects and the water storage capacity was 1,682 MCM. There were also 5,172 projects of small ponds that were operated by LDD with the storage capacity of 300 MCM as shown in Table 4. The benefited areas were 2,056,128 rais (6.25 rais = 1 hectare) and benefited households were 819,678 households.

Table 4 Small Irrigated Project and small ponds in each basin group

Group basin	Small irrigated project		Small pond			
	No. of projects (projects)	Storage (MCM)	No. of projects (projects)	Storage (MCM)	Benefit areas (rais)	Benefit household (household)
1. Mae Khong basin group	5,638	1,016.95	2,495	180.73	900,519.95	380,517
2. Salawin basin group	275	10.49	19	0.47	10,825.00	1,249
3. Chao Phraya-Tachin basin group	3,039	272.50	1,676	92.94	829,745	270,043
4. Mae Khlong basin group	223	162.45	79	1.61	16,284	27,629
5. Bang Prakong basin group	431	25.03	150	4.67	49,145	19,971
6. Eastern coast basin group	248	17.90	200	7.40	68,923	25,957
7. Western coast basin group	397	83.64	86	1.70	11,740	20,194
8. Eastern south basin group	1,186	70.01	319	7.92	121,952	51,000
9. Western sough basin group	374	22.57	148	2.50	46,995	23,118
Total	11,811	1,681.54	5,172	299.93	2,056,128	819,678

2. Groundwater

The groundwater resources were evaluated from change in water level, aquifer area and storage coefficient. From the review of groundwater resources in Thailand (Vachee and Somchai, 1999), they estimated the amount of groundwater in confined aquifer in the main groundwater basins of Thailand. The average change in water level was 5 meters. Storage coefficient in confined aquifer is 0.16, unconfined aquifer is $2x10^{-4}$ and semi-confined aquifer is 0.085. The safe yield is the balance of natural water recharge, the recovery of water level that reducing 5 meters to the normal level was determined in this study. Groundwater storage in confined aquifer in each region of Thailand in 12 basins is shown in Table 5. Groundwater storage is 15,877 MCM or 42% of rainfall infiltrated to groundwater resources. However there are many small basins in confined aquifer in riverside in the northern- eastern region that were not included in this study.

Table 5 Groundwater storage and safe yield

Groundwater Basin	Storage (MCM)	Developing ground water per year (MCM)	Developing ground water per day(MCM)
Cheingmai –Lumphun basin	485	97	0.265
Lumpang basin	295	59	0.161
Cheingrai – Payao basin	212	42	0.115
Prae basin	160	32	0.087
Nan basin	200	40	0.110
Upper Chaopraya basin	6400	1,280	3.500
Lower Chaopraya basin	6470	1,294	3.500
Thasheng basin	320	64	0.175
Nakornsrithumrat basin	420	84	0.230
Ranode-Songkla basin	400	80	0.200
Hatyai basin	175	35	0.096
Pattani basin	340	68	0.186
Total	**15,877**	**3,175**	**8,625**

Source : Groundwater Resources in Thailand , 1999

Water Account integrating the environment with economy is proposed to measure a country's economic growth. United Nation is the main agency that conducted Water Account. At the beginning, there was only environment aspect, SEEA-2003. Later, it was improved and specified regarding water issue, SEEAW. At present, there are approximately 44 countries[1] that integrate the economy with environment regarding the water issue (UN-EMWIS, 2009).

Literature review

System of Environmental-Economic Accounting for Water (SEEAW)

United Nation conducted the System of Environmental-Economic Accounting for Water (SEEAW), the satellite account of the 1993, SNA that integrated environment, especially water related issues, and economy to standardize concepts and methods in water accounting. SEEAW, the new version of SEEA-2003, further elaborated its framework to cover more detailed aspects related to water issues (UN, 2007:4). In addition, SEEAW is an effective tool to support IWRM by providing valuable information for the decision-making process.

Water Consumption and Water Use

Calculating water use by industries is not straightforward. Water use can include self-extracted water, distributed water, or reuse water, and sometimes a combination of all three sources are used. Calculating water use estimates for an industry or business is made more complicated when water is also supplied to other users, or when water is used in-stream. As such, simply adding self-extracted water, distributed water, and reuse water to derive a figure for total water use can be misleading.

Some countries have implemented their water account in measuring their countries' economic growth as stated in the following.

Australia

Australia is a major country that has implemented the water account under the strong guideline of UN. Under the Australian Bureau of Statistics (ABS), a water account, every four years, is made for the public, and so far, 3 reports, ABS, 2001; ABS, 2006 and ABS, 2009, have already been issued. The ABS water account shows the quantities of water supply and

1 Andorra, Australia, Austria, Bahamas, Botswana, Canada, China, Colombia, Denmark, Dominican Republic, Egypt, France, Germany, Guatemala, Hungary, Iraq, Israel, Italy, Jordan, Mexico, Namibia, Netherlands, New Zealand, Peru, Philippines, Portugal, Singapore, South Africa, Spain, Sweden, Switzerland, Trinidad and Tobago, Ukraine, Armenia, Estonia, Greece, Lebanon, Mauritius, Norway, Occupied Palestinian Territory, Romania, Tunisia, Turkey, and United Kingdom

use in the economy at state/territory and national levels. It is based on the principles for integrated environmental and economic accounting outlined in the System of Integrated Environmental and Economic Accounting 2003 (SEEA) (UN 2003), which is consistent with Australia's economic accounting framework, the System of National Account. (National Water Account Roadmap, 2009:7)

The details of ABS Water Account 2009 are shown below. The year 2008–09 was a wet year for Australia with the rainfall of 519 mm. However, some areas, especially in the Southeast faced drought. When compared to the year 2004–05 that has average rainfall. The amount of 59, 839 GL of water was extracted from the environment and used within the Australian economy. Out of that, 9,673 GL was extracted by water providers, and 50,166 GL by water users. Water consumption was 14,101 GL, a 25% decrease from the year 2004–05. The Agriculture Industry consumed 6,996 GL, the largest volume of water, representing 50% of water consumption from the year 2008–09 during which there were 401 water providers, supplying 9,673 GL of water. There were 413 providers and 11,337 GL from the year 2004–05.

The study of water account was also conducted in Thailand in 9 group basins of Thailand. Biltonen, Kwanyuen, Kositsakulchai, and Pattani (2002: 109-137) had done a water account in the Mae Klong River Basin, Thailand to estimate the water supply and use in the Basin and forecast for the next 15 years (till 2017). Their water account is based on the framework of IWRM. The study separated the basin into seven parts according to their hydrological characteristics and water-control facilities, and they are (i) Khwae Yai Upper (KHY), (ii) Lam Pachi (LPC), (iii) Khwae Noi Upper (KHN-U), (iv) Khwae Noi Middle (KHN-M), (v) Lam Tapheon(LTP), (vi) Mae Klong Plain Upper (MK-PU), and (vii) Greater Mae Klong Irrigation Project (GMKIP). In their study, the water account components and water indicators are set for measuring the supply and use. The Water Account components are (i) Net Flows (Depleted water, Process-irrigation evaporation, Beneficial-forest evaporation, Non-Beneficial -other evaporation), (ii) Outflows (Committed water, Uncommitted utilizable outflow, Uncommitted non-utilizable outflow, and available water). The indicators consist of depleted fraction and process fraction. The results show that in the upper part of the basin (KHN-U, KHN-M, KHY), the moderated depletion fractions are mainly due to the evaporation from forest, while water use is very small as observed from the low process fractions. Lam Pachi (LPC) and Lam Tapheon (LTP) produce high depletion fractions and moderate process fractions. According to the Water- Account components and indicators, for years water supply has been sufficient. However, in the future, the results could be reversed due to different scenarios, such as demand for an increased irrigation by sugarcane growers and increased influx of Bangkok immigrants.

There are several researches studying on water supply or demand side issues; however, they hardly integrate social aspect allowing for effective allocation and management of the limited water resource. Many literatures on integrating economic and environment studies were conducted with regards to water issues in Thailand. They use various type of analysis for example Input-Output Model, and CGE Model. For example, TDRI (2000), included three water sectors, namely fresh, recycle and waste water into the intermediate demand section to estimate the economic value of water in Thailand, using CGE Model. Hubacek and Sun (2005) adopted input-output techniques to conduct a scenario analysis forecasting the water consumption for China's economy in 2025 based on 1992's national data. They matched watershed boundaries with regional input-output boundaries. Guan and Hubacek (2006) extended regional input-output tables by adding coefficients for freshwater consumption and wastewater discharge to account for trade of virtual freshwater and virtual wastewater respectively. In Thailand, the literature on integrating economic and environment is the Extended Environmental Social Account Matrix: ESAM done by NESDB in 1998.

Chulalongkorn (2005) studied water use and water providers of Thailand in year 2005. The total water use was 34,631 MCM and can be categorized into domestic use of 3,567 MCM, industrial use of 2,218 MCM and agriculture use of 28,838 MCM. Water providers consist of MWA distributing water around 1,628 MCM, PWA distributing water around 147.63 MCM, CWA distributing water around 180.79 MCM, and VWA distributing water around 407.21 MCM. There were 10,989 private wells and pumping volume was 1,970 MCM/year. The total water allocation of reservoir was 62,863 MCM/year. The ratio of surface water to groundwater was 66,461 MCM (95%) and 3,272 MCM (5%), respectively.

Chulalongkorn (2005) studied the groundwater potential and demand study for groundwater management in the Northern Part of Lower Central Plain. The water demand was estimated to be 10,982 million cubic meters in year 1999, which was the baseline for this study, and the agriculture use accounted for almost 95 to 98 percentage of the total demand. In the future, the demand will increase to be 12,801 million cubic meters which is more than 17% increase if the economic growth were to be maintained and with no constraints of land and raw water supply. This will be impossible in practice to respond to economical demand. Hence, other measures like economic measures must be also considered in water management planning for the study area.

The study on surface water revealed that during the year 1989 – 1998, water use in the study area was 8,700 million cubic meters per year in average where most of the water was for agricultural sector. Water allocation from surface water source was 6,000 million cubic meters per year on average. In the future due to the demand study, water use amount will increase to 12,801 million cubic meters to support the agricultural use mainly during the dry season. Water allocation from surface water source was 7,100 million cubic meter per year on

average. This shows the increasing trend of water use while raw water source still remain close to the past. This will render the increase of groundwater use as supplement in the agricultural sector in the future.

Koontanakulvong S., et.al (2007) estimated the water use for industries in Bangkok and its vicinity where the main industries are located. It was found that this area had groundwater use as the first order, the second were waterworks supply and surface water, respectively. The ratio of number of groundwater user to water waterworks supply to surface water is 52 : 36 : 12. In year 2003, the groundwater demand was on average 1 million cubic meter per day by the industrial sector. This area has the high potential groundwater and the pumping cost is cheaper than waterworks supply. However the reducing groundwater use and waterworks supply compensation under extension by MWA and PWA in year 2004 will reduce groundwater use to 0.46 million cubic meter per day.

Conceptual Framework

The Thailand Water Account has been constructed based on the Water Account Concept from the United Nations, SEEAW. SEEAW has provided a mechanism to gather data from different sources that are consolidated into one information set. It has integrated water issues according to their sources and agencies plus economic activities such as water usage by households, industries, agriculture, and ecology balance.

The origin of water resources is the rainfall from atmosphere that becomes the water budget. Naturally, the rainfall falls to the terrestrial environment or the earth, and is separated into 2 parts. The first part is flow on the surface as direct runoff and infiltration into soil as recharge to the groundwater; second phase is through the evapotranspiration back to the environment. The first part directly becomes the water budget in the water account which becomes surface water, ground water and others in both natural resources, ponds, and canals and the man-made water resources, reservoirs, ponds, and canals.

In this study, they are categorized into Water Supply 1 or Water Managers, Water Supply 2 or Water Providers and Water Supply 3 or Water Users.

Water Supply 1 or Water Managers consist of RID and EGAT who manage water in the reservoirs, and canals, and their functions are to distribute water to Water Supplier 2 and Water Supplier 3.

Water Supply 2 or Water Providers consist of RID (irrigation Project), DGR, DWR and MWA who receive water from Water Supplier 1 and distribute water to Water Supplier 3 or Water Users for water use proposes including: households, agriculture, industry, and ecology maintain.

Water Supply 3 or Water Users also receive water from Water Supplier 2 and private-extracted water from surface water and groundwater pumping.

The reuse and recycle water are discharged back to the system under the control of water regulators; PCD, IEAT, DIW.

The linkages between the flow and distribution among these water providers will be balanced between the water supply and water use in each water use activity and area. Figure 1 shows the conceptual framework of the water account.

Conceptual Framework of Water Account

In the water account, volumes of water used and supplied by each industry have been balanced to derive 'water consumption'. Figure 2 takes into account the different characteristics of water supply and use of industries and is a way of standardizing water use, allowing for comparisons between industries. The schematic of water account shows the flow of water component such as water managers, water providers and water users. As such, the following accounting identities have been used:

Total water use is equal to the sum of distributed water use, self-extracted water use and reuse water use. Water consumption is equal to the sum of distributed water use, self-extracted water use and reuse water use.

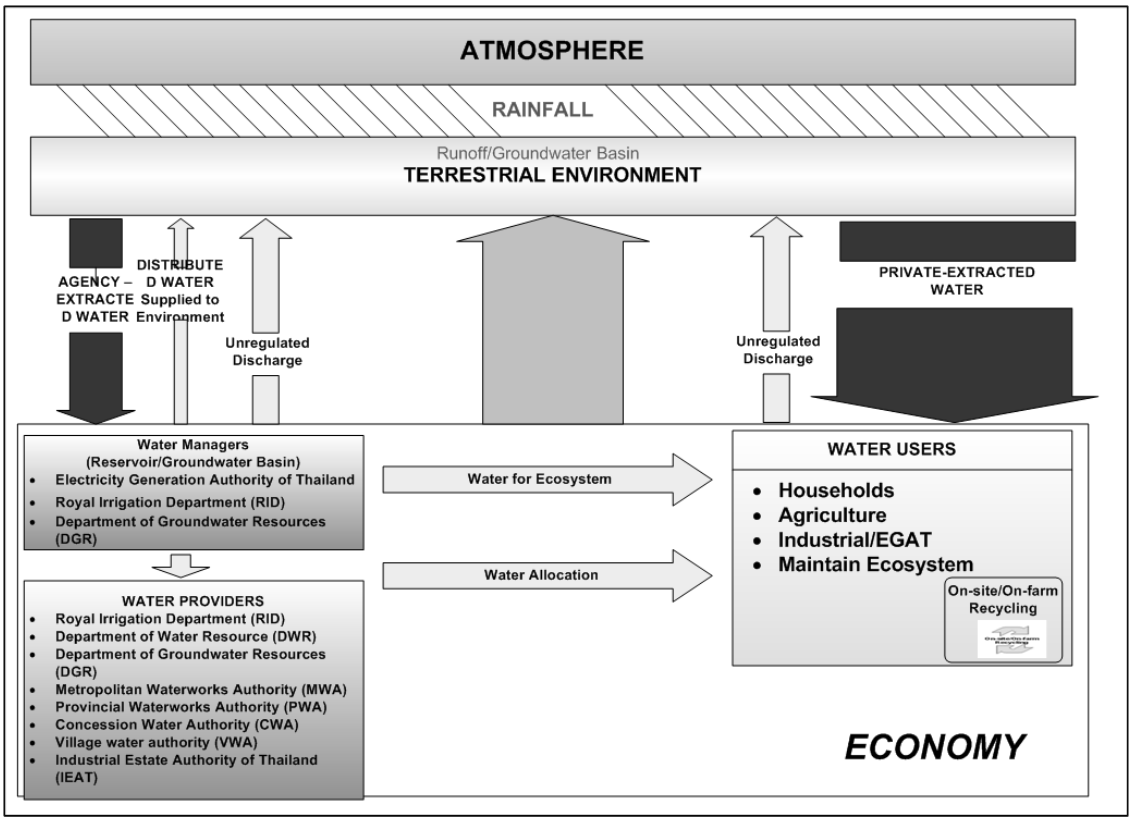


Figure 2 The conceptual framework of the water account

Components of Water Account

The implementation procedures of Thailand Water Account, consists of four main components; namely water resources, water managers, water providers and water users. These components link to various related agencies. These agencies have their own role and responsibility in context of their law and regulation which also under Thai law and regulation.

Water resources

Water resources consist of the natural water resources and man-made water resources which can be separated into surface and ground water. The surface water includes catchment runoff, small ponds and natural water resources. The groundwater is potential water resources or safe yield.

Water Managers (supply 1)

Water managers take responsibility for water management of the large, medium small reservoirs and groundwater basin. The related agencies are Royal Irrigation Department (RID), Electricity Generation Authority of Thailand (EGAT), Department of Water Resources (DWR) and Department of Groundwater Resources (DGR). The function of RID is to provide water from surface water and irrigating water for agricultural, domestic and industrial users. RID also provides raw water to MWA and PWA. EGAT's role is to allocate the water to water providers also. Besides DWR, DGR manages the surface water and groundwater by controlling and supervising the water user.

Water providers (supply 2)

Water providers take responsibility for water allocating to all the users in their respective areas i.e. Metropolitan Waterworks Authority (MWA) who provides water to Bangkok and its vicinities residents and Provincial Waterworks Authority (PWA) who provides water to provincial residents. The water providers provide water to domestic, industrial and agricultural users. The water providers (or water supply 2) include MWA, PWA, CWA, VWA, RID, IEAT and DGR.

Water Users (supply 3)

Water users are domestic, industrial, agricultural, hydropower, tourism, and ecological balance consumers. In addition, they consume water directly from the environment such as rainfall, water from natural resources and ponds.

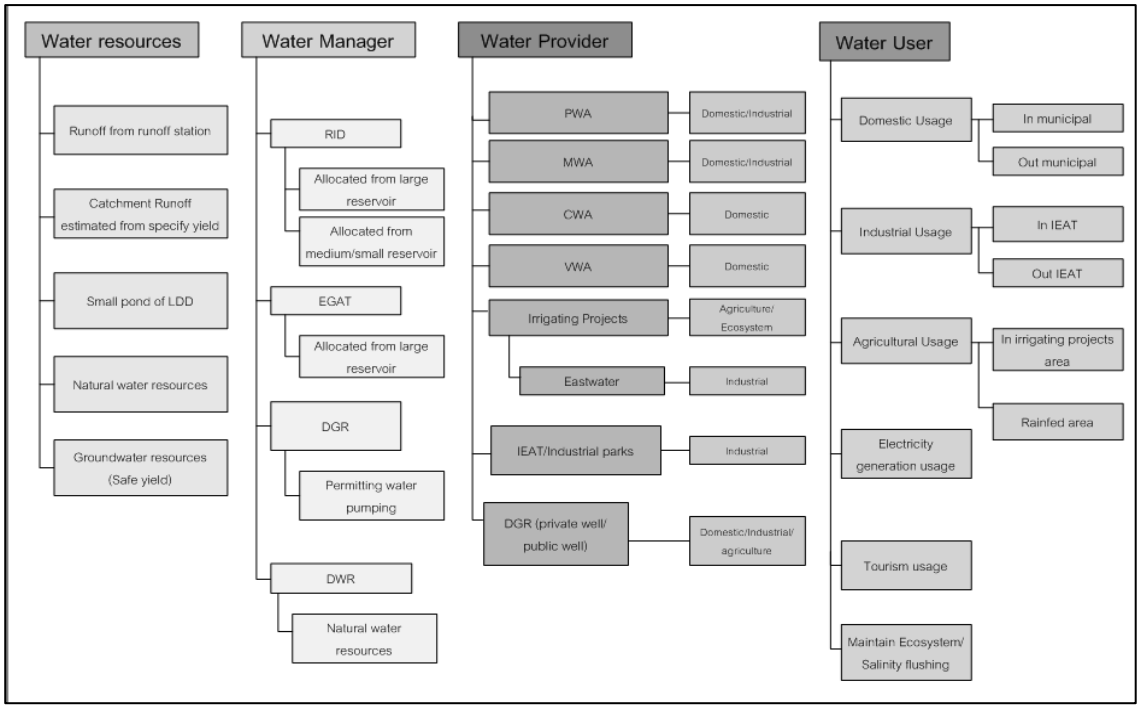


Figure 3 The components of water resources and water agencies

Water accounting procedures

In the implementation of Thailand water account, the balance between water supply and water use was carried out. The water supply was collected from the related agencies that provide water to water user and can be identified to 3 levels. Since water loss occurs and cannot be ignored in the water distribution system, therefore the water loss estimation was considered in each water supplier.

- Water Supply 1 is the water released for irrigated projects from the large, medium and small reservoirs. Those reservoirs are operated by water managers, i.e, EGAT and RID (headworks).
- Water Supply 2 is the water allocated for irrigated projects to water providers e.g. MWA, PWA and RID (irrigation project level).
- Water Supply 3 is the water allocated that farmers receive on farms, or end users

The procedures are as follows:

1) Collect the basic data that are related hydrology, water use and water provider.
2) Analyze water allocation such as water release from reservoirs and potential groundwater resources in main basins of Thailand.
3) Estimate water provided by the agencies in the water manager level (or water supply 1) in each district (amphoe) in the main basins of Thailand.
4) Estimate water provided by the agencies in the water provider level (or water supply 2) in each amphoe in the main basins of Thailand.
5) Estimate water allocation of the agencies in the water provider/self extraction level (or water Supply 3) in each amphoe in the main basins of Thailand.

6) Analyze water use for various proposes in each amphoe in the main basins of Thailand

7) Analyze water balance between water provided, water allocated and water use in each amphoe in the main basins of Thailand

8) Verify the water balance between water provided and water use in each amphoe in the main basins of Thailand

9) Summarize the water balance results in the main basins and group basins of Thailand.

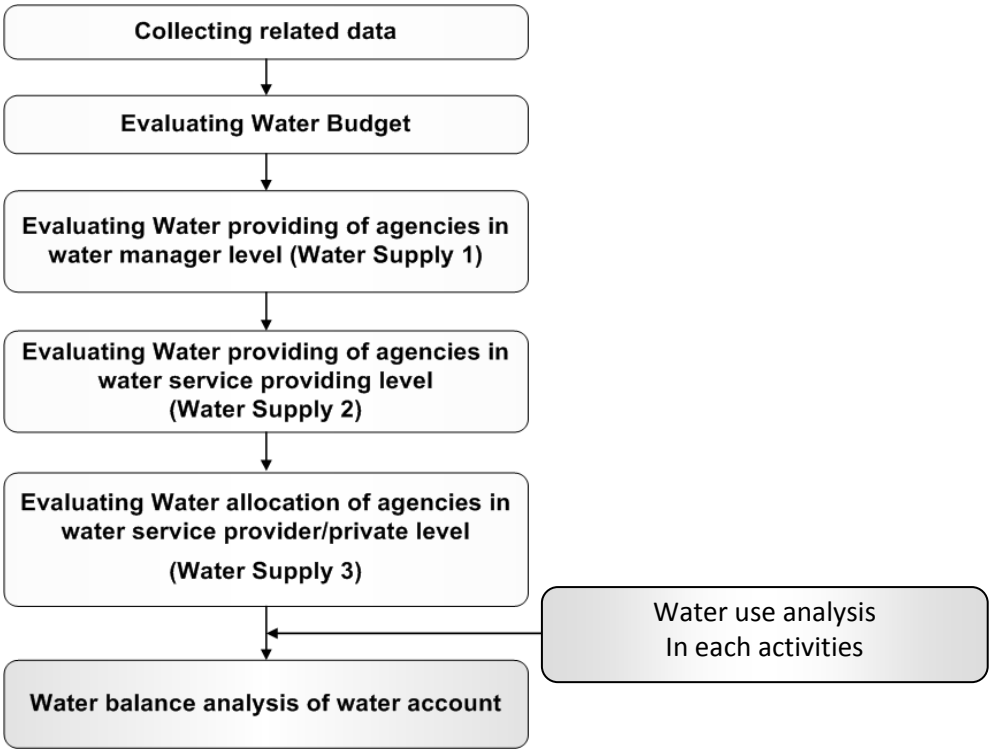


Figure 4 The water account implementation procedure

Water allocation evaluation

- Inflow of large reservoirs (IRES) were collected from RID and EGAT.
- Developing groundwater of groundwater basin was modified from potential of groundwater basin in groundwater resources of Thailand in the year 1999

Water supply 1 estimation

Water supply 1 includes the water release of large, medium and small reservoirs. The water release of large reservoirs (LRES) was from EGAT and RID.

For the water release of medium (MRES) and small reservoirs (SRES), the data are not available..Therefore the water allocation could be calculated from the water storage and

annual evaporation. The assumption is that thewater allocation is equal to full water level of reservoir subtract annual evaporation of each province. So the residual water in reservoir is effective storage. As a result, this study determined the average depth of reservoir at 4 meters and supposed that the catchment area is equal to surface area of reservoir expressed as :

$$Wa = S - \frac{E * A}{1000}$$

Where Wa = Water allocation of reservoir (MCM)

S = Water storage of reservoir (MCM)

E = Annual evaporation (mm/year)

A = Surface area of reservoir or pond, (m^2) A= $\frac{S}{D}$

D = The depth of the reservoir or pond (m) (assuming 4 meters)

Water supply 2 estimation

1) Receiving water of irrigated projects from reservoir

Large , medium and small irrigated projects were evaluated from water release of reservoirs operated by EGAT and RID and the ratio of agriculture water use in irrigated areas.

2) Receiving water of irrigated projects from stream

The receiving water of large, medium and small irrigated projects were estimated from water allocation and multiplied by the factor 1.3. The purpose is to separate water loss and water receiving from irrigated projects .

3) Effective storage of pond

The effective storage of pond was estimated in the same method as medium and small scale reservoirs.

4) Raw Water Pumped by Provincial Waterworks Authority

It was estimated from the water sale data by the Provincial Water Authority (PWA), multiplied by 1.3.

5) Raw Water of Metropolitan Waterworks Authority (MWA)

It was estimated from the water sale data of the Municipal Water Authority (MWA), multiplied by 1.3.

(Note: It is assumed that the water loss is around 30% according to the data of PWA. This is to separate the water volume in an irrigation project or water user ending points from water loss.)

Water Supply 3 estimation

Water Supplier 3 is the distributing water from the water providers to end users according to their water use activities.

1) Water sale of PWA for domestic, commercial, and industrial uses

The data was collected from the water sale database of PWA.

2) Water sale of MWA for domestic, commercial, and industrial uses

The data was collected from the water sale database of MWA.

3) Raw water pumped by concession pipe water office

The data was collected from the water pumping database of concession pipe water office.

4) Ground water pumped by village pipe water office

The data was collected and analyzed from the village basic data Community Development Department, 2007 and the survey results on the potential groundwater demand in northern area of the lower part of central Thailand (Chulalongkorn, 2002) that the study of water producing of water work system results as follows :

Type of water works system	Small	Medium	Large
Number of household (households)	< 50	50 - 120	> 120
Producing capacity (cu.m./hour)	5	10	20
Average producing rate per month (cu.m./month)	320	570	1070

source : Chulalongkorn, 2002

5) Ground water pumping by the Government agencies for Domestic Use

It was estimated by multiplying the permitted pumping volume (p) by the pumping hour (8), and the coefficient of pumping (0.60) as shown below

$$W = p^* 8 *0.60$$

6) Ground water pumping by Private Offices for Domestic, Business, and Agriculture Consumption.

It was estimated by multiplying the permitted pumping volume (p) by the pumping hour (8), and the coefficient of pumping (0.60) as shown below

$$W = p^* 8 *0.60$$

7) Water allocation by Industrial Estates

They were estimated from their water production capacities.

8) Water allocation to the irrigating projects

They were estimated from the agricultural water usage at the paddy field.

9) Water allocation to the pumping projects (in paddy fields)

They were estimated from the agriculture water use of pumping projects, assuming that pumping water from stream is equal to water use of pumping projects.

10) Water allocation to agricultural area by ponds

They were estimated from the effective storage of each pond divided by 1.3.

Water Use Estimation

Domestic water use

1. Collect the related data from the Department of Provincial Administration such as number of population in Tambon inside municipal and outside municipal in year 2005 – 2007 and water use rate inside municipal and outside municipal. Water use rate in municipal was estimated from water sale of PWA , number of water user, number of population and households in municipal. The water use rate in municipal can be estimated from :

$$R_i = \frac{W_s}{N_c * N_p * 1000 * 365}$$

R_i = water use rate in urban or rural area (liter/day/person)

W_s = water sale (cb.m./year)

N_c = number of households

N_p = number of people per households

For water use rate out municipal was determined to be 50 liter/person/day

2. Summarize number of population in and out municipal of each Tambon, Amphoe and Changwat.
3. Calculate water use in each Tambon in year 2005 -2007 by using number of population multiply with water use rate in and out of municipal area in year 2005 -2007
4. Summarize water use in and out municipal in year 2005 -2007

Industrial water use

1. Collect related data such as number of worker and water use rate of 107 industrial types. The unit of water use for each industrial type is in unit of cu.m./ horse power/day (Koontanakulvong S., 2007).
2. Summarize horse power and water use rate in 107 industrial types.

3. Calculate water use in year 2005 -2007 in each Tambon by using horse power in each types multiply with water use rate of each industrial type.
4. Summarize water use in year 2005 – 2007 in each Tambon, Amphoe in each basins.

Agricultural water use

1. Collect annual cultivated area in irrigating projects and rain fed. The irrigated areas were collected from large, medium, small and pumping irrigating projects from RID records. The rain fed areas were collected from the cultivated areas from OAE, cropping calendar, climate data, rainfall, cropping water demand coefficient and evaporation.
2. Summarize the annual economic cultivated areas in irrigated areas in large, medium, small and pumping projects in each province in year 2005 – 2007 such as major rice crop, second rice crop, sugarcane, maize and cassava.
3. Estimate crop water demand by using effective rainfall, infiltration in paddy field, crop water demand coefficient and evapotranspiration as follows :

$$ET = K_c \times E_{TP}$$
$$W_{tr} = ET + P - R_e$$

where WDcrop is water demand for Crop
ETcrop is Crop Evapotranspiration (mm./day/rais
RE is Effective Rainfall (mm/month)
Acrop is crop area
Kc is Crop Coefficient
ETp is Reference crop evaportranspiration

4. Analyze agricultural water use by using cultivated areas in each Tambon multiply with water demand after subtracting effective rainfall.
5. Summarize agriculture water use in irrigating projects and rainfed in year 2005 – 2007 in each Tambon, Amphoe in each basin.

Water Balance Analysis

The steps in the water balance analysis are adjusted as follows:

1. Adjusting the water use in various activities to be equal to the water distributed to water supply 3. The water balance was based on the following assumptions:

- Domestic water use inside municipal must not be more than water sale in the household sector of PWA, MWA and water producing of CWA. If it is more than water sale, the water use would be adjusted to equal to water sale or water producing. On the other hand, if water use is less than water sale, the water use would be increased to equal to water sale or water producing.
- Domestic water use outside municipal must be water provided from public wells, private wells for domestic and village water works. If water use is more than water providing, the water use would be adjusted to be equal to water providing. On the other hand, if water use is less then water providing, the water use would be increased to equal to water providing.
- Industrial water use in the industrial estate is equal to water allocation of the industrial estate. The water use is adjusted to equal to water allocation of the industrial estate.
- Industrial water use outside industrial estate must not exceed water sale in the business sector of PWA and MWA. If water use is more than water sale, the water use would be adjusted to equal to water sale. On the other hand, if water use is less than water sale, the water use would be increased to equal to water sale.
- Agricultural water use in irrigated projects is determined from water allocation at the paddy field of large, medium, small and pumping projects.
- Agricultural water use in rainfed area cannot be more than water provided from agricultural well, ponds and runoff of stream (set to be 10% that is not exceed runoff at the index station for sustainable reason).

2. Adjusting the distributed water at Water Supply 3 to equal to the allocated water at Water Supply 2
   - The water allocation at paddy field cannot exceed the receiving water of irrigated projects (Water supply 2). If water allocation at paddy field is more than receiving water of irrigation projects, the water allocation must be adjusted to equal to receiving water divided by 1.3 (30% efficiency) then adjusted the water allocation at the first step again. Then the water loss in the water allocation at paddy field (Loss2) can be calculated from the receiving water of irrigated projects (water supply 2) subtracting the water allocation at paddy field (water supply 3).
   - The water allocation of pumping projects is assumed no loss. So the water allocation is equal to the agricultural water use of projects.
   - The water loss of water supply works is estimated from the water pumping of PWA and MWA subtracting water sale.

- The water loss of water use from pond is estimated from the effective water storage of pond subtracting water allocation of pond.

3. Readjusting the water supply received by an irrigation project from Water Supply 2. Receiving water of irrigation projects (water supply 2) must not exceed the water release from reservoir (water supply 1). If the water receiving is more than water release, the water receiving would be adjusted to equal to water release divided by 1.3. In case that the water receiving is less than water release, the water receiving would be adjusted to equal to water release divided by 1.3. The water loss of projects can be calculated from water release of reservoir (water supply 1) subtracting water receiving (water supply 2).

4. The water use in rain fed areas is verified by comparing with stream runoff at the index runoff station and is set to be not exceeding 10% of low flow runoff for sustainable reason.

The water providing agencies of the government, state enterprises and private companies provide both surface water and groundwater as follows:

1) Water budget is the sum of inflow to reservoir and developing groundwater of groundwater basins
2) Water from raw water resources (or water supply 1) is the water release from large, medium and small reservoirs that are operated by EGAT and RID.
3) Water from raw water resources to projects (or water supply 2) is estimated from the water receiving of irrigated projects from reservoir and stream, effective storage of ponds and water pumping of PWA and MWA.
4) Water from project to water user (or water supply 3) is estimated from water sale of PWA and MWA, water pumping of CWA, water pumping of village water works supply, water pumping of public well, water allocation of IEAT, water allocation of large, medium, small and pumping projects and water allocation of ponds.

Water Budget

1) Inflows of large reservoirs were collected from related agencies e.g. RID and EGAT. In the year 2005, 2006 and 2007, the total annual inflow was 39,141 MCM/year, 51,341 MCM/year and 41,489 MCM/year, respectively. Table 6 shows the inflow of reservoirs in the main group basins of Thailand.

Table 6 Summary of inflow of reservoir in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	5,450	669	6,119	7,234	662	7,896	7,124	808	7,932
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	14,144	3,147	17,291	18,717	2,803	21,520	13,292	2,700	15,992
4. Mae Khlong basin group	9,083	1,096	10,178	13,066	1,145	14,211	10,084	1,242	11,326
5. Bang Prakong basin group	-	-	-	-	-	-	-	-	-
6. Eastern coast basin group	190	125	315	274	79	352	301	93	394
7. Western coast basin group	1,082	215	1,297	2,314	212	2,526	1,128	298	1,426
8. Eastern south basin group	3,379	562	3,941	3,433	1,404	4,836	2,718	1,701	4,419
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**33,327**	**5,814**	**39,141**	**45,037**	**6,304**	**51,341**	**34,648**	**6,841**	**41,489**

2) Developing groundwater of groundwater basins was modified from the study of potential of groundwater basin from groundwater resources in Thailand report (DGR, 1999). The results showed that the total developing groundwater resources were 27,376 MCM/year with the assumption that the groundwater development amount was at a constant rate throughout the year. The groundwater development amount in each group basin was summarizs in Table 7.

Table 7 Summary of developing groundwater development amount of groundwater basins

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953	9,953
2. Salawin basin group	782	782	782	782	782	782	782	782	782
3. Chao Phraya-Tachin basin group	7,097	7,097	7,097	7,097	7,097	7,097	7,097	7,097	7,097
4. Mae Khlong basin group	1,720	1,720	1,720	1,720	1,720	1,720	1,720	1,720	1,720
5. Bang Prakong basin group	1,782	1,782	1,782	1,782	1,782	1,782	1,782	1,782	1,782
6. Eastern coast basin group	1,431	1,431	1,431	1,431	1,431	1,431	1,431	1,431	1,431
7. Western coast basin group	1,089	1,089	1,089	1,089	1,089	1,089	1,089	1,089	1,089
8. Eastern south basin group	2,132	2,132	2,132	2,132	2,132	2,132	2,132	2,132	2,132
9. Western sough basin group	1,389	1,389	1,389	1,389	1,389	1,389	1,389	1,389	1,389
Total	**27,376**	**27,376**	**27,376**	**27,376**	**27,376**	**27,376**	**27,376**	**27,376**	**27,376**

Remark : 1/ modified from groundwater resources in Thailand report, 1999

Water Supply 1

1) Water releases of large reservoirs were collected from related agencies e.g. RID and EGAT. In the year 2005, 2006 and 2007, the total amount of release was 28,756 MCM/year, 42,852 MCM/year and 41,372 MCM/year respectively. In the year 2005, Thailand faced drought problems, while in year 2006 and 2007, Thailand faced with flood problems and normal water status respectively . In addition, the water release depends on the water demand. Chaopraya river basin has the highest irrigated water use. Table 8 summarizes the water release of large reservoirs.

2) Water release from medium and small reservoirs was estimated from water storage and evaporation. The results showed that the total water release of medium reservoirs in year 2005, 2006 and 2007 was 2,967.95MCM/year 2,964.94 MCM/year and 2,948.46 MCM/year. The total water release of small reservoirs in year 2005, 2006 and 2007 was 855.03 MCM/year, 856.25 MCM/year and 850.10 MCM/year. Table 9 to 10 summarizes water release from medium and small reservoirs.

Table 8 Water release of large reservoir

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	2,490	1,796	4,286	3,367	2,140	5,507	4,431	2,959	7,390
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	5,281	8,046	13,328	7,892	9,613	17,505	7,392	10,825	18,217
4. Mae Khlong basin group	2,715	4,655	7,370	6,804	4,927	11,731	5,234	5,009	10,242
5. Bang Prakong basin group	-	-	-	-	-	-	-	-	-
6. Eastern coast basin group	195	126	322	185	107	292	203	152	355
7. Western coast basin group	437	312	749	1,997	593	2,590	709	567	1,276
8. Eastern south basin group	1,726	977	2,703	2,938	2,289	5,227	2,288	1,603	3,891
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**12,844**	**15,912**	**28,756**	**23,182**	**19,670**	**42,852**	**20,257**	**21,115**	**41,372**

Remark 1/not included Map Prachan, Ratchaprapa, Nong Kor, Kiritarn and Thatungna due to insufficient data

Table 9 Water release of medium reservoir in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	1,553.62	330.33	1,883.95	1,569.02	310.10	1,879.11	1,673.98	192.67	1,866.65
2. Salawin basin group	3.01	4.75	7.76	2.17	5.75	7.92	2.14	5.70	7.84
3. Chao Phraya-Tachin basin group	288.10	247.24	535.34	233.47	301.32	534.80	254.46	278.91	533.37
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	79.96	31.36	111.32	73.39	36.84	110.23	67.11	45.44	112.55
6. Eastern coast basin group	168.73	78.34	247.07	82.14	165.41	247.55	80.91	161.10	242.02
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	133.26	26.03	159.29	108.11	54.27	162.38	105.54	57.41	162.94
9. Western sough basin group	22.73	0.50	23.23	22.39	0.56	22.95	22.51	0.57	23.08
Total	**2,249.40**	**718.55**	**2,967.95**	**2,090.69**	**874.25**	**2,964.94**	**2,206.66**	**741.80**	**2,948.46**

Table 10 Water release of small reservoir in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	558.62	558.62	-	557.43	557.43	-	554.58	554.58
2. Salawin basin group	-	5.04	5.04	-	4.95	4.95	-	5.00	5.00
3. Chao Phraya-Tachin basin group	-	149.59	149.59	-	150.20	150.20	-	149.30	149.30
4. Mae Khlong basin group	-	16.77	16.77	-	16.95	16.95	-	16.78	16.78
5. Bang Prakong basin group	-	15.40	15.40	-	15.25	15.25	-	15.51	15.51
6. Eastern coast basin group	-	15.13	15.13	-	15.11	15.11	-	14.62	14.62
7. Western coast basin group	-	36.63	36.63	-	36.82	36.82	-	35.47	35.47
8. Eastern south basin group	1.50	49.73	51.23	2.06	50.55	52.61	1.62	50.03	51.65
9. Western sough basin group	-	6.62	6.62	-	6.92	6.92	-	7.20	7.20
Total	**1.50**	**853.53**	**855.03**	**2.06**	**854.20**	**856.25**	**1.62**	**848.48**	**850.10**

Water supply 2

1) Water receiving of irrigated projects from reservoirs

The water receiving of large, medium and small irrigated projects was estimated from water release of EGAT and RID and the ratio of water use in irrigated projects. Table 11-13 summarizes water receiving of large, medium and small irrigated projects from reservoirs.

Table 11 Summary of water receiving of large projects from medium reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	1,992.0	1,436.7	3,428.6	2,693.3	1,712.1	4,405.4	3,544.7	2,367.0	5,911.6
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	5,558.9	4,893.7	10,452.6	7,957.5	4,829.7	12,787.1	7,622.5	5,603.0	13,225.5
4. Mae Khlong basin group	2,481.9	3,881.0	6,362.9	5,809.9	4,142.2	9,952.1	4,462.7	4,223.5	8,686.2
5. Bang Prakong basin group	124.3	84.5	208.8	155.9	71.1	227.1	151.7	98.8	250.4
6. Eastern coast basin group	160.5	101.1	261.6	152.6	85.6	238.2	168.7	121.3	290.0
7. Western coast basin group	294.9	206.4	501.3	1,387.8	386.5	1,774.2	472.8	361.8	834.6
8. Eastern south basin group	651.5	436.1	1,087.6	1,008.5	816.6	1,825.1	569.3	574.5	1,143.8
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**11,264.0**	**11,039.4**	**22,303.4**	**19,165.4**	**12,043.8**	**31,209.2**	**16,992.3**	**13,349.9**	**30,342.2**

Table 12 Summary of water receiving of medium projects from medium reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	959.47	144.70	1,104.17	955.78	144.56	1,100.34	963.59	125.58	1,089.17
2. Salawin basin group	2.87	4.53	7.41	2.07	5.50	7.57	2.05	5.44	7.48
3. Chao Phraya-Tachin basin group	94.64	61.75	156.39	88.40	68.88	157.28	91.27	64.72	155.99
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	46.65	18.30	64.95	43.19	21.68	64.87	39.47	26.72	66.19
6. Eastern coast basin group	10.23	4.63	14.86	5.03	9.79	14.82	4.85	9.31	14.16
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	47.53	9.28	56.82	38.82	19.49	58.31	38.04	20.69	58.73
9. Western sough basin group	14.05	0.16	14.21	13.77	0.16	13.92	13.67	0.16	13.83
Total	**1,175.46**	**243.34**	**1,418.80**	**1,147.05**	**270.05**	**1,417.11**	**1,152.93**	**252.63**	**1,405.55**

Table 13 Summary of water receiving of small projects from small reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	552.49	552.49	-	551.43	551.43	-	548.56	548.56
2. Salawin basin group	-	5.04	5.04	-	4.95	4.95	-	5.00	5.00
3. Chao Phraya-Tachin basin group	-	149.57	149.57	-	150.19	150.19	-	149.28	149.28
4. Mae Khlong basin group	-	16.77	16.77	-	16.95	16.95	-	16.78	16.78
5. Bang Prakong basin group	-	15.40	15.40	-	15.25	15.25	-	15.51	15.51
6. Eastern coast basin group	-	15.13	15.13	-	15.11	15.11	-	14.62	14.62
7. Western coast basin group	-	36.35	36.35	-	36.54	36.54	-	35.20	35.20
8. Eastern south basin group	1.13	50.10	51.23	1.32	51.29	52.61	1.13	50.52	51.65
9. Western sough basin group	-	6.62	6.62	-	6.92	6.92	-	7.20	7.20
Total	**1.13**	**847.46**	**848.59**	**1.32**	**848.64**	**849.96**	**1.13**	**842.66**	**843.80**

2) Water receiving of irrigated projects from stream

The water receiving of large, medium and small irrigated projects was estimated from water use of the projects multiply by 1.3. Table 14-16 summarizes water receiving of large, medium and small irrigated projects from stream.

Table 14 Summary of water receiving of large irrigated projects from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	113.77	108.69	222.46	108.82	127.17	235.99	92.37	72.52	164.90
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	75.91	154.32	230.23	77.67	139.40	217.07	46.61	100.64	147.25
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	184.92	275.28	460.19	211.50	273.24	484.73	157.33	125.91	283.24
6. Eastern coast basin group	2.78	5.50	8.27	2.53	5.48	8.00	3.93	3.83	7.76
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	234.41	55.48	289.88	177.23	151.20	328.43	123.50	57.24	180.73
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**611.78**	**599.25**	**1,211.04**	**577.75**	**696.47**	**1,274.22**	**423.73**	**360.14**	**783.88**

Table 15 Summary of water receiving of medium irrigated projects from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	21.27	181.30	202.57	24.50	232.45	256.95	22.32	229.94	252.26
2. Salawin basin group	0.51	9.31	9.82	0.30	9.45	9.75	0.47	11.04	11.51
3. Chao Phraya-Tachin basin group	72.65	561.18	633.83	74.27	548.93	623.19	64.81	715.26	780.06
4. Mae Khlong basin group	8.20	11.87	20.07	7.92	10.78	18.70	5.23	10.99	16.22
5. Bang Prakong basin group	854.85	516.31	1,371.16	916.78	378.68	1,295.46	835.12	316.71	1,151.82
6. Eastern coast basin group	319.50	117.99	437.48	377.41	93.74	471.15	353.61	75.54	429.15
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	53.36	78.90	132.27	59.52	85.55	145.07	81.55	104.26	185.81
9. Western sough basin group	0.44	1.60	2.04	0.40	1.26	1.66	0.46	1.35	1.81
Total	**1,330.78**	**1,478.46**	**2,809.24**	**1,461.10**	**1,360.83**	**2,821.93**	**1,363.56**	**1,465.09**	**2,828.64**

Table 16 Summary of water receiving of small irrigated projects from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	6.29	6.29	-	6.09	6.09	-	6.01	6.01
2. Salawin basin group	-	2.16	2.16	-	1.99	1.99	-	2.13	2.13
3. Chao Phraya-Tachin basin group	-	106.24	106.24	-	109.77	109.77	-	108.82	108.82
4. Mae Khlong basin group	-	0.25	0.25	-	0.25	0.25	-	0.25	0.25
5. Bang Prakong basin group	-	7.00	7.00	-	7.47	7.47	-	7.82	7.82
6. Eastern coast basin group	-	1.36	1.36	-	1.40	1.40	-	1.39	1.39
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	14.09	27.82	41.91	9.35	22.08	31.43	8.96	24.32	33.28
9. Western sough basin group	0.45	12.63	13.08	0.26	10.59	10.85	0.29	11.31	11.60
Total	**14.54**	**163.75**	**178.29**	**9.61**	**159.65**	**169.25**	**9.25**	**162.06**	**171.31**

3) Effective storage of pond was estimated with the same methodology as water release from medium and small reservoirs. The results showed that the total effective storage of ponds in year 2005, 2006 and 2007 was about 169.30 MCM/year, 169.30 MCM/year and 177.45 MCM/year. Table 17 summarizes the effective storage of ponds.

Table 17 Summary of the effective storage of ponds.

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	83.07	18.55	101.62	83.56	18.06	101.62	85.06	20.01	105.07
2. Salawin basin group	0.30	0.00	0.30	0.30	0.00	0.30	0.30	0.00	0.30
3. Chao Phraya-Tachin basin group	31.90	20.24	52.15	28.87	23.28	52.15	31.61	23.92	55.52
4. Mae Khlong basin group	0.51	0.57	1.07	0.48	0.59	1.07	0.47	0.63	1.10
5. Bang Prakong basin group	2.24	0.91	3.15	2.11	1.03	3.15	2.25	1.12	3.37
6. Eastern coast basin group	2.95	0.78	3.74	2.83	0.91	3.74	3.06	1.31	4.37
7. Western coast basin group	0.62	0.23	0.85	0.56	0.29	0.85	0.70	0.31	1.01
8. Eastern south basin group	4.64	0.21	4.86	4.58	0.28	4.86	4.70	0.38	5.08
9. Western sough basin group	1.57	0.00	1.57	1.57	0.00	1.57	1.63	0.00	1.63
Total	**127.81**	**41.49**	**169.30**	**124.85**	**44.45**	**169.30**	**129.77**	**47.68**	**177.45**

4) Raw water pumping of PWA was estimated from water sale of PWA multiply by 1.3. That water sale is the water use in the various activities. The results showed that the total raw water pumping in year 2005, 2006 and 2007 was about 778.58 MCM/year, 827.56 MCM/year and 874.76 MCM/year. Table 18 summarizes raw water pumping of PWA.

Table 18 Summary raw water pumping of PWA

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	133.76	131.29	265.05	133.77	131.63	265.40	141.52	138.54	280.06
2. Salawin basin group	4.17	4.32	8.49	4.70	4.69	9.38	4.91	4.66	9.57
3. Chao Phraya-Tachin basin group	94.32	89.98	184.30	105.74	99.51	205.26	114.25	111.15	225.40
4. Mae Khlong basin group	3.08	2.99	6.07	2.72	2.27	4.99	1.25	1.09	2.34
5. Bang Prakong basin group	11.79	11.42	23.22	12.18	12.56	24.74	16.54	12.43	28.97
6. Eastern coast basin group	65.58	68.16	133.74	68.68	66.51	135.20	82.64	66.98	149.61
7. Western coast basin group	5.00	4.33	9.33	10.57	7.00	17.56	6.10	5.76	11.86
8. Eastern south basin group	73.99	30.74	104.74	63.53	54.73	118.26	58.56	59.29	117.85
9. Western sough basin group	23.04	20.61	43.64	23.23	23.53	46.76	24.60	24.49	49.09
Total	**414.74**	**363.84**	**778.58**	**425.12**	**402.43**	**827.56**	**450.36**	**424.40**	**874.76**

5) Raw water pumping of MWA was estimated from the water sale of MWA (multiply by 1.3). The water sale is the water use in various activities. The results showed that the total raw water pumping in year 2005, 2006 and 2007 was about 1,449.89 MCM/year, 1,494.09 MCM/year and 1,578.72 MCM/year. Table 19 summarizes raw water pumping of MWA.

Table 19 Summary of raw water pumping of MWA

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
Chao Phraya-Tachin basin group	724.95	724.95	1,449.89	747.05	747.05	1,494.09	789.36	789.36	1,578.72
Total	**724.95**	**724.95**	**1,449.89**	**747.05**	**747.05**	**1,494.09**	**789.36**	**789.36**	**1,578.72**

Water supply 3

1) Water sale of PWA in domestic, business and industrial sectors was collected from water sale in each type of PWA. Table 20 summarizes water sale of PWA in domestic, business and industrial sectors.

Table 20 Summary of water sale of PWA in domestic, business and industrial

a) Domestic

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	43.20	41.85	85.05	44.98	44.58	89.56	48.13	46.64	94.77
2. Salawin basin group	1.26	1.25	2.51	1.30	1.31	2.61	1.40	1.36	2.76
3. Chao Phraya-Tachin basin group	57.13	54.14	111.27	64.32	63.31	127.62	70.31	67.79	138.10
4. Mae Khlong basin group	3.38	3.20	6.58	2.51	2.31	4.82	2.99	2.96	5.95
5. Bang Prakong basin group	4.14	3.98	8.12	4.38	4.37	8.75	4.96	4.90	9.85
6. Eastern coast basin group	18.25	17.59	35.84	19.48	19.07	38.55	21.62	21.31	42.93
7. Western coast basin group	5.31	4.91	10.22	3.11	3.04	6.16	3.31	3.83	7.14
8. Eastern south basin group	22.41	9.20	31.62	16.92	16.06	32.98	18.15	17.37	35.52
9. Western sough basin group	8.53	7.02	15.56	8.62	8.37	17.00	9.53	9.41	18.95
Total	**163.62**	**143.15**	**306.77**	**165.62**	**162.42**	**328.04**	**180.41**	**175.57**	**355.98**

b) Business

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	27.70	26.32	54.02	29.38	28.16	57.55	31.13	29.92	61.05
2. Salawin basin group	1.00	0.98	1.98	1.08	1.03	2.10	1.16	1.10	2.26
3. Chao Phraya-Tachin basin group	39.05	36.88	75.93	43.16	41.80	84.96	46.81	44.78	91.59
4. Mae Khlong basin group	1.56	1.53	3.09	1.24	1.15	2.38	1.47	1.45	2.92
5. Bang Prakong basin group	3.24	3.01	6.25	3.39	3.34	6.72	3.88	3.78	7.65
6. Eastern coast basin group	16.28	15.44	31.72	16.59	16.24	32.83	18.16	17.68	35.84
7. Western coast basin group	2.88	2.65	5.54	1.60	1.53	3.13	1.54	1.78	3.32
8. Eastern south basin group	17.91	7.03	24.95	12.84	12.20	25.04	13.93	13.11	27.04
9. Western sough basin group	5.01	4.55	9.56	4.75	4.69	9.43	5.16	5.18	10.34
Total	**114.63**	**98.39**	**213.03**	**114.02**	**110.12**	**224.14**	**123.22**	**118.78**	**242.00**

Table 20 Summary of water sale of PWA in domestic, business and industrial (con't)

c) Industrial

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	15.19	14.30	29.48	16.42	15.77	32.19	17.43	16.54	33.97
2. Salawin basin group	0.49	0.46	0.95	0.53	0.51	1.04	0.56	0.52	1.08
3. Chao Phraya-Tachin basin group	37.91	36.30	74.20	48.21	46.06	94.27	49.28	49.52	98.79
4. Mae Khlong basin group	0.86	0.85	1.72	0.59	0.57	1.15	0.89	0.81	1.70
5. Bang Prakong basin group	1.40	1.29	2.69	1.49	1.47	2.96	1.72	1.71	3.43
6. Eastern coast basin group	15.14	15.40	30.54	16.27	15.94	32.20	18.19	18.66	36.85
7. Western coast basin group	1.95	1.76	3.71	1.28	1.21	2.50	1.21	1.28	2.49
8. Eastern south basin group	9.61	4.11	13.72	7.19	6.61	13.80	8.06	7.51	15.57
9. Western sough basin group	4.28	4.21	8.49	4.47	4.66	9.13	5.12	5.60	10.72
Total	**86.82**	**78.68**	**165.50**	**96.45**	**92.80**	**189.25**	**102.46**	**102.14**	**204.59**

d) Total

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	86.09	82.47	168.56	90.78	88.51	179.29	96.69	93.10	189.79
2. Salawin basin group	2.75	2.70	5.44	2.91	2.84	5.75	3.12	2.98	6.10
3. Chao Phraya-Tachin basin group	134.09	127.31	261.40	155.69	151.17	306.86	166.39	162.10	328.49
4. Mae Khlong basin group	5.80	5.58	11.39	4.34	4.02	8.36	5.35	5.22	10.57
5. Bang Prakong basin group	8.77	8.28	17.05	9.27	9.17	18.44	10.56	10.38	20.94
6. Eastern coast basin group	49.67	48.43	98.11	52.34	51.24	103.58	57.96	57.65	115.61
7. Western coast basin group	10.14	9.33	19.46	5.99	5.79	11.79	6.06	6.89	12.94
8. Eastern south basin group	49.93	20.35	70.28	36.94	34.87	71.82	40.14	37.99	78.13
9. Western sough basin group	17.83	15.78	33.61	17.84	17.72	35.56	19.81	20.18	40.00
Total	**365.07**	**320.23**	**685.30**	**376.09**	**365.34**	**741.43**	**406.08**	**396.49**	**802.57**

Remark : 1/ summary from water sale of PWA in year 2005, 2006 and 2007

2) Water sale of MWA in domestic and industrial sectors was collected water sale in each type of MWA. Table 21 summarizes water sale of MWA in domestic and industrial sectors.

Table 21 Summary of water sale of MWA in domestic and industrial

a) Domestic

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
Chao Phraya-Tachin basin group	258.25	258.25	516.50	258.20	258.20	516.40	280.70	280.70	561.40
Total	**258.25**	**258.25**	**516.50**	**258.20**	**258.20**	**516.40**	**280.70**	**280.70**	**561.40**

b) Industrial

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
Chao Phraya-Tachin basin group	299.40	299.40	598.80	316.45	316.45	632.90	326.50	326.50	653.00
Total	**299.40**	**299.40**	**598.80**	**316.45**	**316.45**	**632.90**	**326.50**	**326.50**	**653.00**

c) Total

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
Chao Phraya-Tachin basin group	557.65	557.65	1,115.30	574.65	574.65	1,149.30	607.20	607.20	1,214.40
Total	**557.65**	**557.65**	**1,115.30**	**574.65**	**574.65**	**1,149.30**	**607.20**	**607.20**	**1,214.40**

Remark : 1/ summary from water sale of MWA in year 2005, 2006 and 2007

3) Raw water pumping of CWA was collected from water producing of concession water works supply. The results showed that the total raw water pumping of concession water works was about 326.27 MCM/year. Table 22 summarizes raw water pumping of concession water works.

Table 22 Summary of raw water pumping of concession water works

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	25.16	25.16	50.32	25.16	25.16	50.32	25.16	25.16	50.32
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	106.06	106.06	212.11	106.06	106.06	212.11	106.06	106.06	212.11
4. Mae Khlong basin group	11.89	11.89	23.79	11.89	11.89	23.79	11.89	11.89	23.79
5. Bang Prakong basin group	1.89	1.89	3.79	1.89	1.89	3.79	1.89	1.89	3.79
6. Eastern coast basin group	3.21	3.21	6.43	3.21	3.21	6.43	3.21	3.21	6.43
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	13.77	2.75	16.53	8.26	8.26	16.53	8.26	8.26	16.53
9. Western sough basin group	6.65	6.65	13.30	6.65	6.65	13.30	6.65	6.65	13.30
Total	**168.64**	**157.63**	**326.27**	**163.13**	**163.13**	**326.27**	**163.13**	**163.13**	**326.27**

4) Groundwater pumping of village water works was collected and analyzed from village water works from Community Development Department database in year 2007and the survey on the potential groundwater demand in northern area of the lower part of central Thailand (Koontanakulwong S., et.al., 2002) The results showed that groundwater pumping of village water works was about 458.72 MCM/year. Table 23 summarizes groundwater pumping of village water works.

Table 23 Summary of groundwater pumping of village water works

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	109.85	109.85	219.70	109.85	109.85	219.70	109.85	109.85	219.70
2. Salawin basin group	2.28	2.28	4.56	2.28	2.28	4.56	2.28	2.28	4.56
3. Chao Phraya-Tachin basin group	73.71	73.71	147.43	73.71	73.71	147.43	73.71	73.71	147.43
4. Mae Khlong basin group	6.16	6.16	12.32	6.16	6.16	12.32	6.16	6.16	12.32
5. Bang Prakong basin group	7.19	7.19	14.38	7.19	7.19	14.38	7.19	7.19	14.38
6. Eastern coast basin group	3.13	3.13	6.27	3.13	3.13	6.27	3.13	3.13	6.27
7. Western coast basin group	3.59	3.59	7.18	3.59	3.59	7.18	3.59	3.59	7.18
8. Eastern south basin group	25.44	7.92	33.36	16.68	16.68	33.36	16.68	16.68	33.36
9. Western sough basin group	7.16	6.37	13.53	6.76	6.76	13.53	6.76	6.76	13.53
Total	**238.51**	**220.20**	**458.72**	**229.36**	**229.36**	**458.72**	**229.36**	**229.36**	**458.72**

5) Groundwater pumping of public wells for domestic use was estimated by the permitted pumping multiply by the number of pumping hours (8 hours) tand the pumping coefficient (0.60) Table 24 summarizes groundwater pumping of public wells for domestic use in each group basin.

Table 24 Summary of groundwater pumping of public wells for domestic use in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	133.73	133.73	267.45	134.55	134.55	269.10	137.88	137.88	275.75
2. Salawin basin group	0.80	0.80	1.60	0.84	0.84	1.69	0.90	0.90	1.79
3. Chao Phraya-Tachin basin group	138.64	138.64	277.29	141.82	141.82	283.64	179.61	179.61	359.21
4. Mae Khlong basin group	14.35	14.35	28.71	14.40	14.40	28.81	14.86	14.86	29.72
5. Bang Prakong basin group	13.96	13.96	27.91	13.96	13.96	27.91	14.86	14.86	29.72
6. Eastern coast basin group	5.26	5.26	10.52	5.40	5.40	10.79	5.97	5.97	11.93
7. Western coast basin group	3.56	3.56	7.12	3.56	3.56	7.12	4.01	4.01	8.02
8. Eastern south basin group	40.16	13.61	53.76	27.91	27.91	55.83	55.83	55.83	111.65
9. Western sough basin group	7.93	7.26	15.20	8.70	8.70	17.39	17.39	17.39	34.78
Total	**358.39**	**331.17**	**689.57**	**351.14**	**351.14**	**702.27**	**431.30**	**431.30**	**862.60**

6) Groundwater pumping of private wells for domestic, business and agricultural use was estimated from the permitted pumping multiply by the number of pumping hours (8 hours) and the pumping coefficient (0.60). Table 25 summarizes groundwater pumping of private wells for domestic, business and agricultural use in each group basin.

Table 25 Summary of groundwater pumping of private well for domestic, business and agricultural in each group basin

a) Domestic

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	7.78	7.78	15.55	8.34	8.34	16.68	10.52	10.52	21.04
2. Salawin basin group	0.22	0.22	0.45	0.28	0.28	0.56	0.35	0.35	0.70
3. Chao Phraya-Tachin basin group	82.36	82.36	164.73	89.15	89.15	178.30	95.15	95.15	190.31
4. Mae Khlong basin group	4.93	4.93	9.87	5.75	5.75	11.50	5.85	5.85	11.71
5. Bang Prakong basin group	4.58	4.58	9.16	5.14	5.14	10.28	5.49	5.49	10.97
6. Eastern coast basin group	3.42	3.42	6.84	3.83	3.83	7.67	4.06	4.06	8.11
7. Western coast basin group	0.81	0.81	1.63	1.20	1.20	2.41	1.40	1.40	2.80
8. Eastern south basin group	21.72	7.21	28.94	16.07	16.07	32.14	16.20	16.20	32.41
9. Western sough basin group	4.44	4.39	8.83	4.98	4.98	9.96	5.63	5.63	11.26
Total	**130.27**	**115.71**	**245.98**	**134.75**	**134.75**	**269.50**	**144.65**	**144.65**	**289.31**

b) business

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	14.52	14.52	29.03	15.08	15.08	30.16	17.26	17.26	34.52
2. Salawin basin group	0.23	0.23	0.45	0.29	0.29	0.57	0.36	0.36	0.71
3. Chao Phraya-Tachin basin group	144.04	144.04	288.09	150.83	150.83	301.66	156.83	156.83	313.67
4. Mae Khlong basin group	26.74	26.74	53.48	27.55	27.55	55.11	27.66	27.66	55.32
5. Bang Prakong basin group	5.42	5.42	10.84	5.99	5.99	11.97	6.33	6.33	12.66
6. Eastern coast basin group	4.03	4.03	8.07	4.45	4.45	8.90	4.67	4.67	9.34
7. Western coast basin group	2.45	2.45	4.91	2.85	2.85	5.69	3.04	3.04	6.08
8. Eastern south basin group	28.30	8.64	36.94	20.07	20.07	40.14	20.21	20.21	40.41
9. Western sough basin group	5.53	5.48	11.02	6.07	6.07	12.15	6.72	6.72	13.44
Total	**231.27**	**211.56**	**442.83**	**233.18**	**233.18**	**466.35**	**243.08**	**243.08**	**486.15**

c) agricultural

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	5.30	5.30	10.60	6.12	6.12	12.24	6.41	6.41	12.83
2. Salawin basin group	0.49	0.49	0.97	0.56	0.56	1.12	0.57	0.57	1.14
3. Chao Phraya-Tachin basin group	16.99	16.99	33.97	19.25	19.25	38.49	20.35	20.35	40.70
4. Mae Khlong basin group	0.82	0.82	1.65	0.94	0.94	1.87	0.95	0.95	1.90
5. Bang Prakong basin group	2.67	2.67	5.35	3.17	3.17	6.34	3.36	3.36	6.73
6. Eastern coast basin group	1.74	1.74	3.48	2.21	2.21	4.42	2.21	2.21	4.42
7. Western coast basin group	0.73	0.73	1.45	0.87	0.87	1.75	0.87	0.87	1.75
8. Eastern south basin group	0.80	0.45	1.25	0.86	0.86	1.72	0.92	0.92	1.84
9. Western sough basin group	0.49	0.49	0.99	0.52	0.52	1.04	0.55	0.55	1.10
Total	**30.04**	**29.68**	**59.72**	**34.50**	**34.50**	**68.99**	**36.21**	**36.21**	**72.41**

7) Water allocation of industrial estate was estimated from water producing capacity in each industrial estate. The results showed that the total water allocation of industrial estate was about 245.55 MCM/year. Table 26 summarizes water allocation of ndustrial estate in each group basin.

8) Water allocation of large, medium and small irrigated projects at the paddy fields (reservoir/stream) was estimated from agricultural water use divided by 1.3. Table 27-32 summarize water allocation of large, medium and small irrigated projects at the paddy field.

9) Water allocation of pumping irrigated projects at the paddy fields was estimated from agricultural water use. Table 33 summarizes water allocation of pumping irrigated projects at the paddy field.

Table 26 Summary of water allocation of Industrial Estate in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	46.53	46.53	93.06	46.53	46.53	93.06	46.53	46.53	93.06
4. Mae Khlong basin group	3.12	3.12	6.24	3.12	3.12	6.24	3.12	3.12	6.24
5. Bang Prakong basin group	3.64	3.64	7.29	3.64	3.64	7.29	3.64	3.64	7.29
6. Eastern coast basin group	67.88	67.88	135.77	67.88	67.88	135.77	67.88	67.88	135.77
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	2.64	0.53	3.17	1.59	1.59	3.17	1.59	1.59	3.17
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**123.83**	**121.72**	**245.55**	**122.77**	**122.77**	**245.55**	**122.77**	**122.77**	**245.55**

Table 27 Summary of water allocation of large irrigated projects at the paddy field from reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	1,532.3	1,105.1	2,637.4	2,071.7	1,317.0	3,388.8	2,726.7	1,820.7	4,547.4
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	4,276.1	3,764.4	8,040.5	6,121.1	3,715.1	9,836.3	5,863.5	4,310.0	10,173.5
4. Mae Khlong basin group	1,909.1	2,985.4	4,894.5	4,469.2	3,186.3	7,655.4	3,432.9	3,248.9	6,681.7
5. Bang Prakong basin group	95.6	65.0	160.6	120.0	54.7	174.7	116.7	76.0	192.6
6. Eastern coast basin group	123.5	77.7	201.2	117.4	65.9	183.2	129.7	93.3	223.1
7. Western coast basin group	226.8	158.8	385.6	1,067.5	297.3	1,364.8	363.7	278.3	642.0
8. Eastern south basin group	501.2	335.5	836.6	775.8	628.1	1,403.9	437.9	441.9	879.8
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**8,664.6**	**8,491.9**	**17,156.5**	**14,742.6**	**9,264.4**	**24,007.1**	**13,071.0**	**10,269.1**	**23,340.2**

Table 28 Summary of water allocation of medium irrigated projects at the paddy field from reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	738.1	111.3	849.4	735.2	111.2	846.4	741.2	96.6	837.8
2. Salawin basin group	2.2	3.5	5.7	1.6	4.2	5.8	1.6	4.2	5.8
3. Chao Phraya-Tachin basin group	72.8	47.5	120.3	68.0	53.0	121.0	70.2	49.8	120.0
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	35.9	14.1	50.0	33.2	16.7	49.9	30.4	20.6	50.9
6. Eastern coast basin group	7.9	3.6	11.4	3.9	7.5	11.4	3.7	7.2	10.9
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	36.6	7.1	43.7	29.9	15.0	44.9	29.3	15.9	45.2
9. Western sough basin group	10.8	0.1	10.9	10.6	0.1	10.7	10.5	0.1	10.6
Total	**904.2**	**187.2**	**1,091.4**	**882.3**	**207.7**	**1,090.1**	**886.9**	**194.3**	**1,081.2**

Table 29 Summary of water allocation of small irrigated projects at the paddy field from reservoirs

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	424.99	424.99	-	424.18	424.18	-	421.97	421.97
2. Salawin basin group	-	3.88	3.88	-	3.81	3.81	-	3.84	3.84
3. Chao Phraya-Tachin basin group	-	115.06	115.06	-	115.53	115.53	-	114.83	114.83
4. Mae Khlong basin group	-	12.90	12.90	-	13.04	13.04	-	12.91	12.91
5. Bang Prakong basin group	-	11.85	11.85	-	11.73	11.73	-	11.93	11.93
6. Eastern coast basin group	-	11.63	11.63	-	11.63	11.63	-	11.24	11.24
7. Western coast basin group	-	27.96	27.96	-	28.11	28.11	-	27.08	27.08
8. Eastern south basin group	0.87	38.54	39.41	1.02	39.46	40.47	0.87	38.86	39.73
9. Western sough basin group	-	5.09	5.09	-	5.33	5.33	-	5.54	5.54
Total	**0.87**	**651.89**	**652.76**	**1.02**	**652.80**	**653.82**	**0.87**	**648.20**	**649.07**

Table 30 Summary of water allocation of large irrigated projects at the paddy field from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	87.5	83.6	171.1	83.7	97.8	181.5	71.1	55.8	126.8
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	58.4	118.7	177.1	59.7	107.2	167.0	35.9	77.4	113.3
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	142.2	211.8	354.0	162.7	210.2	372.9	121.0	96.9	217.9
6. Eastern coast basin group	2.1	4.2	6.4	1.9	4.2	6.2	3.0	2.9	6.0
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	180.3	42.7	223.0	136.3	116.3	252.6	95.0	44.0	139.0
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**470.6**	**461.0**	**931.6**	**444.4**	**535.7**	**980.2**	**325.9**	**277.0**	**603.0**

Table 31 Summary of water allocation of medium irrigated projects at the paddy field from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	16.4	139.5	155.8	18.8	178.8	197.7	17.2	176.9	194.0
2. Salawin basin group	0.4	7.2	7.6	0.2	7.3	7.5	0.4	8.5	8.9
3. Chao Phraya-Tachin basin group	55.9	431.7	487.6	57.1	422.3	479.4	49.9	550.2	600.0
4. Mae Khlong basin group	6.3	9.1	15.4	6.1	8.3	14.4	4.0	8.5	12.5
5. Bang Prakong basin group	657.6	397.2	1,054.7	705.2	291.3	996.5	642.4	243.6	886.0
6. Eastern coast basin group	245.8	90.8	336.5	290.3	72.1	362.4	272.0	58.1	330.1
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	41.0	60.7	101.7	45.8	65.8	111.6	62.7	80.2	142.9
9. Western sough basin group	0.3	1.2	1.6	0.3	1.0	1.3	0.4	1.0	1.4
Total	**1,023.7**	**1,137.3**	**2,161.0**	**1,123.9**	**1,046.8**	**2,170.7**	**1,048.9**	**1,127.0**	**2,175.9**

Table 32 Summary of water allocation of small irrigated projects at the paddy field from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	4.84	4.84	-	4.69	4.69	-	4.63	4.63
2. Salawin basin group	-	1.66	1.66	-	1.53	1.53	-	1.64	1.64
3. Chao Phraya-Tachin basin group	-	81.73	81.73	-	84.44	84.44	-	83.71	83.71
4. Mae Khlong basin group	-	0.19	0.19	-	0.19	0.19	-	0.19	0.19
5. Bang Prakong basin group	-	5.38	5.38	-	5.75	5.75	-	6.02	6.02
6. Eastern coast basin group	-	1.05	1.05	-	1.08	1.08	-	1.07	1.07
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	10.84	21.40	32.24	7.19	16.98	24.17	6.89	18.71	25.60
9. Western sough basin group	0.35	9.71	10.06	0.20	8.15	8.35	0.22	8.70	8.92
Total	**11.18**	**125.96**	**137.14**	**7.39**	**122.81**	**130.20**	**7.11**	**124.66**	**131.77**

Table 33 Summary of water allocation of pumping irrigated projects at the paddy field from stream

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	204.14	204.14	-	200.64	200.64	-	197.21	197.21
2. Salawin basin group	-	1.62	1.62	-	1.51	1.51	-	1.61	1.61
3. Chao Phraya-Tachin basin group	-	103.45	103.45	-	106.02	106.02	-	108.74	108.74
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	-	11.76	11.76	-	12.04	12.04	-	12.54	12.54
6. Eastern coast basin group	-	7.14	7.14	-	7.56	7.56	-	7.31	7.31
7. Western coast basin group	-	0.12	0.12	-	0.12	0.12	-	0.12	0.12
8. Eastern south basin group	1.66	5.95	7.60	1.15	5.09	6.24	1.14	5.57	6.71
9. Western sough basin group	0.05	2.13	2.18	0.03	1.99	2.02	0.03	1.98	2.02
Total	**1.71**	**336.30**	**338.01**	**1.18**	**334.96**	**336.14**	**1.18**	**335.07**	**336.25**

10) Water allocation of ponds was estimated from the effective storage of ponds divided by 1.3. The results showed that the total water allocation of ponds in year 2005, 2006 and 2007 was about 130.23 MCM/year, 130.23 MCM/year and 136.50 MCM/year. Table 34 summarizes water allocation of ponds in each group basin.

Table 34 Summary of water allocation of ponds in each group basin

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	63.90	14.27	78.17	64.27	13.89	78.17	65.43	15.39	80.83
2. Salawin basin group	0.23	0.00	0.23	0.23	0.00	0.23	0.23	0.00	0.23
3. Chao Phraya-Tachin basin group	24.54	15.57	40.11	22.21	17.91	40.11	24.31	18.40	42.71
4. Mae Khlong basin group	0.39	0.43	0.82	0.37	0.45	0.82	0.36	0.48	0.84
5. Bang Prakong basin group	1.72	0.70	2.42	1.63	0.80	2.42	1.73	0.86	2.60
6. Eastern coast basin group	2.27	0.60	2.87	2.18	0.70	2.87	2.35	1.01	3.36
7. Western coast basin group	0.48	0.18	0.66	0.43	0.23	0.66	0.54	0.24	0.78
8. Eastern south basin group	3.57	0.16	3.74	3.52	0.22	3.74	3.62	0.29	3.91
9. Western sough basin group	1.21	0.00	1.21	1.20	0.00	1.21	1.25	0.00	1.26
Total	**98.31**	**31.92**	**130.23**	**96.04**	**34.19**	**130.23**	**99.83**	**36.67**	**136.50**

Domestic water use

1. Domestic use in municipal area

The domestic water use in a municipal area was estimated from the number of population in the municipal area and water use rate of PWA. The results showed that the total domestic use in municipal areas in year 2005, 2006 and 2007 was about 889.48 MCM/year, 887.97 MCM/year and 890.95 MCM/year. Table 35 summarizes the domestic water use ithe municipal areas.

Table 35 Summary of the domestic water use in the municipal areas

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	43.39	43.39	86.78	41.29	41.29	82.59	41.04	41.04	82.07
2. Salawin basin group	1.18	1.18	2.36	1.16	1.16	2.32	1.16	1.16	2.32
3. Chao Phraya-Tachin basin group	329.66	329.66	659.32	332.21	332.21	664.42	333.68	333.68	667.36
4. Mae Khlong basin group	5.21	5.21	10.41	5.13	5.13	10.26	5.08	5.08	10.16
5. Bang Prakong basin group	3.80	3.80	7.60	3.76	3.76	7.52	3.74	3.74	7.49
6. Eastern coast basin group	20.55	20.55	41.10	20.34	20.34	40.67	20.70	20.70	41.40
7. Western coast basin group	4.23	4.23	8.46	4.27	4.27	8.54	4.23	4.23	8.46
8. Eastern south basin group	38.88	13.18	52.06	25.36	25.36	50.72	25.99	25.99	51.98
9. Western sough basin group	11.89	9.50	21.39	10.46	10.46	20.92	9.86	9.86	19.71
Total	**458.78**	**430.70**	**889.48**	**443.99**	**443.99**	**887.97**	**445.47**	**445.47**	**890.95**

2. Domestic use outside municipal area

The domestic water use outside a municipal area was estimated from the number of population outside the municipal area and the water use rate of 50 liter/person/day. The results showed that the total domestic use outside the municipal areas in year 2005, 2006 and 2007 was about 808.07 MCM/year, 811.27 MCM/year and 805.67 MCM/year. Table 2 summarizes the domestic water use outside the municipal areas.

Table 36 Summary of the domestic water use outside the municipal areas

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	180.29	180.29	360.58	180.44	180.44	360.88	179.34	179.34	358.68
2. Salawin basin group	3.85	3.85	7.70	3.89	3.89	7.78	3.91	3.91	7.82
3. Chao Phraya-Tachin basin group	118.02	118.02	236.03	118.87	118.87	237.74	117.75	117.75	235.51
4. Mae Khlong basin group	11.00	11.00	22.01	11.03	11.03	22.07	11.08	11.08	22.16
5. Bang Prakong basin group	15.15	15.15	30.30	15.25	15.25	30.49	15.26	15.26	30.53
6. Eastern coast basin group	10.01	10.01	20.01	9.79	9.79	19.58	9.94	9.94	19.87
7. Western coast basin group	6.32	6.32	12.64	6.38	6.38	12.77	6.38	6.38	12.75
8. Eastern south basin group	67.11	21.37	88.48	44.59	44.59	89.18	44.48	44.48	88.97
9. Western sough basin group	16.12	14.18	30.31	15.39	15.39	30.77	14.69	14.69	29.39
Total	**427.88**	**380.20**	**808.07**	**405.63**	**405.64**	**811.27**	**402.83**	**402.84**	**805.67**

3. Overview of domestic water use

The domestic water use outside of the municipal areas was estimated from the number of population in and out of the municipal areas and the water use rate. The results showed that the total domestic use outside of the municipal areas in year 2005, 2006 and 2007 was about 1,697.55 MCM/year, 1,699.24 MCM/year and 1696.62 MCM/year. Table 37 summarizes the domestic water use in and out of the municipal areas.

Table 37 Summary of the domestic water use in and out of the municipal areas

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	223.68	223.68	447.36	221.73	221.73	443.47	220.38	220.38	440.76
2. Salawin basin group	5.03	5.03	10.06	5.05	5.05	10.10	5.07	5.07	10.14
3. Chao Phraya-Tachin basin group	447.67	447.67	895.35	451.08	451.08	902.16	451.43	451.43	902.87
4. Mae Khlong basin group	16.21	16.21	32.42	16.17	16.17	32.33	16.16	16.16	32.32
5. Bang Prakong basin group	18.95	18.95	37.90	19.01	19.01	38.02	19.01	19.01	38.02
6. Eastern coast basin group	30.55	30.55	61.11	30.13	30.13	60.25	30.63	30.63	61.27
7. Western coast basin group	10.55	10.55	21.10	10.65	10.65	21.31	10.60	10.60	21.21
8. Eastern south basin group	105.99	34.56	140.54	69.95	69.95	139.90	70.47	70.47	140.95
9. Western sough basin group	28.01	23.68	51.70	25.85	25.85	51.69	24.55	24.55	49.10
Total	886.66	810.89	1,697.55	849.62	849.62	1,699.24	848.31	848.31	1,696.62

Industrial water use

1. Industrial water use in industrial estate

The industrial water use in an industrial estate was estimated from the horse power of the industrial estate and the water use rate by type of factories. The results showed that the total industrial water use in year 2005, 2006 and 2007 was about 212.83 MCM/year 214.62 MCM/year and 216.10 MCM/year Table 38 summarizes the industrial water use in thes industrial estate.

Table 38 Summary of the industrial water use in the industrial estates

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	0.003	0.003	0.005	0.003	0.003	0.005	0.003	0.003	0.005
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	42.93	42.93	85.86	43.32	43.32	86.65	43.51	43.51	87.03
4. Mae Khlong basin group	0.000046	0.000046	0.000093	0.000046	0.000046	0.000093	0.000046	0.000046	0.000093
5. Bang Prakong basin group	1.34	1.34	2.67	1.35	1.35	2.71	1.37	1.37	2.74
6. Eastern coast basin group	62.06	62.06	124.12	62.54	62.54	125.08	63.07	63.07	126.15
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	0.15	0.03	0.18	0.09	0.09	0.18	0.09	0.09	0.18
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**106.47**	**106.36**	**212.83**	**107.31**	**107.31**	**214.62**	**108.05**	**108.05**	**216.10**

2. Industrial water use outside industrial estate

The industrial water use outside of an industrial estate was estimated from the horse power and and the water use rate by type of factories. The results showed that the total industrial water use in year 2005, 2006 and 2007 was about 3,826.8 MCM/year 4,000.5 MCM/year and 4,022.8 MCM/year. Table 39 summarizes the industrial water use outside the industrial estates.

Table 39 Summary of the industrial water use outside the industrial estate**s**

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	145.5	145.5	291.0	146.7	146.7	293.5	149.6	149.6	299.1
2. Salawin basin group	0.7	0.7	1.5	0.8	0.8	1.5	0.8	0.8	1.6
3. Chao Phraya-Tachin basin group	1,356.2	1,356.2	2,712.4	1,434.0	1,434.0	2,868.0	1,439.7	1,439.7	2,879.3
4. Mae Khlong basin group	114.6	114.6	229.2	115.8	115.8	231.6	116.1	116.1	232.2
5. Bang Prakong basin group	60.4	60.4	120.8	62.7	62.7	125.3	63.6	63.6	127.3
6. Eastern coast basin group	147.8	147.8	295.6	150.8	150.8	301.5	150.9	150.9	301.8
7. Western coast basin group	27.1	27.1	54.2	27.8	27.8	55.5	28.2	28.2	56.4
8. Eastern south basin group	21.7	11.0	32.7	16.8	16.8	33.7	17.2	17.2	34.5
9. Western sough basin group	69.5	19.7	89.2	45.0	45.0	89.9	45.3	45.3	90.5
Total	**1,943.7**	**1,883.1**	**3,826.8**	**2,000.2**	**2,000.2**	**4,000.5**	**2,011.4**	**2,011.4**	**4,022.8**

3. Overview of industrial water use

Overall, the industrial water use was estimated from the horse power and the water use rate of factories. The results showed that the total industrial water use in year 2005, 2006 and 2007 was about 4,039.7 MCM/year, 4,215.1 MCM/year and 4,238.9 MCM/year Table 40 summarizes the industrial water use in overview.

Table 40 Summary of the industrial water use in overview

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	145.5	145.5	291.0	146.7	146.7	293.5	149.6	149.6	299.1
2. Salawin basin group	0.7	0.7	1.5	0.8	0.8	1.5	0.8	0.8	1.6
3. Chao Phraya-Tachin basin group	1,399.1	1,399.1	2,798.3	1,477.3	1,477.3	2,954.6	1,483.2	1,483.2	2,966.3
4. Mae Khlong basin group	114.6	114.6	229.2	115.8	115.8	231.6	116.1	116.1	232.2
5. Bang Prakong basin group	61.8	61.8	123.5	64.0	64.0	128.0	65.0	65.0	130.0
6. Eastern coast basin group	209.9	209.9	419.8	213.3	213.3	426.6	214.0	214.0	427.9
7. Western coast basin group	27.1	27.1	54.2	27.8	27.8	55.5	28.2	28.2	56.4
8. Eastern south basin group	21.9	11.1	32.9	16.9	16.9	33.9	17.3	17.3	34.7
9. Western sough basin group	69.5	19.7	89.2	45.0	45.0	89.9	45.3	45.3	90.5
Total	**2,050.2**	**1,989.5**	**4,039.7**	**2,107.6**	**2,107.6**	**4,215.1**	**2,119.5**	**2,119.5**	**4,238.9**

Agricultural water use

1. Agricultural water use in irrigated projects

The agricultural water use in the irrigated projects was estimated from cultivated areas of large, medium, small and pumping project areas, crop coefficient, evapotranspiration and effective rainfall. The results showed that the total agricultural water use in the irrigated projects in year 2005, 2006 and 2007 was about 26,260.2 MCM/year, 27,562.2 MCM/year and 29,368.5 MCM/year. Table 41 summarizes the agricultural water use in the irrigated projects

Table 41 Summary of the agricultural water use in the irrigated projects

a) Large irrigated projects

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	1,509.2	995.9	2,505.0	1,397.7	946.4	2,344.1	1,248.0	1,289.7	2,537.7
2. Salawin basin group	-	-	-	-	-	-	-	-	-
3. Chao Phraya-Tachin basin group	6,972.9	8,918.7	15,891.6	7,385.5	9,779.9	17,165.4	8,324.2	10,240.0	18,564.2
4. Mae Khlong basin group	282.6	489.2	771.9	340.7	505.0	845.7	378.6	494.1	872.7
5. Bang Prakong basin group	383.3	265.7	648.9	433.5	268.8	702.3	427.1	336.8	763.8
6. Eastern coast basin group	19.6	15.7	35.3	23.6	18.5	42.1	22.5	20.1	42.6
7. Western coast basin group	258.4	343.5	601.8	335.6	371.7	707.3	313.0	337.1	650.1
8. Eastern south basin group	777.6	136.2	913.8	601.4	293.7	895.1	577.8	433.3	1,011.1
9. Western sough basin group	-	-	-	-	-	-	-	-	-
Total	**10,203.5**	**11,164.8**	**21,368.3**	**10,517.9**	**12,184.1**	**22,701.9**	**11,291.1**	**13,151.1**	**24,442.2**

b) Medium irrigated projects

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	595.1	271.3	866.5	559.4	331.7	891.1	557.3	319.3	876.6
2. Salawin basin group	6.8	19.3	26.1	4.8	21.6	26.4	5.1	23.9	29.0
3. Chao Phraya-Tachin basin group	131.8	612.0	743.7	120.3	595.2	715.5	125.4	775.1	900.5
4. Mae Khlong basin group	8.2	11.9	20.1	7.9	10.8	18.7	5.2	11.0	16.2
5. Bang Prakong basin group	867.0	521.0	1,387.9	928.6	384.5	1,313.1	844.5	323.0	1,167.4
6. Eastern coast basin group	322.4	119.3	441.6	380.3	99.4	479.7	354.9	78.1	433.0
7. Western coast basin group	-	-	-	-	-	-	-	-	-
8. Eastern south basin group	139.9	150.6	290.5	140.1	175.0	315.1	181.4	212.4	393.8
9. Western sough basin group	5.6	1.6	7.3	5.0	1.3	6.3	5.1	1.4	6.5
Total	**2,076.7**	**1,707.0**	**3,783.7**	**2,146.4**	**1,619.4**	**3,765.8**	**2,079.0**	**1,744.1**	**3,823.1**

Table 41 Summary of the agricultural water use in the irrigated projects (con't)

c) Small irrigated projects

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	241.8	241.8	-	239.0	239.0	-	236.5	236.5
2. Salawin basin group	-	7.8	7.8	-	7.5	7.5	-	7.9	7.9
3. Chao Phraya-Tachin basin group	-	293.7	293.7	-	301.2	301.2	-	306.4	306.4
4. Mae Khlong basin group	-	2.5	2.5	-	2.5	2.5	-	2.7	2.7
5. Bang Prakong basin group	-	19.5	19.5	-	19.4	19.4	-	20.8	20.8
6. Eastern coast basin group	-	9.7	9.7	-	10.5	10.5	-	10.1	10.1
7. Western coast basin group	-	8.2	8.2	-	8.2	8.2	-	8.3	8.3
8. Eastern south basin group	18.4	44.9	63.4	13.8	35.7	49.4	13.0	39.9	52.9
9. Western sough basin group	0.5	21.8	22.2	0.3	19.4	19.7	0.3	20.3	20.5
Total	**18.9**	**649.9**	**668.8**	**14.0**	**643.5**	**657.5**	**13.3**	**652.7**	**666.0**

d) Pumping projects

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	-	265.4	265.4	-	260.8	260.8	-	256.4	256.4
2. Salawin basin group	-	2.1	2.1	-	2.0	2.0	-	2.1	2.1
3. Chao Phraya-Tachin basin group	-	134.5	134.5	-	137.8	137.8	-	141.4	141.4
4. Mae Khlong basin group	-	-	-	-	-	-	-	-	-
5. Bang Prakong basin group	-	15.3	15.3	-	15.7	15.7	-	16.3	16.3
6. Eastern coast basin group	-	9.3	9.3	-	9.8	9.8	-	9.5	9.5
7. Western coast basin group	-	0.2	0.2	-	0.2	0.2	-	0.2	0.2
8. Eastern south basin group	2.2	7.7	9.9	1.5	6.6	8.1	1.5	7.2	8.7
9. Western sough basin group	0.1	2.8	2.8	0.0	2.6	2.6	0.0	2.6	2.6
Total	**2.2**	**437.2**	**439.4**	**1.5**	**435.4**	**437.0**	**1.5**	**435.6**	**437.1**

e) Total

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	2,104.3	1,774.4	3,878.7	1,957.1	1,777.9	3,734.9	1,805.3	2,101.9	3,907.1
2. Salawin basin group	6.8	29.2	36.0	4.8	31.0	35.8	5.1	33.8	38.9
3. Chao Phraya-Tachin basin group	7,104.7	9,958.8	17,063.5	7,505.8	10,814.2	18,319.9	8,449.6	11,462.9	19,912.5
4. Mae Khlong basin group	290.8	503.6	794.4	348.6	518.3	866.9	383.9	507.8	891.6
5. Bang Prakong basin group	1,250.2	821.4	2,071.7	1,362.1	688.4	2,050.5	1,271.5	696.8	1,968.3
6. Eastern coast basin group	341.9	153.9	495.8	403.9	138.2	542.1	377.4	117.9	495.3
7. Western coast basin group	258.4	351.8	610.2	335.6	380.1	715.7	313.0	345.5	658.5
8. Eastern south basin group	938.1	339.5	1,277.6	756.7	511.0	1,267.7	773.7	692.8	1,466.5
9. Western sough basin group	6.2	26.2	32.3	5.3	23.3	28.6	5.4	24.2	29.7
Total	**12,301.4**	**13,958.8**	**26,260.2**	**12,679.9**	**14,882.4**	**27,562.2**	**13,385.0**	**15,983.5**	**29,368.5**

2. Agricultural water use in rainfed area

The agricultural water use in the rainfed areas was estimated from cultivated areas of large, medium, small and pumping projects, crop coefficient, evapotranspiration and effective rainfall. The results showed that the total agricultural water use in the rainfed areas in year 2005, 2006 and 2007 was about 25,719 MCM/year, 24,874 MCM/year and 25,110 MCM/year. Table 42 summarizes the agricultural water use in the rainfed areas.

Table 42 Summary of the agricultural water use in the rainfed areas

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	9,168	3,644	12,812	9,118	3,781	12,899	8,789	3,915	12,703
2. Salawin basin group	101	131	232	91	132	222	86	134	219
3. Chao Phraya-Tachin basin group	5,037	3,863	8,900	4,028	4,039	8,067	4,324	4,315	8,638
4. Mae Khlong basin group	513	661	1,173	481	671	1,151	431	687	1,118
5. Bang Prakong basin group	1,114	491	1,606	1,025	532	1,556	987	534	1,522
6. Eastern coast basin group	210	212	422	178	255	432	177	278	455
7. Western coast basin group	96	47	143	76	50	126	54	37	91
8. Eastern south basin group	388	4	392	381	8	388	323	7	331
9. Western sough basin group	39	0	39	31	0	32	32	0	33
Total	**16,666**	**9,053**	**25,719**	**15,408**	**9,466**	**24,874**	**15,203**	**9,907**	**25,110**

3. Agricultural water use in overview

The agricultural water use in both the irrigated and rainfed areas in year 2005, 2006 and 2007 was 51,979 MCM/year 52,437 MCM/year and 54,478 MCM/year. Table 43 summarizes the agricultural water use in overview.

Table 43 Summary of the agricultural water use in total

Group Basin	2005			2006			2007		
	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)	Wet (MCM)	Dry (MCM)	Total (MCM)
1. Mae Khong basin group	11,272	5,418	16,690	11,075	5,559	16,634	10,594	6,017	16,611
2. Salawin basin group	108	161	268	95	163	258	91	167	258
3. Chao Phraya-Tachin basin group	12,142	13,822	25,964	11,534	14,853	26,387	12,773	15,778	28,551
4. Mae Khlong basin group	804	1,164	1,968	829	1,189	2,018	815	1,195	2,009
5. Bang Prakong basin group	2,365	1,313	3,677	2,387	1,220	3,607	2,259	1,231	3,490
6. Eastern coast basin group	552	366	918	582	393	975	554	396	950
7. Western coast basin group	354	399	753	412	430	842	367	383	749
8. Eastern south basin group	1,326	344	1,669	1,138	518	1,656	1,097	700	1,797
9. Western sough basin group	45	26	71	37	23	60	38	24	62
Total	**28,967**	**23,012**	**51,979**	**28,088**	**24,349**	**52,437**	**28,588**	**25,891**	**54,478**

Water use in Thailand

From the estimation of the water use in each sector in year 2005, 2006 and 2007 , the total water use was about 57,716 MCM/year 58,351 MCM/year and 60,414 MCM/year. The ratio between domestic, industrial, agricultural water use in the irrigated areas and agricultural water in the rainfed areas was about 2.89% 7.08% 47.12% and 42.92%, respectively. Table 44 summarizes the water use in each sector in overview.

Table 44 Summary of the water use in each sector in overview

Year	Domestic (MCM)	Ratio	Industrial (MCM)	Ratio	Agriculture in irrigated project area (MCM)	Ratio	Agriculture in rainfed area (MCM)	Ratio	Total (MCM)
2005	1,698	2.94%	4,039.7	7.00%	26,260.2	45.50%	25,718.9	44.56%	57,716
2006	1,699	2.91%	4,215.1	7.22%	27,562.2	47.24%	24,874.5	42.63%	58,351
2007	1,697	2.81%	4,238.9	7.02%	29,368.5	48.61%	25,110.0	41.56%	60,414
Average	**1,698**	**2.89%**	**4,165**	**7.08%**	**27,730**	**47.12%**	**25,234**	**42.92%**	**58,827**

In the water account, the water supply in each level and the water use at each end user type were estimated. The water balance in each level was analyzed according to the procedures described in Chapter 3. The three main components of the water account are the amount of water supply from each resources and in each level (water supply 1), the amount of water supply in each water provider, and the amount of water use for each activity. The water balance in each step can be simplified as water balance mapping shown in Figure 5. The water balance provided reliable information by checking the volume of water supply and water use in each water user activity in each area.

From the water balance in water supply 1, the domestic water supply in 2005, 2006 and 2007 was 2,786 MCM/year, 2,849 MCM/year and 3,124 MCM/year, respectively. The industrial water supply was 4,383 MCM/year, 4,582 MCM/year and 4,626 MCM/year, respectively. The agricultural water supply was 36,411 MCM/year, 47,984 MCM/year and 47,700 MCM/year, respectively. The ecosystem water supply was 10,310 MCM/year, 28,126 MCM/year and 18,725 MCM/year, respectively. The water loss 1 that occurred in the large, medium and small irrigated projects was about 8,245 MCM/year, 16,380 MCM/year and 16,081 MCM/year, respectively. The water supply 1 analysis results are shown in Table 45 to Table 47. The water supply 1 analysis in the industrial sectors is shown in Table 48 to Table 52.

From the water balance analysis in water supply 2, the domestic water supply in 2005, 2006 and 2007 was 2,786 MCM/year, 2,849 MCM/year and 3,124 MCM/year, respectively. The industrial water supply was 4,383 MCM/year, 4,582 MCM/year and 4,626 MCM/year, respectively. The agricultural water supply was 34,683 MCM/year, 39,504 MCM/year and 39,385 MCM/year, respectively. The ecosystem water supply was 10,310 MCM/year, 28,126 MCM/year and 18,725 MCM/year, respectively. The water supply 2 analysis results are shown in Table 53 to Table 55. The water supply 2 analysis in the industrial sectors is shown in Table 56 to Table 58.

From the water balance analysis in the water use, the domestic water use in 2005, 2006 and 2007 was 2,027 MCM/year, 1,171 MCM/year and 1,244 MCM/year, respectively. The industrial water use was 4,084 MCM/year, 4,263 MCM/year and 4,290 MCM/year, respectively. The agricultural water use was 21,610 MCM/year, 23,666 MCM/year and 23,808 MCM/year, respectively. The ecosystem water use was 10,310 MCM/year, 28,126 MCM/year and 18,725 MCM/year, respectively. The water loss 2 that occurred in the water distributing processes was about 7,009 MCM/year, 8,374 MCM/year and 8,263 MCM/year, respectively. The water use analysis results are shown in Table 59 to Table 61. The water use analysis in the industrial sectors is shown in Table 62 to Table 64.

The variable and legend are defined as follows

- **Water Budget**
  - IRES Water inflow to large scale reservoir
  - SGW Potential ground water
- **Water Managers-(Water Supply 1)**
  - LRES Water releasing by large scale reservoir
  - MRES Water releasing by medium scale reservoir
  - SRES Water releasing by small scale reservoir
- **Water Providers (Water Supply 2)**
  - SLIRR Water received of Large scale irrigation project
  - SMIRR Water received of medium scale irrigation project
  - SSIRR Water received of small scale irrigation project
  - DLIRR Water diverting from stream to the large scale irrigation project
  - DMIRR Water diverting from stream to the medium scale irrigation project
  - DSIRR Water diverting from stream to the small scale irrigation project
  - SPOND Water allocation by pond
  - SPWA Raw water pumping by Provincial Water Authority
  - SMWA Raw water pumping by Municipal Water Authority
- **Water Providers _private (Water Supply 3)**
  - DPWA Domestic consumption of PWA
  - BPWA Business consumption of PWA
  - IPWA Industrial consumption of PWA
  - DMWA Domestic consumption of MWA
  - IMWA Industrial consumption of MWA
  - DPRW Pumping of private groundwater for domestic consumption
  - BPRW Pumping of private groundwater for business consumption
  - APRW Pumping of private groundwater for agricultural consumption
  - PUW Pumping of official groundwater for domestic consumption
  - CWA Pumping of civil water authority for domestic consumption
- **VWA** pumping of village pipe water authority for domestic consumption
  - PLIRR Water releasing from large scale irrigation project to paddy field (reservoir)
  - PDLIRR Water releasing from large scale irrigation project to paddy field (stream)
  - PMIRR Water releasing from the medium scale irrigation project to paddy field (reservoir)
  - PDMIRR Water releasing from the medium scale irrigation project to paddy field

(stream)

- PSIRR Water releasing from the small scale irrigation project to paddy field (reservoir)
- PDSIRR Water releasing from small scale irrigation project to paddy field (stream)
- PPUMP Water allocating to the electric pumping project to paddy field (stream)
- IEAW Water allocating of IEAT
- POND Water allocating of pond

➢ **Water Use**

- IDOM Domestic consumption in Municipal area
- ODOM Domestic consumption in rural area
- IEAT Industrial consumption in the industrial estate area
- OIND Industrial consumption outside the industrial estate area
- LIRR Agricultural consumption of the large scale irrigation project
- MIRR Agricultural consumption of the medium scale irrigation project
- SIRR Agricultural consumption of the small scale irrigation project
- PUMP Agricultural consumption of the electric pumping project
- AGR Agricultural consumption in rural area
- Liv Livestock water consumption

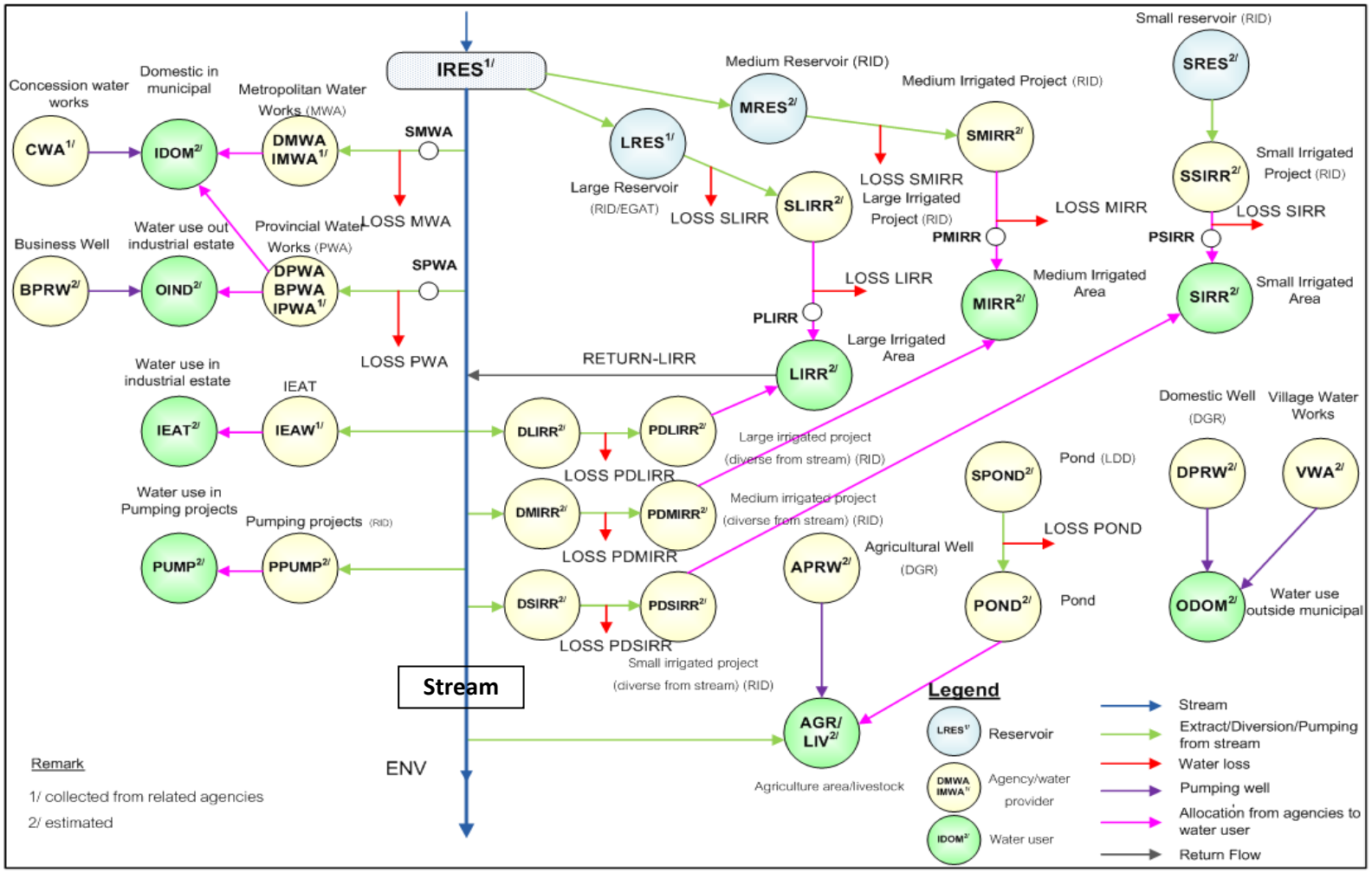


Figure 5 Water balance mapping

Table 45 Summary of water supply 1 analysis in year 2005

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1	Natural stream	873.3	873.3	-	3,568.4	7,625.0	1,132.4	2,804.5	168.0	338.0	2,960.8	221.2	-
2	Reservoir*	79.8	79.8	-	204.1	19,290.1	17,529.3	1,209.3	551.6	-	-	-	10,309.9
	Water Loss from reservoir	-	-	-	-	8,245.2	7,649.1	430.7	165.5	-	-	-	-
3	Irrigated Canal	51.3	51.3	-	70.7	-	-	-	-	-	-	-	-
4	Groundwater well	1,781.0	386.8	1,394.3	539.8	282.8	-	-	-	-	266.3	16.5	-
5	Pond	-	-	-	-	967.6	-	-	-	-	911.7	55.9	-
Total		**2,785.5**	**1,391.2**	**1,394.3**	**4,382.9**	**36,410.8**	**26,310.7**	**4,444.5**	**885.1**	**338.0**	**4,138.9**	**293.7**	**10,309.9**

Remark * Water release subtract water loss

Table 46 Summary of water supply1 analysis in year 2006

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1	Natural stream	882.5	882.5	-	3,711.4	7,547.8	1,035.9	2,812.5	158.0	336.1	3,004.7	200.6	-
2	Reservoir*	84.1	84.1	-	210.1	22,800.5	21,096.2	1,159.5	544.7	-	-	-	28,126.1
	Water Loss from reservoir	-	-	-	-	16,380.3	15,306.3	910.6	163.4	-	-	-	-
3	Irrigated Canal	58.1	58.1	-	82.8	-	-	-	-	-	-	-	-
4	Groundwater well	1,824.3	393.8	1,430.5	577.9	348.1	-	-	-	-	330.7	17.3	-
5	Pond	-	-	-	-	907.5	-	-	-	-	854.1	53.4	-
Total		**2,849.0**	**1,418.5**	**1,430.5**	**4,582.1**	**47,984.3**	**37,438.4**	**4,882.7**	**866.2**	**336.1**	**4,189.5**	**271.4**	**28,126.1**

Remark * Water release subtract water loss

Table 47 Summary of water supply 1 analysis in year 2007

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1	Natural stream	958.7	958.7	-	3,712.1	7,030.0	697.5	2,822.5	160.7	336.3	2,771.5	241.4	-
2	Reservoir*	91.8	91.8	-	220.5	23,387.6	21,701.4	1,142.9	543.4	-	-	-	18,724.8
	Water Loss from reservoir	-	-	-	-	16,081.0	14,417.7	1,500.3	163.0	-	-	-	-
3	Irrigated Canal	62.9	62.9	-	88.4	-	-	-	-	-	-	-	-
4	Groundwater well	2,010.2	399.5	1,610.6	604.7	324.0	-	-	-	-	302.0	22.0	-
5	Pond	-	-	-	-	874.9	-	-	-	-	813.1	61.9	-
Total		**3,123.5**	**1,512.9**	**1,610.6**	**4,625.7**	**47,697.5**	**36,816.6**	**5,465.7**	**867.1**	**336.3**	**3,886.6**	**325.3**	**18,724.8**

Remark * Water release subtract water loss

Table 48 Summary of water supply1 analysis in industrial sector in year 2005

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1	Natural stream	3,668.4	224.2	373.4	44.8	145.7	596.7	30.2	39.9	84.0	53.5	188.9	23.7	226.9
2	Reservoir*	104.1	13.3	10.8	0.7	5.8	4.9	0.7	0.5	2.9	1.5	1.8	0.3	18.0
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	70.7	3.6	6.6	1.0	2.9	13.7	0.7	0.9	1.9	1.1	2.6	0.5	3.1
4	Groundwater well	539.8	31.6	68.3	9.0	24.3	90.9	4.4	5.7	16.8	8.1	37.2	3.5	18.4
5	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,382.9**	**272.7**	**459.0**	**55.6**	**178.6**	**706.2**	**36.0**	**47.0**	**105.6**	**64.2**	**230.6**	**28.0**	**266.5**

Table 48 Summary of water supply1 analysis in industrial sector in year 2005 (Con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1	Natural stream	3,668.4	14.8	108.0	180.2	77.9	293.4	227.9	61.1	158.5	237.8	277.0
2	Reservoir*	104.1	0.9	2.6	3.7	3.2	8.6	4.0	0.9	3.5	6.2	9.4
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	70.7	0.3	2.3	3.8	1.5	5.9	5.0	1.3	2.8	4.7	4.5
4	Groundwaterwell	539.8	2.3	22.5	24.8	10.9	37.3	32.0	8.6	18.4	31.8	32.9
5	Pond	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,382.9**	**18.3**	**135.4**	**212.5**	**93.5**	**345.2**	**268.9**	**71.8**	**183.2**	**280.5**	**323.8**

Table 49 Summary of water supply1 analysis in industrial sector in year 2006

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1	Natural stream	3,811.4	227.9	386.5	47.1	150.2	621.0	31.5	43.2	86.8	55.8	198.9	25.9	232.0
2	Reservoir*	110.1	13.6	11.4	0.7	6.1	5.3	0.7	0.5	3.1	1.5	2.3	0.4	18.6
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	82.8	4.1	7.6	1.2	3.3	16.1	0.8	1.1	2.2	1.3	3.2	0.7	3.6
4	Groundwaterwell	577.9	33.5	72.8	9.8	25.9	96.6	4.7	6.4	18.2	8.7	39.6	3.9	19.8
5	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,582.1**	**279.1**	**478.4**	**58.8**	**185.4**	**739.1**	**37.7**	**51.2**	**110.3**	**67.3**	**244.0**	**30.8**	**273.9**

Table 49 Summary of water supply1 analysis in industrial sector in year 2006 (Con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1	Natural stream	3,811.4	15.3	111.2	190.5	80.2	304.1	239.1	63.6	165.9	247.7	287.0
2	Reservoir*	110.1	0.9	2.7	4.2	3.4	9.0	4.3	0.9	3.8	6.6	9.9
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	82.8	0.4	2.6	4.5	1.7	7.0	5.9	1.5	3.4	5.5	5.1
4	Groundwaterwell	577.9	2.4	23.8	26.9	11.6	40.0	34.4	9.2	19.9	34.2	35.9
5	Pond	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,582.1**	**19.1**	**140.3**	**226.1**	**96.9**	**360.0**	**283.7**	**75.2**	**192.9**	**294.0**	**337.9**

Table 50 Summary of water supply1 analysis in industrial sector in year 2007

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1	Natural stream	3,812.1	225.6	391.0	48.7	147.9	622.2	31.0	42.3	86.0	54.7	201.7	26.1	231.8
2	Reservoir*	120.5	14.2	12.3	0.8	6.3	5.6	0.7	0.5	3.3	1.6	2.8	0.4	21.6
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	88.4	4.3	8.3	1.3	3.4	17.2	0.9	1.2	2.3	1.3	3.5	0.7	3.8
4	Groundwaterwell	604.7	35.7	76.8	10.3	26.9	101.2	4.9	6.5	18.7	8.9	41.0	4.1	20.4
5	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,625.7**	**279.9**	**488.3**	**61.0**	**184.6**	**746.2**	**37.5**	**50.5**	**110.3**	**66.6**	**248.9**	**31.3**	**277.7**

Table 50 Summary of water supply1 analysis in industrial sector in year 2007 (Con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1	Natural stream	3,812.1	15.4	111.6	192.7	80.8	300.0	238.8	64.1	164.8	243.8	291.0
2	Reservoir*	120.5	1.1	3.1	4.5	3.9	9.9	4.7	1.0	4.1	7.1	10.8
	Water Loss from reservoir	-	-	-	-	-	-	-	-	-	-	-
3	Irrigated Canal	88.4	0.4	2.8	4.9	1.9	7.3	6.3	1.6	3.6	5.8	5.6
4	Groundwaterwell	604.7	2.5	24.2	28.6	12.2	41.3	36.0	9.7	20.7	35.2	38.7
5	Pond	-	-	-	-	-	-	-	-	-	-	-
รวม		**4,625.7**	**19.4**	**141.7**	**230.7**	**98.8**	**358.6**	**285.8**	**76.4**	**193.3**	**291.9**	**346.0**

Table 51 Summary of water supply 2 analysis or water allocated from projects to water user in year 2005

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**397.75**	**397.75**	-	**501.51**	-	-	-	-	-	-	-	-
(Pumping points)	Stream	158.83	158.83	-	189.19	-	-	-	-	-	-	-	-
	Water loss from stream	47.31	47.31	-	56.29								
	Reservoirs	61.43	61.43	-	80.16	-	-	-	-	-	-	-	-
	Water loss from reservoirs	18.35	18.35	-	23.95								
	Irrigated canal	39.70	39.70	-	54.69	-	-	-	-	-	-	-	-
	Water loss from Irrigated canal	11.62	11.62	-	16.00								
	Groundwater well	46.80	46.80	-	62.86	-	-	-	-	-	-	-	-
	Water loss from groundwater well	13.70	13.70	-	18.37								
2. Metropolitan Water Works*	**Total**	**667.19**	**667.19**	-	**814.21**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream	667.19	667.19	-	814.21	-	-	-	-	-	-	-	-
	Water loss from natural stream	150.69	150.69	-	183.90	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**212.83**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream	-	-	-	212.83	-	-	-	-	-	-	-	-
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	**458.72**	-	**458.72**	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	458.72	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**935.55**	-	**935.55**	**458.56**	**282.80**	-	-	-	-	**266.30**	**16.50**	-
(Pumping points)	Public well	689.57	-	689.57	-	-	-	-	-	-	-	-	-
	Private well	245.98	-	245.98	458.56	282.80	-	-	-	-	266.30	16.50	-
7. RID/EGAT*	**Total**	-	-	-	-	**30,250.38**	**24,086.67**	**4,940.05**	**885.66**	**338.01**	-	-	**10,309.90**
(Projects)	Reservoirs	-	-	-	-	19,290.10	17,529.29	1,209.26	551.55	-	-	-	10,309.90
	Water loss from reservoirs					5,570.06	5,163.72	279.06	127.28				
	Natural stream	-	-	-	-	4,442.94	1,132.35	2,804.53	168.04	338.01	-	-	-
	Water loss from natural stream	-	-	-	-	947.29	261.31	647.20	38.78	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	**967.65**	-	-	-	-	**911.74**	**55.91**	-
(Pumping points)	Pond	-	-	-	-	967.65	-	-	-	-	911.74	55.91	-
	Water loss from pond	-	-	-	-	36.51	-	-	-	-	36.51	-	-
9. Department of Water Resources	**Total**	-	-	-	**2,395.84**	**3,182.09**	-	-	-	-	**2,960.85**	**221.24**	-
(Pumping points)	Natural stream	-	-	-	2,395.84	3,182.09	-	-	-	-	2,960.85	221.24	-
Total of agaencies		**2,785.47**	**1,391.21**	**1,394.26**	**4,382.95**	**34,682.92**	**24,086.67**	**4,940.05**	**885.66**	**338.01**	**4,138.88**	**293.65**	**10,309.90**

Table 52 Summary of water supply 2 analysis or water allocated from projects to water user in year 2006

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**425.24**	**425.24**	-	**548.56**	-	-	-	-	-	-	-	-
(Pumping points)	Stream	166.07	166.07	-	200.98	-	-	-	-	-	-	-	-
	Water loss from stream	49.43	49.43	-	59.74								
	Reservoirs	64.79	64.79	-	84.75	-	-	-	-	-	-	-	-
	Water loss from reservoirs	19.35	19.35	-	25.31								
	Irrigated canal	44.91	44.91	-	64.05	-	-	-	-	-	-	-	-
	Water loss from Irrigated canal	13.14	13.14	-	18.72								
	Groundwater well	52.27	52.27	-	73.55	-	-	-	-	-	-	-	-
	Water loss from groundwater well	15.28	15.28	-	21.47								
2. Metropolitan Water Works*	**Total**	**666.96**	**666.96**	-	**860.44**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream	666.96	666.96	-	860.44	-	-	-	-	-	-	-	-
	Water loss from natural stream	150.56	150.56	-	194.23	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**214.62**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream	-	-	-	214.62	-	-	-	-	-	-	-	-
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	**458.72**	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	-	-	**971.78**	**482.86**	**348.09**	-	-	-	-	**330.74**	**17.35**	-
(Pumping points)	Public well	-	-	702.27	-	-	-	-	-	-	-	-	-
	Private well	-	-	269.50	482.86	348.09	-	-	-	-	330.74	17.35	-
7. RID/EGAT*	**Total**	-	-	-	-	**35,043.30**	**28,953.63**	**4,888.64**	**864.90**	**336.14**	-	-	**28,126.12**
(Projects)	Reservoirs	-	-	-	-	22,800.50	21,096.25	1,159.50	544.75	-	-	-	28,126.12
	Water loss from reservoirs	-	-	-	-	6,975.73	6,582.44	267.58	125.71	-	-	-	-
	Natural stream	-	-	-	-	4,342.52	1,035.89	2,812.51	157.98	336.14	-	-	-
	Water loss from natural stream	-	-	-	-	924.55	239.05	649.04	36.46	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	**907.52**	-	-	-	-	**854.09**	**53.43**	-
(Pumping points)	Pond	-	-	-	-	907.52	-	-	-	-	854.09	53.43	-
	Water loss from pond	-	-	-	-	36.62	-	-	-	-	36.62	-	-
9. Department of Water Resources	**Total**	-	-	-	**2,475.58**	**3,205.31**	-	-	-	-	**3,004.70**	**200.60**	-
(Pumping points)	Natural stream	-	-	-	2,475.58	3,205.31	-	-	-	-	3,004.70	200.60	-
Total of agaencies		**1,418.47**	**1,418.47**	**1,430.49**	**4,582.07**	**39,504.21**	**28,953.63**	**4,888.64**	**864.90**	**336.14**	**4,189.53**	**271.38**	**28,126.12**

Table 53 Summary of water supply 2 analysis or water allocated from projects to water user in year 2007

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**461.46**	**461.46**	-	**592.49**	-	-	-	-	-	-	-	
(Pumping points)	Stream	179.96	179.96	-	217.57	-	-	-	-	-	-	-	-
	Water loss from stream	53.57	53.57	-	64.68	-	-	-	-	-	-	-	-
	Reservoirs	70.66	70.66	-	92.81	-	-	-	-	-	-	-	-
	Water loss from reservoirs	21.10	21.10	-	27.71	-	-	-	-	-	-	-	-
	Irrigated canal	48.66	48.66	-	68.37	-	-	-	-	-	-	-	-
	Water loss from Irrigated canal	14.23	14.23	-	19.98	-	-	-	-	-	-	-	-
	Groundwater well	56.70	56.70	-	78.45	-	-	-	-	-	-	-	-
	Water loss from groundwater well	16.58	16.58	-	22.91	-	-	-	-	-	-	-	-
2. Metropolitan Water Works*	**Total**	**725.18**	**725.18**	-	**887.90**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream	725.18	725.18	-	887.90	-	-	-	-	-	-	-	-
	Water loss from natural stream	163.78	163.78	-	200.54	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**216.10**	-	-	-	-	-	-	-	-
(Pumping points)	Natural stream				216.10								
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	**458.72**	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	-	-	**1,151.90**	**503.33**	**323.98**	-	-	-	-	**302.02**	**21.95**	-
(Pumping points)	Public well	-	-	862.60	-	-	-	-	-	-	-	-	-
	Private well	-	-	289.31	503.33	323.98	-	-	-	-	302.02	21.95	-
7. RID/EGAT*	**Total**	-	-	-	-	**35,173.29**	**29,090.02**	**4,880.44**	**866.58**	**336.25**	-	-	**18,724.78**
(Projects)	Reservoirs	-	-	-	-	23,387.63	21,701.38	1,142.87	543.39	-	-	-	18,724.78
	Water loss from reservoirs					6,919.28	6,530.14	263.74	125.40	-	-	-	-
	Natural stream	-	-	-	-	4,016.98	697.54	2,822.49	160.71	336.25	-	-	-
	Water loss from natural stream	-	-	-	-	849.40	160.97	651.34	37.09	-	-	-	-
8. Land Development Departmer	**Total**	-	-	-	-	**874.94**	-	-	-	-	**813.07**	**61.87**	-
(Pumping points)	Pond	-	-	-	-	874.94	-	-	-	-	813.07	61.87	-
	Water loss from pond	-	-	-	-	37.77	-	-	-	-	37.77	-	-
9. Department of Water Resourc	**Total**	-	-	-	**2,425.87**	**3,012.97**	-	-	-	-	**2,771.54**	**241.43**	-
(Pumping points)	Natural stream	-	-	-	2,425.87	3,012.97	-	-	-	-	2,771.54	241.43	-
Total of agaencies		**1,512.92**	**1,512.92**	**1,610.62**	**4,625.69**	**39,385.18**	**29,090.02**	**4,880.44**	**866.58**	**336.25**	**3,886.64**	**325.25**	**18,724.78**

Table 54 Summary of water supply 2 analysis or water allocated from projects to water user in industrial sector in year 2005

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**501.51**	**51.83**	**58.80**	**8.20**	**28.71**	**54.31**	**3.84**	**3.74**	**19.84**	**7.29**	**13.70**	**2.35**	**38.51**
(Pumping points)	Stream	189.19	23.32	25.75	4.14	12.87	15.05	1.30	1.00	10.10	2.71	4.26	0.68	11.16
	Water loss from stream	56.29	6.97	7.68	1.24	3.84	4.42	0.39	0.29	3.02	0.81	1.25	0.20	3.33
	Reservoirs	80.16	10.24	8.33	0.53	4.43	3.79	0.51	0.38	2.25	1.12	1.40	0.22	13.85
	Water loss from reservoirs	23.95	3.06	2.49	0.16	1.33	1.12	0.15	0.11	0.67	0.33	0.41	0.07	4.15
	Irrigated canal	54.69	2.77	5.10	0.80	2.22	10.58	0.55	0.70	1.50	0.85	2.05	0.42	2.40
	Water loss from Irrigated canal	16.00	0.81	1.50	0.23	0.65	3.08	0.16	0.20	0.44	0.25	0.60	0.12	0.71
	Groundwater well	62.86	3.60	6.14	0.86	2.61	12.60	0.61	0.82	1.44	0.95	2.88	0.50	2.25
	Water loss from groundwater well	18.37	1.06	1.80	0.25	0.77	3.67	0.18	0.24	0.42	0.28	0.84	0.14	0.66
2. Metropolitan Water Works*	**Total**	**814.21**	**32.47**	**67.03**	**10.94**	**27.55**	**180.21**	**8.31**	**11.88**	**16.59**	**12.77**	**34.04**	**7.11**	**30.92**
(Pumping points)	Natural stream	814.21	32.47	67.03	10.94	27.55	180.21	8.31	11.88	16.59	12.77	34.04	7.11	30.92
	Water loss from natural stream	183.90	7.33	15.14	2.47	6.22	40.70	1.88	2.68	3.75	2.88	7.69	1.60	6.98
3. Industrial Estate	**Total**	**212.83**	**1.17**	**2.04**	**1.11**	**1.98**	**4.54**	**0.72**	**0.63**	**0.31**	**0.80**	**3.19**	**0.29**	**35.59**
(Pumping points)	Natural stream	212.83	1.17	2.04	1.11	1.98	4.54	0.72	0.63	0.31	0.80	3.19	0.29	35.59
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**458.56**	**26.97**	**60.33**	**7.94**	**20.92**	**74.63**	**3.58**	**4.66**	**14.97**	**6.88**	**33.52**	**2.83**	**15.53**
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	458.56	26.97	60.33	7.94	20.92	74.63	3.58	4.66	14.97	6.88	33.52	2.83	15.53
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs													
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,395.84**	**160.26**	**270.84**	**27.41**	**99.44**	**392.48**	**19.51**	**26.11**	**53.94**	**36.46**	**146.13**	**15.42**	**145.94**
(Pumping points)	Natural stream	2,395.84	160.26	270.84	27.41	99.44	392.48	19.51	26.11	53.94	36.46	146.13	15.42	145.94
Total of agaencies		**4,382.95**	**272.69**	**459.04**	**55.60**	**178.59**	**706.18**	**35.97**	**47.01**	**105.64**	**64.20**	**230.59**	**28.01**	**266.50**

Table 54 Summary of water supply 2 analysis or water allocated from projects to water user in industrial sector in year 2005 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product	2.21 Vihicle and equipment	2.22 Other product (MCM)
1. Provincial Water works*	**Total**	**501.51**	**3.37**	**24.54**	**20.11**	**12.47**	**34.40**	**23.86**	**5.91**	**15.67**	**28.39**	**41.65**
(Pumping points)	Stream	189.19	1.47	13.31	6.29	4.71	10.21	6.98	1.72	4.68	9.34	18.14
	Water loss from stream	56.29	0.44	3.98	1.86	1.40	3.02	2.06	0.51	1.38	2.77	5.42
	Reservoirs	80.16	0.67	1.98	2.88	2.47	6.61	3.09	0.67	2.70	4.78	7.24
	Water loss from reservoirs	23.95	0.20	0.59	0.86	0.74	1.98	0.92	0.20	0.80	1.43	2.17
	Irrigated canal	54.69	0.25	1.80	2.92	1.16	4.54	3.86	1.00	2.18	3.60	3.45
	Water loss from Irrigated canal	16.00	0.07	0.53	0.85	0.34	1.33	1.13	0.29	0.64	1.05	1.01
	Groundwater well	62.86	0.21	1.82	3.44	1.27	5.19	4.51	1.18	2.55	4.19	3.27
	Water loss from groundwater well	18.37	0.06	0.53	1.00	0.37	1.51	1.31	0.34	0.74	1.22	0.96
2. Metropolitan Water Works*	**Total**	**814.21**	**2.31**	**21.21**	**47.95**	**15.98**	**73.61**	**64.14**	**16.68**	**35.71**	**56.95**	**39.85**
(Pumping points)	Natural stream	814.21	2.31	21.21	47.95	15.98	73.61	64.14	16.68	35.71	56.95	39.85
	Water loss from natural stream	183.90	0.52	4.79	10.83	3.61	16.63	14.49	3.77	8.07	12.86	9.00
3. Industrial Estate	**Total**	**212.83**	**0.22**	**8.47**	**8.45**	**3.64**	**17.37**	**7.96**	**3.30**	**26.24**	**17.39**	**67.42**
(Pumping points)	Natural stream	212.83	0.22	8.47	8.45	3.64	17.37	7.96	3.30	26.24	17.39	67.42
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**458.56**	**1.98**	**20.15**	**20.38**	**9.23**	**30.60**	**26.16**	**7.07**	**15.10**	**26.43**	**28.72**
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	458.56	1.98	20.15	20.38	9.23	30.60	26.16	7.07	15.10	26.43	28.72
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs											
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,395.84**	**10.37**	**61.00**	**115.61**	**52.14**	**189.21**	**146.78**	**38.84**	**90.45**	**151.31**	**146.19**
(Pumping points)	Natural stream	2,395.84	10.37	61.00	115.61	52.14	189.21	146.78	38.84	90.45	151.31	146.19
Total of agaencies		**4,382.95**	**18.25**	**135.37**	**212.50**	**93.46**	**345.18**	**268.90**	**71.80**	**183.17**	**280.47**	**323.83**

Table 55 Summary of water supply 2 analysis or water allocated from projects to water user in industrial sector in year 2006

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (MCM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**548.6**	**53.74**	**63.30**	**8.69**	**30.73**	**62.40**	**4.35**	**4.50**	**21.10**	**7.98**	**16.14**	**2.86**	**40.82**
(Pumping points)	Stream	201.0	23.70	27.12	4.22	13.48	16.89	1.45	1.19	10.52	2.89	4.99	0.81	11.74
	Water loss from stream	59.7	7.08	8.08	1.26	4.03	4.95	0.43	0.35	3.14	0.86	1.47	0.24	3.50
	Reservoirs	84.8	10.48	8.80	0.55	4.68	4.11	0.55	0.42	2.39	1.18	1.77	0.27	14.29
	Water loss from reservoirs	25.3	3.14	2.63	0.16	1.40	1.21	0.16	0.13	0.71	0.35	0.52	0.08	4.28
	Irrigated canal	64.1	3.15	5.91	0.93	2.54	12.47	0.64	0.86	1.69	0.99	2.49	0.52	2.76
	Water loss from Irrigated canal	18.7	0.92	1.73	0.27	0.75	3.63	0.19	0.25	0.50	0.29	0.73	0.15	0.81
	Groundwater well	73.5	4.07	6.98	1.01	2.99	14.82	0.72	1.01	1.66	1.11	3.23	0.61	2.66
	Water loss from groundwater well	21.5	1.20	2.05	0.30	0.88	4.32	0.21	0.29	0.49	0.32	0.94	0.18	0.77
2. Metropolitan Water Works*	**Total**	**860.4**	**34.07**	**71.26**	**11.74**	**29.12**	**188.78**	**8.73**	**12.98**	**17.46**	**13.44**	**36.31**	**7.77**	**32.65**
(Pumping points)	Natural stream	860.4	34.07	71.26	11.74	29.12	188.78	8.73	12.98	17.46	13.44	36.31	7.77	32.65
	Water loss from natural stream	194.2	7.69	16.09	2.65	6.57	42.61	1.97	2.93	3.94	3.03	8.20	1.75	7.37
3. Industrial Estate	**Total**	**214.6**	**1.18**	**2.06**	**1.12**	**2.00**	**4.58**	**0.73**	**0.63**	**0.31**	**0.81**	**3.22**	**0.30**	**35.87**
(Pumping points)	Natural stream	214.6	1.18	2.06	1.12	2.00	4.58	0.73	0.63	0.31	0.81	3.22	0.30	35.87
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**482.9**	**28.21**	**63.75**	**8.48**	**21.99**	**77.48**	**3.75**	**5.05**	**16.04**	**7.25**	**35.42**	**3.09**	**16.35**
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	482.9	28.21	63.75	8.48	21.99	77.48	3.75	5.05	16.04	7.25	35.42	3.09	16.35
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs													
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,475.6**	**161.90**	**277.98**	**28.74**	**101.58**	**405.81**	**20.15**	**28.04**	**55.41**	**37.78**	**152.96**	**16.80**	**148.22**
(Pumping points)	Natural stream	2,475.6	161.90	277.98	28.74	101.58	405.81	20.15	28.04	55.41	37.78	152.96	16.80	148.22
Total of agaencies		**4,582.07**	**279.10**	**478.35**	**58.77**	**185.42**	**739.05**	**37.71**	**51.20**	**110.32**	**67.26**	**244.05**	**30.82**	**273.91**

Table 55 Summary of water supply 2 analysis or water allocated from projects to water user in industrial sector in year 2006 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1. Provincial Water works*	**Total**	**548.6**	**3.62**	**25.26**	**23.27**	**13.50**	**38.21**	**27.34**	**6.72**	**17.87**	**31.75**	**44.43**
(Pumping points)	Stream	201.0	1.55	13.24	7.13	5.00	10.99	7.84	1.92	5.24	10.23	18.86
	Water loss from stream	59.7	0.46	3.96	2.11	1.49	3.25	2.31	0.56	1.55	3.03	5.63
	Reservoirs	84.8	0.71	2.11	3.23	2.60	6.94	3.34	0.71	2.92	5.08	7.62
	Water loss from reservoirs	25.3	0.21	0.63	0.96	0.78	2.07	1.00	0.21	0.87	1.52	2.28
	Irrigated canal	64.1	0.28	2.03	3.50	1.35	5.39	4.59	1.18	2.61	4.25	3.93
	Water loss from Irrigated canal	18.7	0.08	0.60	1.02	0.39	1.57	1.34	0.34	0.76	1.24	1.16
	Groundwater well	73.5	0.24	2.08	4.11	1.47	6.19	5.36	1.39	3.04	4.95	3.83
	Water loss from groundwater well	21.5	0.07	0.61	1.20	0.43	1.80	1.56	0.40	0.89	1.44	1.12
2. Metropolitan Water Works*	**Total**	**860.4**	**2.42**	**22.32**	**51.08**	**16.73**	**77.73**	**67.84**	**17.54**	**38.04**	**60.23**	**42.20**
(Pumping points)	Natural stream	860.4	2.42	22.32	51.08	16.73	77.73	67.84	17.54	38.04	60.23	42.20
	Water loss from natural stream	194.2	0.55	5.04	11.53	3.78	17.55	15.32	3.96	8.59	13.60	9.53
3. Industrial Estate	**Total**	**214.6**	**0.22**	**8.55**	**8.52**	**3.67**	**17.51**	**8.03**	**3.33**	**26.45**	**17.54**	**68.00**
(Pumping points)	Natural stream	214.6	0.22	8.55	8.52	3.67	17.51	8.03	3.33	26.45	17.54	68.00
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**482.9**	**2.11**	**21.10**	**21.58**	**9.69**	**31.97**	**27.48**	**7.39**	**15.96**	**27.76**	**30.96**
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	482.9	2.11	21.10	21.58	9.69	31.97	27.48	7.39	15.96	27.76	30.96
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs											
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,475.6**	**10.67**	**63.11**	**121.62**	**53.34**	**194.59**	**153.04**	**40.21**	**94.63**	**156.72**	**152.29**
(Pumping points)	Natural stream	2,475.6	10.67	63.11	121.62	53.34	194.59	153.04	40.21	94.63	156.72	152.29
Total of agaencies		**4,582.07**	**19.05**	**140.34**	**226.07**	**96.92**	**360.00**	**283.73**	**75.18**	**192.95**	**293.99**	**337.88**

Table 56 Summary of water supply 2 analysis or water allocated from projects to water user in industrial in sector year 2007

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**592.5**	**56.62**	**68.85**	**9.42**	**32.16**	**66.40**	**4.57**	**4.57**	**22.70**	**8.43**	**18.51**	**3.07**	**46.30**
(Pumping points)	Stream	217.6	25.03	29.57	4.54	14.11	17.90	1.53	1.17	11.38	3.07	5.90	0.87	13.37
	Water loss from stream	64.7	7.48	8.82	1.35	4.21	5.25	0.45	0.34	3.40	0.91	1.74	0.26	3.99
	Reservoirs	92.8	10.96	9.48	0.58	4.87	4.35	0.58	0.41	2.56	1.24	2.16	0.30	16.61
	Water loss from reservoirs	27.7	3.28	2.83	0.17	1.46	1.28	0.17	0.12	0.76	0.37	0.64	0.09	4.98
	Irrigated canal	68.4	3.31	6.41	1.02	2.67	13.31	0.67	0.90	1.79	1.04	2.68	0.56	2.94
	Water loss from Irrigated canal	20.0	0.97	1.88	0.30	0.78	3.88	0.20	0.26	0.53	0.30	0.78	0.16	0.86
	Groundwater well	78.5	4.30	7.63	1.12	3.14	15.83	0.75	1.06	1.76	1.17	3.56	0.65	2.75
	Water loss from groundwater well	22.9	1.27	2.24	0.33	0.92	4.61	0.22	0.31	0.51	0.34	1.04	0.19	0.80
2. Metropolitan Water Works*	**Total**	**887.9**	**34.82**	**74.84**	**12.69**	**29.65**	**195.69**	**8.89**	**13.27**	**17.76**	**13.71**	**37.68**	**8.10**	**32.63**
(Pumping points)	Natural stream	887.9	34.82	74.84	12.69	29.65	195.69	8.89	13.27	17.76	13.71	37.68	8.10	32.63
	Water loss from natural stream	200.5	7.87	16.90	2.87	6.70	44.20	2.01	3.00	4.01	3.10	8.51	1.83	7.37
3. Industrial Estate	**Total**	**216.1**	**1.18**	**2.07**	**1.12**	**2.01**	**4.59**	**0.73**	**0.63**	**0.31**	**0.81**	**3.23**	**0.30**	**36.16**
(Pumping points)	Natural stream	216.1	1.18	2.07	1.12	2.01	4.59	0.73	0.63	0.31	0.81	3.23	0.30	36.16
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**503.3**	**30.16**	**66.89**	**8.81**	**22.87**	**80.79**	**3.89**	**5.15**	**16.41**	**7.43**	**36.39**	**3.24**	**16.89**
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	503.3	30.16	66.89	8.81	22.87	80.79	3.89	5.15	16.41	7.43	36.39	3.24	16.89
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs													
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,425.9**	**157.12**	**275.69**	**28.96**	**97.94**	**398.77**	**19.44**	**26.90**	**53.14**	**36.23**	**153.11**	**16.59**	**145.69**
(Pumping points)	Natural stream	2,425.9	157.12	275.69	28.96	97.94	398.77	19.44	26.90	53.14	36.23	153.11	16.59	145.69
Total of agaencies		**4,625.69**	**279.91**	**488.34**	**61.00**	**184.62**	**746.25**	**37.51**	**50.52**	**110.32**	**66.62**	**248.92**	**31.30**	**277.68**

Table 56 Summary of water supply 2 analysis or water allocated from projects to water user in industrial sector in year 2007 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product
1. Provincial Water works*	**Total**	**592.49**	**3.98**	**27.27**	**25.00**	**15.24**	**40.96**	**29.33**	**7.25**	**19.19**	**33.61**	**49.06**
(Pumping points)	Stream	217.57	1.69	14.26	7.63	5.72	11.89	8.44	2.07	5.65	10.83	20.96
	Water loss from stream	64.68	0.51	4.26	2.25	1.71	3.52	2.49	0.61	1.67	3.21	6.26
	Reservoirs	92.81	0.82	2.38	3.45	2.99	7.66	3.65	0.78	3.20	5.48	8.31
	Water loss from reservoirs	27.71	0.24	0.71	1.03	0.89	2.29	1.09	0.23	0.95	1.63	2.48
	Irrigated canal	68.37	0.30	2.17	3.79	1.45	5.64	4.88	1.27	2.76	4.46	4.35
	Water loss from Irrigated canal	19.98	0.09	0.64	1.11	0.43	1.64	1.42	0.37	0.80	1.30	1.28
	Groundwater well	78.45	0.25	2.21	4.45	1.58	6.45	5.70	1.49	3.22	5.18	4.20
	Water loss from groundwater well	22.91	0.07	0.65	1.30	0.46	1.88	1.66	0.44	0.94	1.51	1.23
2. Metropolitan Water Works*	**Total**	**887.90**	**2.48**	**22.86**	**53.78**	**17.16**	**78.57**	**69.99**	**18.32**	**38.99**	**61.17**	**44.85**
(Pumping points)	Natural stream	887.90	2.48	22.86	53.78	17.16	78.57	69.99	18.32	38.99	61.17	44.85
	Water loss from natural stream	200.54	0.56	5.16	12.15	3.88	17.75	15.81	4.14	8.81	13.82	10.13
3. Industrial Estate	**Total**	**216.10**	**0.22**	**8.56**	**8.55**	**3.68**	**17.66**	**8.06**	**3.33**	**26.48**	**17.66**	**68.75**
(Pumping points)	Natural stream	216.10	0.22	8.56	8.55	3.68	17.66	8.06	3.33	26.48	17.66	68.75
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**503.33**	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	503.33	2.22	21.40	22.86	10.19	32.99	28.65	7.77	16.59	28.54	33.22
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Projects)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Water loss from reservoirs											
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
	Water loss from natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Pumping points)	Pond	-	-	-	-	-	-	-	-	-	-	-
	Water loss from pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,425.87**	**10.51**	**61.65**	**120.51**	**52.56**	**188.40**	**149.78**	**39.76**	**92.04**	**150.88**	**150.15**
(Pumping points)	Natural stream	2,425.87	10.51	61.65	120.51	52.56	188.40	149.78	39.76	92.04	150.88	150.15
Total of agaencies		**4,625.69**	**17.20**	**120.35**	**207.84**	**88.64**	**325.60**	**257.16**	**68.67**	**176.70**	**263.33**	**312.81**

Table 57 Summary of water supply 3 or water use according to agencies in year 2005

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**306.77**	**306.77**	-	**386.90**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	158.83	158.83	-	189.19	-	-	-	-	-	-	-	-
	Reservoirs	61.43	61.43	-	80.16	-	-	-	-	-	-	-	-
	Irrigated canal	39.70	39.70	-	54.69	-	-	-	-	-	-	-	-
	Groundwater well	46.80	46.80	-	62.86	-	-	-	-	-	-	-	-
2. Metropolitan Water Works*	**Total**	-	**516.50**	-	**630.32**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	516.50	-	630.32	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**212.83**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	-	-	212.83	-	-	-	-	-	-	-	-
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	**458.72**	-	**458.72**	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	458.72	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**935.55**	-	**935.55**	**458.56**	**281.54**	-	-	-	-	**266.30**	**15.24**	-
(Household/Factories/Paddy field)	Public well	689.57	-	689.57	-	-	-	-	-	-	-	-	-
	Private well	245.98	-	245.98	458.56	281.54	-	-	-	-	266.30	15.24	-
7. RID/EGAT*	**Total**	-	-	-	-	**17,215.68**	**13,236.61**	**3,087.53**	**553.54**	**338.01**	-	-	**10,309.90**
(Paddy field)	Reservoirs	-	-	-	-	13,720.04	12,365.57	930.20	424.27	-	-	-	10,309.90
	Natural stream	-	-	-	-	3,495.65	871.04	2,157.33	129.27	338.01	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	**931.14**	-	-	-	-	**875.23**	**55.91**	-
(Paddy field)	Pond	-	-	-	-	931.14	-	-	-	-	875.23	55.91	-
9. Department of Water Resources	**Total**	-	-	-	**2,395.84**	**3,182.09**	-	-	-	-	**2,960.85**	**221.24**	-
(Factories/Paddy field)	Natural stream	-	-	-	2,395.84	3,182.09	-	-	-	-	2,960.85	221.24	-
Total of agaencies		**2,027.30**	**1,149.54**	**1,394.26**	**4,084.45**	**21,610.45**	**13,236.61**	**3,087.53**	**553.54**	**338.01**	**4,102.38**	**292.39**	**10,309.90**

Table 58 Summary of water supply 3 or water use according to agencies in year 2006

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**328.04**	**328.04**	-	**423.33**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	-	-	200.98	-	-	-	-	-	-	-	-
	Reservoirs	-	-	-	84.75	-	-	-	-	-	-	-	-
	Irrigated canal	-	-	-	64.05	-	-	-	-	-	-	-	-
	Groundwater well	-	-	-	73.55	-	-	-	-	-	-	-	-
2. Metropolitan Water Works*	**Total**	**516.40**	**516.40**	-	**666.21**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	516.40	516.40	-	666.21	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**214.62**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	-	-	214.62	-	-	-	-	-	-	-	-
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	**458.72**	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	-	-	**971.78**	**482.86**	**346.87**	-	-	-	-	**330.74**	**16.13**	-
(Household/Factories/Paddy field)	Public well	-	-	702.27	-	-	-	-	-	-	-	-	-
	Private well	-	-	269.50	482.86	346.87	-	-	-	-	330.74	16.13	-
7. RID/EGAT*	**Total**	-	-	-	-	**19,242.74**	**15,310.64**	**3,055.40**	**540.56**	**336.14**	-	-	**28,126.12**
(Paddy field)	Reservoirs	-	-	-	-	15,824.77	14,513.80	891.93	419.04	-	-	-	28,126.12
	Natural stream	-	-	-	-	3,417.97	796.83	2,163.47	121.52	336.14	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	**870.90**	-	-	-	-	**817.47**	**53.43**	-
(Paddy field)	Pond	-	-	-	-	870.90	-	-	-	-	817.47	53.43	-
9. Department of Water Resources	**Total**	-	-	-	**2,475.58**	**3,205.31**	-	-	-	-	**3,004.70**	**200.60**	-
(Factories/Paddy field)	Natural stream	-	-	-	2,475.58	3,205.31	-	-	-	-	3,004.70	200.60	-
Total of agaencies		**1,170.71**	**1,170.71**	**1,430.49**	**4,262.60**	**23,665.82**	**15,310.64**	**3,055.40**	**540.56**	**336.14**	**4,152.91**	**270.17**	**28,126.12**

Table 59 Summary of water supply 3 or water use according to agencies in year 2007

List	Water Resources	1. Domestic water use (MCM/year)	1.1 In municipal area (MCM/year)	1.2 Out municipal (MCM/year)	2. Industrial water use (MCM/year)	3. Agriculture water use (MCM/year)	3.1 Large irrigated projects (MCM/year)	3.2 Medium irrigated projects (MCM/year)	3.3 Small irrigated projects (MCM/year)	3.4 Pumping irrigated projects (MCM/year)	3.5 Rainfed area (MCM/year)	3.6 Livestock (MCM/year)	4. Water for ecosystem (MCM/year)
1. Provincial Water works*	**Total**	**355.98**	**355.98**	-	**457.20**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	-	-	217.57	-	-	-	-	-	-	-	-
	Reservoirs	-	-	-	92.81	-	-	-	-	-	-	-	-
	Irrigated canal	-	-	-	68.37	-	-	-	-	-	-	-	-
	Groundwater well	-	-	-	78.45	-	-	-	-	-	-	-	-
2. Metropolitan Water Works*	**Total**	**561.40**	**561.40**	-	**687.37**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	561.40	561.40	-	687.37	-	-	-	-	-	-	-	-
3. Industrial Estate	**Total**	-	-	-	**216.10**	-	-	-	-	-	-	-	-
(Household/Factories)	Natural stream	-	-	-	216.10	-	-	-	-	-	-	-	-
4. Concession Water Works	**Total**	**326.27**	**326.27**	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	326.27	326.27	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	**458.72**	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	458.72	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	-	-	**1,151.90**	**503.33**	**322.27**	-	-	-	-	**302.02**	**20.24**	-
(Household/Factories/Paddy field)	Public well	-	-	862.60	-	-	-	-	-	-	-	-	-
	Private well	-	-	289.31	503.33	322.27	-	-	-	-	302.02	20.24	-
7. RID/EGAT*	**Total**	-	-	-	-	**19,635.94**	**15,707.80**	**3,050.27**	**541.61**	**336.25**	-	-	**18,724.78**
(Paddy field)	Reservoirs	-	-	-	-	16,468.36	15,171.24	879.13	417.99	-	-	-	18,724.78
	Natural stream	-	-	-	-	3,167.58	536.57	2,171.14	123.62	336.25	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	**837.18**	-	-	-	-	**775.31**	**61.87**	-
(Paddy field)	Pond	-	-	-	-	837.18	-	-	-	-	775.31	61.87	-
9. Department of Water Resources	**Total**	-	-	-	**2,425.87**	**3,012.97**	-	-	-	-	**2,771.54**	**241.43**	-
(Factories/Paddy field)	Natural stream	-	-	-	2,425.87	3,012.97	-	-	-	-	2,771.54	241.43	-
Total of agaencies		**1,243.65**	**1,243.65**	**1,610.62**	**4,289.87**	**23,808.35**	**15,707.80**	**3,050.27**	**541.61**	**336.25**	**3,848.87**	**323.54**	**18,724.78**

Table 60 Summary of water supply 3 or water use according to agencies in industrial sector in year 2005

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**386.90**	**39.92**	**45.33**	**6.32**	**22.12**	**42.02**	**2.97**	**2.89**	**15.28**	**5.62**	**10.59**	**1.82**	**29.67**
(Household/Factories)	Natural stream	189.19	23.32	25.75	4.14	12.87	15.05	1.30	1.00	10.10	2.71	4.26	0.68	11.16
	Reservoirs	80.16	10.24	8.33	0.53	4.43	3.79	0.51	0.38	2.25	1.12	1.40	0.22	13.85
	Irrigated canal	54.69	2.77	5.10	0.80	2.22	10.58	0.55	0.70	1.50	0.85	2.05	0.42	2.40
	Groundwater well	62.86	3.60	6.14	0.86	2.61	12.60	0.61	0.82	1.44	0.95	2.88	0.50	2.25
2. Metropolitan Water Works*	**Total**	**630.32**	**25.14**	**51.89**	**8.47**	**21.32**	**139.51**	**6.43**	**9.20**	**12.85**	**9.88**	**26.36**	**5.50**	**23.94**
(Household/Factories)	Natural stream	630.32	25.14	51.89	8.47	21.32	139.51	6.43	9.20	12.85	9.88	26.36	5.50	23.94
3. Industrial Estate	**Total**	**212.83**	**1.17**	**2.04**	**1.11**	**1.98**	**4.54**	**0.72**	**0.63**	**0.31**	**0.80**	**3.19**	**0.29**	**35.59**
(Household/Factories)	Natural stream	212.83	1.17	2.04	1.11	1.98	4.54	0.72	0.63	0.31	0.80	3.19	0.29	35.59
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**458.56**	**26.97**	**60.33**	**7.94**	**20.92**	**74.63**	**3.58**	**4.66**	**14.97**	**6.88**	**33.52**	**2.83**	**15.53**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	458.56	26.97	60.33	7.94	20.92	74.63	3.58	4.66	14.97	6.88	33.52	2.83	15.53
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,395.84**	**160.26**	**270.84**	**27.41**	**99.44**	**392.48**	**19.51**	**26.11**	**53.94**	**36.46**	**146.13**	**15.42**	**145.94**
(Factories/Paddy field)	Natural stream	2,395.84	160.26	270.84	27.41	99.44	392.48	19.51	26.11	53.94	36.46	146.13	15.42	145.94
Total of agaencies		**4,084.45**	**253.45**	**430.43**	**51.25**	**165.78**	**653.18**	**33.21**	**43.48**	**97.34**	**59.65**	**219.79**	**25.87**	**250.67**

Table 60 Summary of water supply 3 or water use according to agencies in industrial sector in year 2005 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1. Provincial Water works*	**Total**	**386.90**	**2.59**	**18.91**	**15.54**	**9.61**	**26.56**	**18.44**	**4.57**	**12.11**	**21.92**	**32.09**
(Household/Factories)	Natural stream	189.19	1.47	13.31	6.29	4.71	10.21	6.98	1.72	4.68	9.34	18.14
	Reservoirs	80.16	0.67	1.98	2.88	2.47	6.61	3.09	0.67	2.70	4.78	7.24
	Irrigated canal	54.69	0.25	1.80	2.92	1.16	4.54	3.86	1.00	2.18	3.60	3.45
	Groundwater well	62.86	0.21	1.82	3.44	1.27	5.19	4.51	1.18	2.55	4.19	3.27
2. Metropolitan Water Works*	**Total**	**630.32**	**1.79**	**16.42**	**37.12**	**12.37**	**56.98**	**49.65**	**12.92**	**27.65**	**44.09**	**30.85**
(Household/Factories)	Natural stream	630.32	1.79	16.42	37.12	12.37	56.98	49.65	12.92	27.65	44.09	30.85
3. Industrial Estate	**Total**	**212.83**	**0.22**	**8.47**	**8.45**	**3.64**	**17.37**	**7.96**	**3.30**	**26.24**	**17.39**	**67.42**
(Household/Factories)	Natural stream	212.83	0.22	8.47	8.45	3.64	17.37	7.96	3.30	26.24	17.39	67.42
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**458.56**	**1.98**	**20.15**	**20.38**	**9.23**	**30.60**	**26.16**	**7.07**	**15.10**	**26.43**	**28.72**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	458.56	1.98	20.15	20.38	9.23	30.60	26.16	7.07	15.10	26.43	28.72
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,395.84**	**10.37**	**61.00**	**115.61**	**52.14**	**189.21**	**146.78**	**38.84**	**90.45**	**151.31**	**146.19**
(Factories/Paddy field)	Natural stream	2,395.84	10.37	61.00	115.61	52.14	189.21	146.78	38.84	90.45	151.31	146.19
Total of agaencies		**4,084.45**	**16.96**	**124.94**	**197.10**	**86.99**	**320.71**	**249.00**	**66.69**	**171.54**	**261.13**	**305.27**

Table 61 Summary of water supply 3 or water use according to agencies in industrial sector in year 2006

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (McM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**423.33**	**41.40**	**48.81**	**6.70**	**23.69**	**48.29**	**3.36**	**3.48**	**16.26**	**6.16**	**12.48**	**2.21**	**31.45**
(Household/Factories)	Natural stream	200.98	23.70	27.12	4.22	13.48	16.89	1.45	1.19	10.52	2.89	4.99	0.81	11.74
	Reservoirs	84.75	10.48	8.80	0.55	4.68	4.11	0.55	0.42	2.39	1.18	1.77	0.27	14.29
	Irrigated canal	64.05	3.15	5.91	0.93	2.54	12.47	0.64	0.86	1.69	0.99	2.49	0.52	2.76
	Groundwater well	73.55	4.07	6.98	1.01	2.99	14.82	0.72	1.01	1.66	1.11	3.23	0.61	2.66
2. Metropolitan Water Works*	**Total**	**666.21**	**26.38**	**55.18**	**9.09**	**22.55**	**146.16**	**6.76**	**10.05**	**13.52**	**10.41**	**28.11**	**6.02**	**25.28**
(Household/Factories)	Natural stream	666.21	26.38	55.18	9.09	22.55	146.16	6.76	10.05	13.52	10.41	28.11	6.02	25.28
3. Industrial Estate	**Total**	**214.62**	**1.18**	**2.06**	**1.12**	**2.00**	**4.58**	**0.73**	**0.63**	**0.31**	**0.81**	**3.22**	**0.30**	**35.87**
(Household/Factories)	Natural stream	214.62	1.18	2.06	1.12	2.00	4.58	0.73	0.63	0.31	0.81	3.22	0.30	35.87
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**482.86**	**28.21**	**63.75**	**8.48**	**21.99**	**77.48**	**3.75**	**5.05**	**16.04**	**7.25**	**35.42**	**3.09**	**16.35**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	482.86	28.21	63.75	8.48	21.99	77.48	3.75	5.05	16.04	7.25	35.42	3.09	16.35
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,475.58**	**161.90**	**277.98**	**28.74**	**101.58**	**405.81**	**20.15**	**28.04**	**55.41**	**37.78**	**152.96**	**16.80**	**148.22**
(Factories/Paddy field)	Natural stream	2,475.58	161.90	277.98	28.74	101.58	405.81	20.15	28.04	55.41	37.78	152.96	16.80	148.22
Total of agaencies		**4,262.60**	**259.07**	**447.78**	**54.13**	**171.80**	**682.33**	**34.75**	**47.25**	**101.54**	**62.40**	**232.19**	**28.41**	**257.17**

Table 61 Summary of water supply3 or water use according to agencies in industrial sector in year 2006 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1. Provincial Water works*	**Total**	**423.33**	**2.79**	**19.46**	**17.98**	**10.41**	**29.51**	**21.14**	**5.20**	**13.80**	**24.52**	**34.24**
(Household/Factories)	Natural stream	200.98	1.55	13.24	7.13	5.00	10.99	7.84	1.92	5.24	10.23	18.86
	Reservoirs	84.75	0.71	2.11	3.23	2.60	6.94	3.34	0.71	2.92	5.08	7.62
	Irrigated canal	64.05	0.28	2.03	3.50	1.35	5.39	4.59	1.18	2.61	4.25	3.93
	Groundwater well	73.55	0.24	2.08	4.11	1.47	6.19	5.36	1.39	3.04	4.95	3.83
2. Metropolitan Water Works*	**Total**	**666.21**	**1.88**	**17.28**	**39.55**	**12.95**	**60.18**	**52.53**	**13.58**	**29.45**	**46.63**	**32.67**
(Household/Factories)	Natural stream	666.21	1.88	17.28	39.55	12.95	60.18	52.53	13.58	29.45	46.63	32.67
3. Industrial Estate	**Total**	**214.62**	**0.22**	**8.55**	**8.52**	**3.67**	**17.51**	**8.03**	**3.33**	**26.45**	**17.54**	**68.00**
(Household/Factories)	Natural stream	214.62	0.22	8.55	8.52	3.67	17.51	8.03	3.33	26.45	17.54	68.00
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**482.86**	**2.11**	**21.10**	**21.58**	**9.69**	**31.97**	**27.48**	**7.39**	**15.96**	**27.76**	**30.96**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	482.86	2.11	21.10	21.58	9.69	31.97	27.48	7.39	15.96	27.76	30.96
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,475.58**	**10.67**	**63.11**	**121.62**	**53.34**	**194.59**	**153.04**	**40.21**	**94.63**	**156.72**	**152.29**
(Factories/Paddy field)	Natural stream	2,475.58	10.67	63.11	121.62	53.34	194.59	153.04	40.21	94.63	156.72	152.29
Total of agaencies		**4,262.60**	**17.67**	**129.51**	**209.25**	**90.06**	**333.76**	**262.20**	**69.70**	**180.30**	**273.17**	**318.16**

Table 62 Summary of water supply3 or water use according to agencies in industrial sector in year 2007

List	Water Resources	Industrial water use (MCM/year)	2.1 Product from plants (MCM)	2.2 food industrial (MCM)	2.3 Seafood industrial (MCM)	2.4 Beverage industrial (MCM)	2.5 Textile (MCM)	2.6 Garment industrial (MCM)	2.7 Leather product (MCM)	2.8 Wood product (MCM)	2.9 Decoratement product (MCM)	2.10 Paper product (MCM)	2.11 Printing product (MCM)	2.12 Petrochemical product (MCM)
1. Provincial Water works*	**Total**	**457.20**	**43.61**	**53.09**	**7.26**	**24.78**	**51.38**	**3.53**	**3.54**	**17.49**	**6.51**	**14.31**	**2.38**	**35.67**
(Household/Factories)	Natural stream	217.57	25.03	29.57	4.54	14.11	17.90	1.53	1.17	11.38	3.07	5.90	0.87	13.37
	Reservoirs	92.81	10.96	9.48	0.58	4.87	4.35	0.58	0.41	2.56	1.24	2.16	0.30	16.61
	Irrigated canal	68.37	3.31	6.41	1.02	2.67	13.31	0.67	0.90	1.79	1.04	2.68	0.56	2.94
	Groundwater well	78.45	4.30	7.63	1.12	3.14	15.83	0.75	1.06	1.76	1.17	3.56	0.65	2.75
2. Metropolitan Water Works*	**Total**	**687.37**	**26.96**	**57.94**	**9.82**	**22.95**	**151.50**	**6.88**	**10.27**	**13.75**	**10.62**	**29.17**	**6.27**	**25.26**
(Household/Factories)	Natural stream	687.37	26.96	57.94	9.82	22.95	151.50	6.88	10.27	13.75	10.62	29.17	6.27	25.26
3. Industrial Estate	**Total**	**216.10**	**1.18**	**2.07**	**1.12**	**2.01**	**4.59**	**0.73**	**0.63**	**0.31**	**0.81**	**3.23**	**0.30**	**36.16**
(Household/Factories)	Natural stream	216.10	1.18	2.07	1.12	2.01	4.59	0.73	0.63	0.31	0.81	3.23	0.30	36.16
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**503.33**	**30.16**	**66.89**	**8.81**	**22.87**	**80.79**	**3.89**	**5.15**	**16.41**	**7.43**	**36.39**	**3.24**	**16.89**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-	-	-
	Private well	503.33	30.16	66.89	8.81	22.87	80.79	3.89	5.15	16.41	7.43	36.39	3.24	16.89
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,425.87**	**157.12**	**275.69**	**28.96**	**97.94**	**398.77**	**19.44**	**26.90**	**53.14**	**36.23**	**153.11**	**16.59**	**145.69**
(Factories/Paddy field)	Natural stream	2,425.87	157.12	275.69	28.96	97.94	398.77	19.44	26.90	53.14	36.23	153.11	16.59	145.69
Total of agaencies		**4,289.87**	**259.04**	**455.68**	**55.98**	**170.55**	**687.03**	**34.47**	**46.49**	**101.10**	**61.60**	**236.21**	**28.77**	**259.67**

Table 62 Summary of water supply3 or water use according to agencies in industrial sector in year 2007 (con't)

List	Water Resources	Industrial water use (MCM/year)	2.13 Petroleum product (MCM)	2.14 Rubber product (MCM)	2.15 Plastic product (MCM)	2.16 Non metal product (MCM)	2.17 Basic metal product (MCM)	2.18 Metal product (MCM)	2.19 Mechine product (MCM)	2.20 Electric product (MCM)	2.21 Vihicle and equipment (MCM)	2.22 Other product (MCM)
1. Provincial Water works*	**Total**	**457.20**	**3.07**	**21.02**	**19.32**	**11.75**	**31.63**	**22.67**	**5.61**	**14.82**	**25.95**	**37.81**
(Household/Factories)	Natural stream	217.57	1.69	14.26	7.63	5.72	11.89	8.44	2.07	5.65	10.83	20.96
	Reservoirs	92.81	0.82	2.38	3.45	2.99	7.66	3.65	0.78	3.20	5.48	8.31
	Irrigated canal	68.37	0.30	2.17	3.79	1.45	5.64	4.88	1.27	2.76	4.46	4.35
	Groundwater well	78.45	0.25	2.21	4.45	1.58	6.45	5.70	1.49	3.22	5.18	4.20
2. Metropolitan Water Works*	**Total**	**687.37**	**1.92**	**17.70**	**41.63**	**13.28**	**60.83**	**54.18**	**14.18**	**30.18**	**47.36**	**34.72**
(Household/Factories)	Natural stream	687.37	1.92	17.70	41.63	13.28	60.83	54.18	14.18	30.18	47.36	34.72
3. Industrial Estate	**Total**	**216.10**	**0.22**	**8.56**	**8.55**	**3.68**	**17.66**	**8.06**	**3.33**	**26.48**	**17.66**	**68.75**
(Household/Factories)	Natural stream	216.10	0.22	8.56	8.55	3.68	17.66	8.06	3.33	26.48	17.66	68.75
4. Concession Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
5. Village Water Works	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Household/Factories)	Groundwater well	-	-	-	-	-	-	-	-	-	-	-
6. Department of Groundwater	**Total**	**503.33**	**2.22**	**21.40**	**22.86**	**10.19**	**32.99**	**28.65**	**7.77**	**16.59**	**28.54**	**33.22**
(Household/Factories/Paddy field)	Public well	-	-	-	-	-	-	-	-	-	-	-
	Private well	503.33	2.22	21.40	22.86	10.19	32.99	28.65	7.77	16.59	28.54	33.22
7. RID/EGAT*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Reservoirs	-	-	-	-	-	-	-	-	-	-	-
	Natural stream	-	-	-	-	-	-	-	-	-	-	-
8. Land Development Department*	**Total**	-	-	-	-	-	-	-	-	-	-	-
(Paddy field)	Pond	-	-	-	-	-	-	-	-	-	-	-
9. Department of Water Resources	**Total**	**2,425.87**	**10.51**	**61.65**	**120.51**	**52.56**	**188.40**	**149.78**	**39.76**	**92.04**	**150.88**	**150.15**
(Factories/Paddy field)	Natural stream	2,425.87	10.51	61.65	120.51	52.56	188.40	149.78	39.76	92.04	150.88	150.15
Total of agaencies		**4,289.87**	**17.94**	**130.33**	**212.87**	**91.47**	**331.51**	**263.34**	**70.66**	**180.12**	**270.39**	**324.65**

Overview of the water supply and the water use

Overview of water accounting implementation covered water providing of agencies in manager level or water supply 1, water providing of agencies in service provider level or water supply 2, water allocation of agencies/private in service provider/private or water supply 3 and water use can be summarized as table 63

Table 63 Summary of water supply and use in the year 2005-2007

List	Water Resources	Water Volume (MCM)/year)		
		2005	2006	2007
Water Supply 1	Natural stream	13,448.60	13,510.99	13,014.52
	Reservoirs1/	35,475.96	58,238.19	49,395.75
	Groundwater well	2,603.63	2,750.28	2,938.84
	Pond	1,004.15	944.14	912.71
Water Supply 2	Natural stream	12,063.11	12,132.48	11,682.55
	Water loss from stream	1,385.49	1,378.51	1,331.97
	Reservoirs	29,741.59	51,076.98	42,276.42
	Water loss from reservoirs	5,612.36	7,020.39	6,968.09
	Irrigated canal	94.39	108.97	117.02
	Water loss from Irrigated canal	27.62	31.85	34.22
	Groundwater well	2,571.56	2,713.53	2,899.35
	Water loss from groundwater well	32.07	36.75	39.49
	Pond	967.65	907.52	874.94
	Water loss from pond	36.51	36.62	37.77
Water Supply 3	Natural stream	10,781.23	10,867.66	10,473.98
	Water loss from stream	1,281.88	1,264.83	1,208.58
	Reservoirs	24,171.53	44,101.25	35,357.14
	Water loss from reservoirs	5,570.06	6,975.73	6,919.28
	Irrigated canal	94.39	106.70	114.64
	Water loss from Irrigated canal	-	2.27	2.38
	Groundwater well	2,570.30	2,709.24	2,894.33
	Water loss from groundwater well	1.26	4.28	5.01
	Pond	931.14	870.90	837.18
	Water loss from pond	36.51	36.62	37.77
	Water reuse	142.00	150.00	150.00
	Return flow to stream	4,123.00	6,810.00	5,809.00
Water Use	Natural stream	10,781.23	10,867.66	10,473.98
	Reservoirs	24,171.53	44,101.25	35,357.14
	Irrigated canal	94.39	106.70	114.64
	Groundwater well	2,570.30	2,709.24	2,894.33
	Pond	931.14	870.90	837.18

Remark : Reservoir in water supply will be separate to receiving water from reservoirs and canals.

From the water accounting implementation, the water supply from each water resources (Water supply-1) was shown as Figure 6. In the year 2005, 2006 and 2007, the main resources of water supply is from reservoirs, i.e, about 35,354 MCM/year, 58,097 MCM/year and 49,245 MCM/year respectively. The second resources of water supply is natural stream , i.e, about 13,449 MCM/year, 13,511 MCM/year and 13,015 MCM/year respectively.

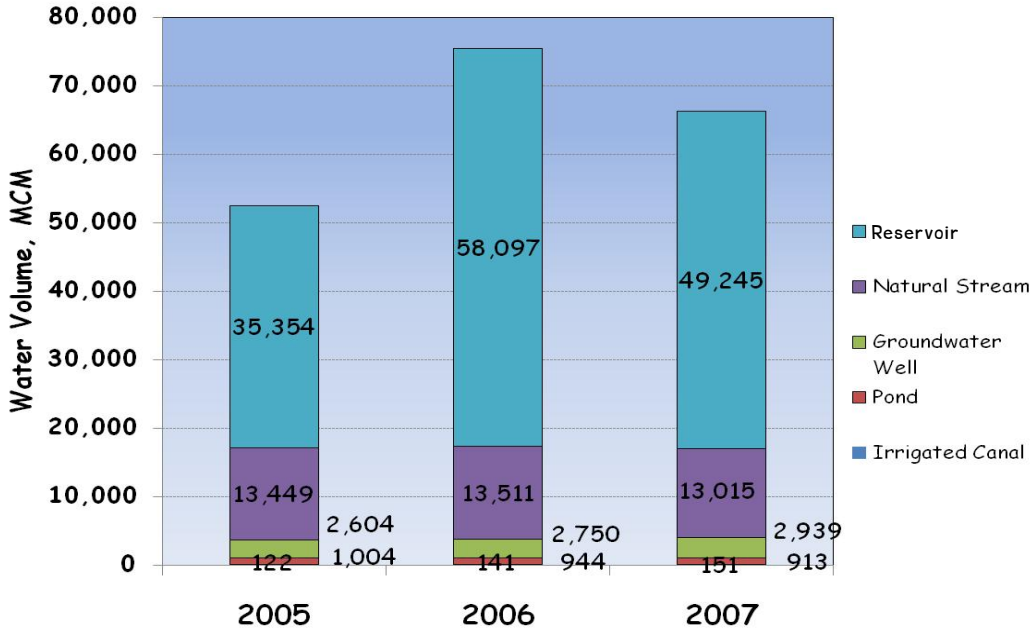


Figure 6 The water supply from each water resource

The water use for each water activities at the water supply 1 level was shown in Figure 7. In the year 2005, 2006 and 2007, the main water use is for agricultural water use, i.e., about 34,719 MCM/year, 39,541 MCM/year and 39,423 MCM/year, respectively. The second water use is for ecosystem water use, i.e., about 10,310 MCM/year, 28,126 MCM/year and 18,725 MCM/year respectively. The industrial water use are 4,567 MCM/year, 4,776 MCM/year and 4,826 MCM/year respectively. The domestic water use are 2,936 MCM/year, 3,000 MCM/year and 3,288 MCM/year respectively.

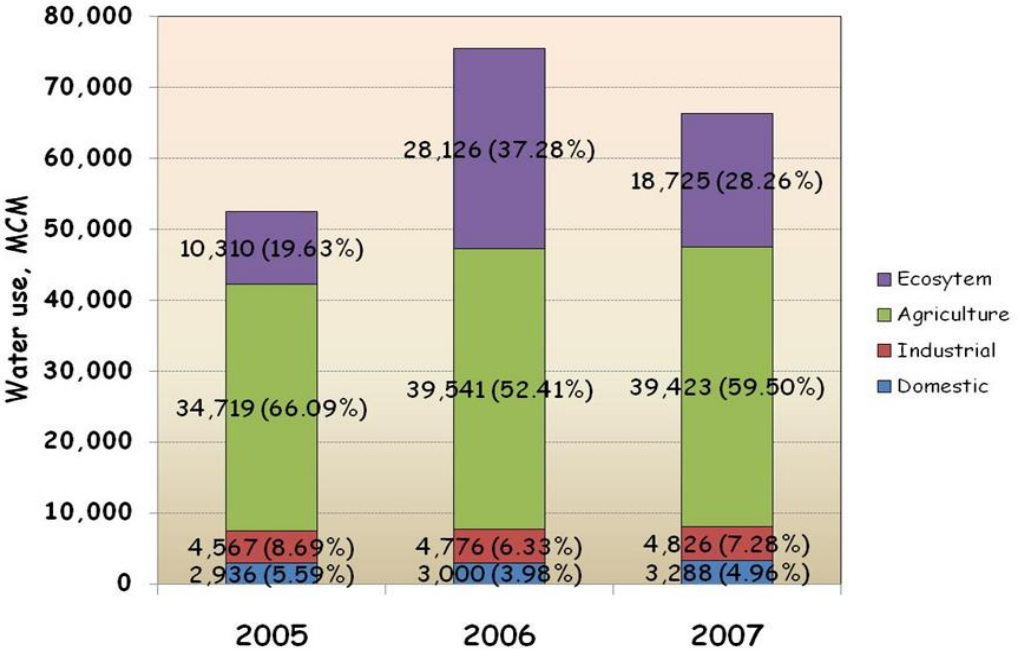


Figure 7 The water use in each activity

The water stock of the country is considered from ratio of reservoirs storage per storage capacity and water release per water use. For the water stock of reservoirs in wet season (May to October) and dry season (January to April) in the year 2005 , 2006 and 2007 at the beginning and end of the season was shown as Figure 8. The abstraction/potential water in the year 2005, 2006 and 2007 shown is Figure 9. The release per inflow are about 64%, 70% and 86%, respectively. The water use per inflow are about 44%, 41% and 52%, respectively. The groundwater use per groundwater potential are about 13%, 14% and 14%, respectively.

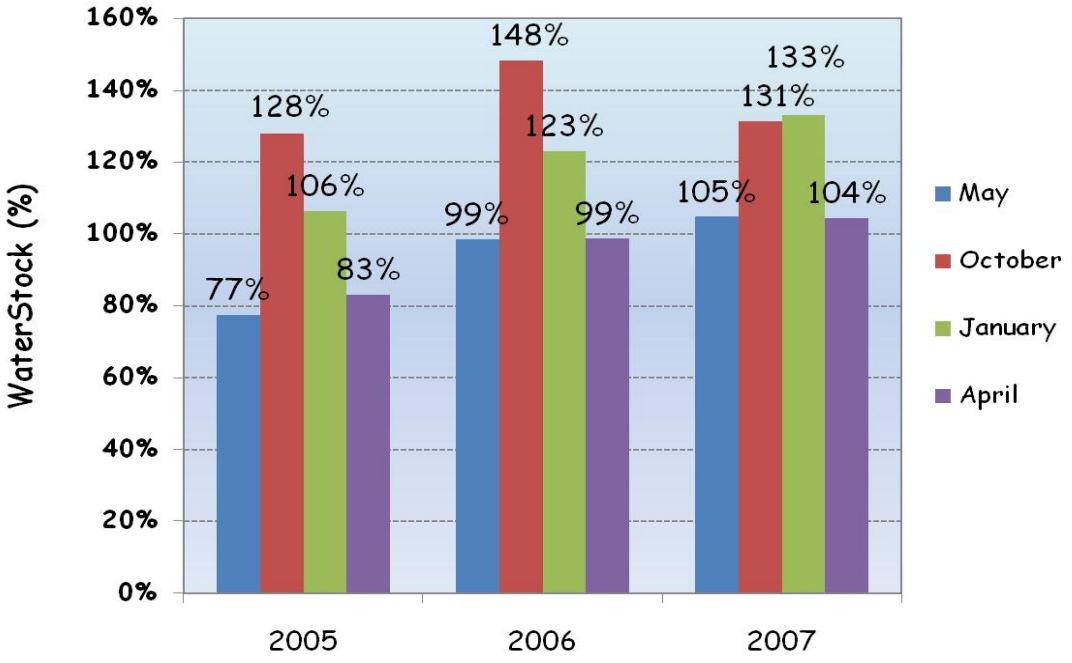


Figure 8 The water stock of reservoir in wet and dry season

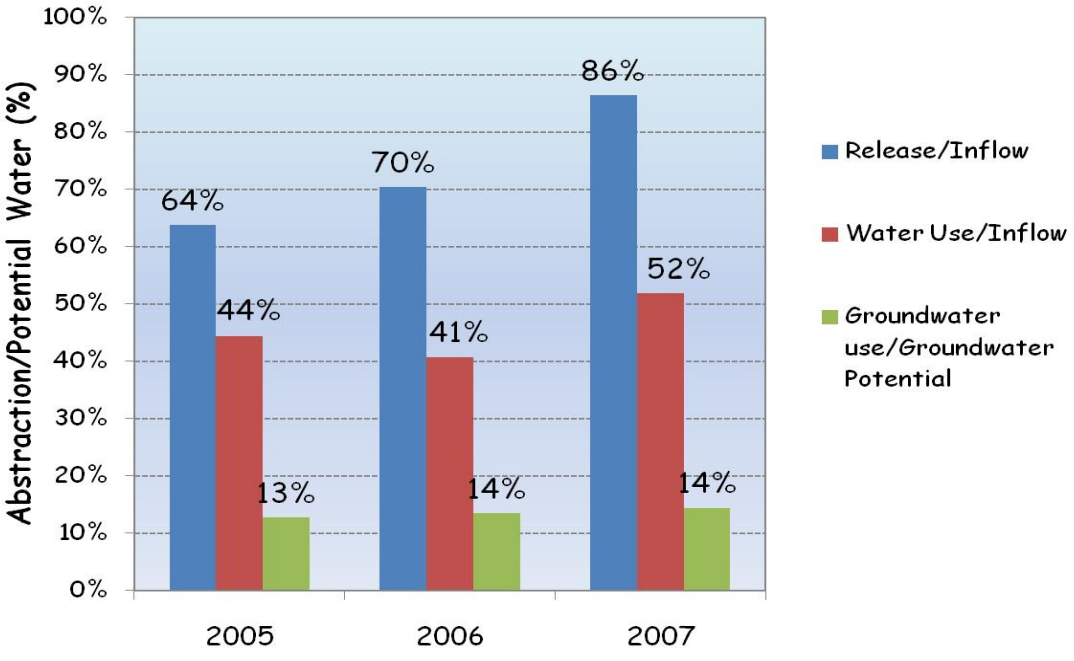


Figure 9 The data of water release /use per inflow in main reservoirs

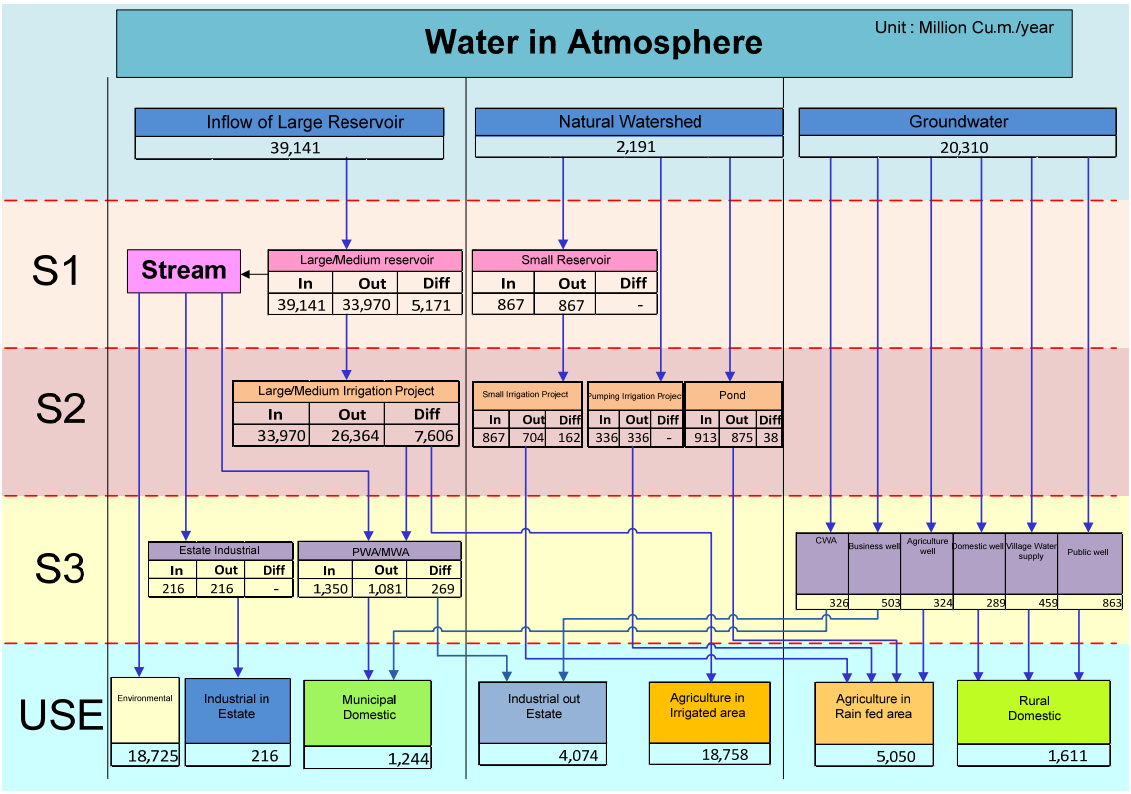
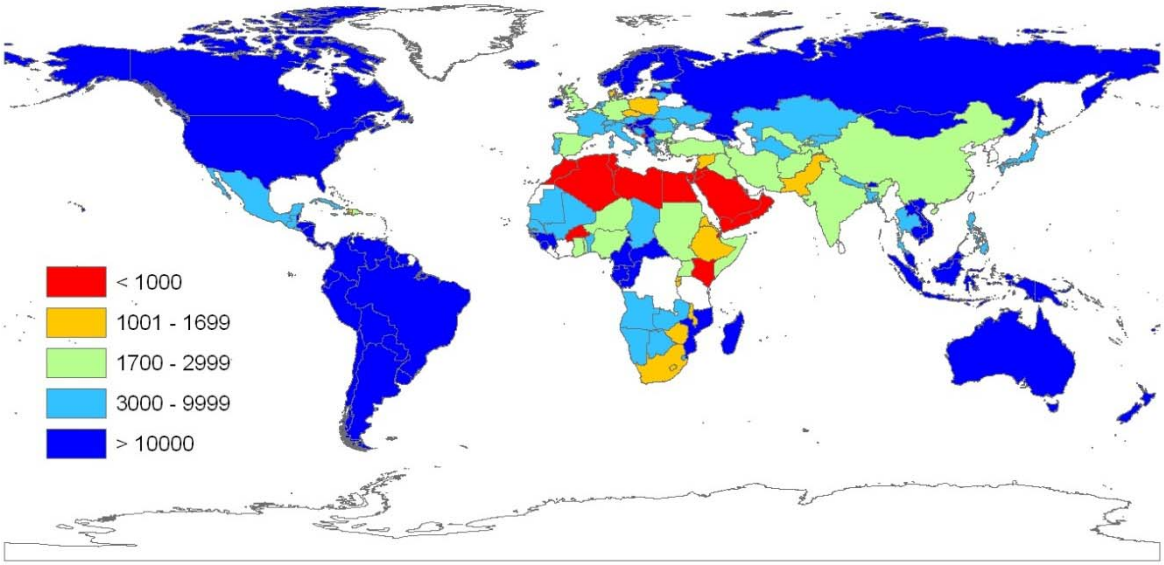


Figure 10 Summary of water distribution in each tier in the year 2007 (normal water year)

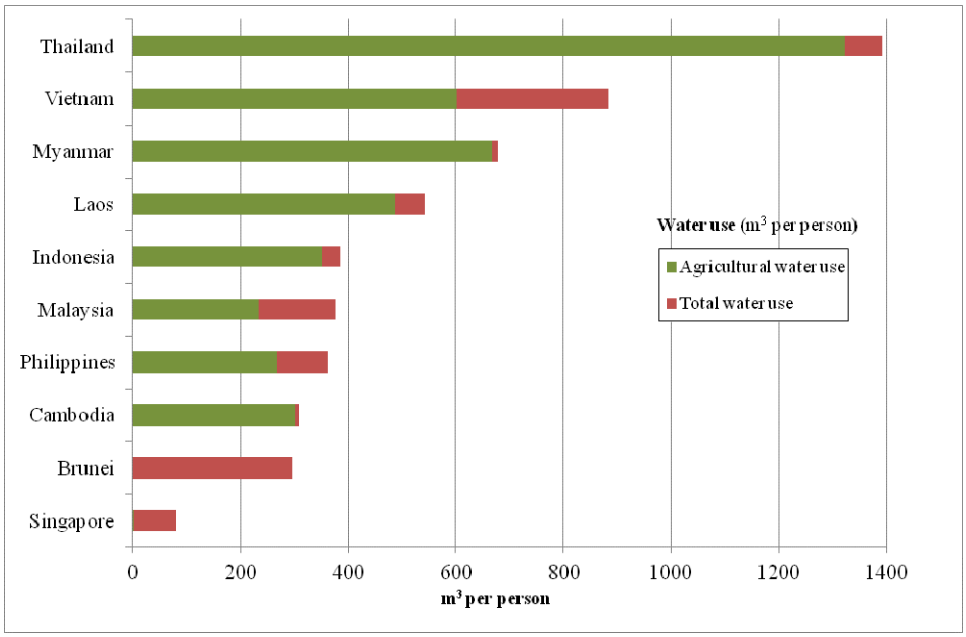
The global water resources are distributed unequally and in most cases mismatch with where dense population are. The annual renewable water resources by country (latest available data 2003-2007 from FAO Aqua stat) is shown in Figure 10.



(data source: FAO Aqua stat).

Figure 11 The global distribution of annual renewable water resources

Countries with the renewable water resources less than 1700 m^3 per person experience water stress according to the United Nations. Thailand's annual renewable water resources were estimated to be 6382 m^3 per person in 2007 and almost half of this amount originated outside the country (FAO Aqua stat). Although Thailand appears to be adequately supplied with water resources on a per capita basis, there is a large seasonal variation of rainfall between wet and dry seasons. Moreover, its agricultural water use is dominant and significantly relied on irrigation. The agricultural water use per capita of Thailand is the highest among Asean countries and was estimated to be 1322 m^3 per person as shown in Figure11. Thailand's agricultural water use is about double that of Myanmar and Vietnam. The ratio of total water use to the renewable water resources per capita of Thailand is about 22% and is only second to the water scarce country, Singapore, whose ratio is almost 60%. With increasing demand from all sectors and larger inter and intra variability of rainfall, Thailand is facing a great challenge to adapt to the changed conditions.



(data source: FAO Aquastat).

Figure 12 The amount withdrawn for agricultural water use and total water use per capita among ASEAN countries

Based on the framework of SEEAW-UN, the water account in the physical unit on water sector was implemented in Thailand (for the first time for the whole country) to estimate the use, supply in each sector and source with water balancing mechanism. The overview of water account implementation included the balancing among water providing of agencies in manager level (or water supply 1), water service providing agencies (or water supply 2), water allocation of agencies/private in service provider/private (or water supply 3).

From the water account implementation, the water supply from each water resources (Water supply-1) was shown as Figure 6. In the year 2005, 2006 and 2007, from the reservoirs were about 35,354 MCM/year, 58,097 MCM/year and 49,245 MCM/year. The second resources of water supply is natural stream were about 13,449 MCM/year, 13,511 MCM/year and 13,015 MCM/year.

The water use for each water activities (at the water supply 1 level) was shown as Figure 7. In the year 2005, 2006 and 2007, were as follows. The main water use is agricultural water use that were about 34,719 MCM/year, 39,541 MCM/year and 39,423 MCM/year. The second water use is ecosystem water use that were about 10,310 MCM/year, 28,126 MCM/year and 18,725 MCM/year. The industrial water use are 4,567 MCM/year, 4,776 MCM/year and 4,826 MCM/year, respectively. The domestic water use are 2,936 MCM/year, 3,000 MCM/year and 3,288 MCM/year, respectively.

For the water stock of main reservoirs in wet season (May to October) and dry season (January to April) was shown as Figure 8. In year 2005 , 2006 and 2007, the abstraction/potential water in the year 2005, 2006 and 2007 was as follows (figure 9). The release per inflow are about 64%, 70% and 86%, respectively. The water use per inflow are about 44%, 41% and 52%, respectively. The groundwater use per groundwater potential are about 13%, 14% and 14%, respectively.

For benchmarking purposes, countries with the renewable water resources less than 1700 m^3 per person experience water stress according to the United Nations. Thailand's annual renewable water resources were estimated to be 6382 m^3 per person in 2007 and almost half of this amount originated outside the country (FAO Aquastat). Although Thailand appears to be adequately supplied with water resources on a per capita basis, there is a large seasonal variation of rainfall between wet and dry seasons. Moreover, its agricultural water use is dominant and significantly relied on irrigation. The agricultural water use per capita of Thailand is the highest among ASEAN countries and was estimated to be 1322 m^3 per person. Thailand's agricultural water use is about double that of Myanmar and Vietnam. The ratio of total water use to the renewable water resources per capita of Thailand is about 22% and is only second to the water scarce country, Singapore, whose ratio is almost 60%. With increasing demand from all sectors and larger inter and intra variability of rainfall, Thailand is facing a great challenge to adapt to the changed conditions.

References

Chulalongkorn University (2002), Groundwater Potential and Demand for Groundwater Management in Northern area of Central Plain, submitted to The Thailand Research Fund.

Chulalongkorn (2010), The System of Integrated Environment and Economic Accounting – Water, Sub-soil and minerals, energy and forest resources- submitted to NESDB (in Thai).

Chulalongkorn (2010) Water Situation 2004 in Thailand, Technical Report (in Thai).

Chulalongkorn (2012), Water Situation 2005 in Thailand, Technical Report (in Thai).

Department of Groundwater Resources (1999), Groundwater Resources in Thailand (edited by Dr. Vachi Ramnaong and Somchai Wongsawad, technical report (in Thai).

Koontanakulvong S. and Suttitamachit C. (2007), Industrial Water Use Estimate in Bangkok Metropolitan Area and its Vicinity, Water International, Vol 32, No 4, Dec., pp. 634-643.

Land Development Department (2007), Small Tank Data (in Thai).

National Economic and Social Advisory Board (2004), Basin and Basin Group Map of Thailand (in Thai).

National Water Account Roadmap, 4 June 2009 Version 2.0 (http://www.bom.gov.au/water/nwa/document/NWA_Roadmap.pdf)

Phuwanich and Tokrisna (2007), Economic Policies for Efficient Water Use in Thailand

Royal Irrigation Department (2007), Reservoir Data (in Thai).

UN (2009), the System of Environmental-Economic Accounting for Water (SEEAW)..