

Miho-chun

Map of River

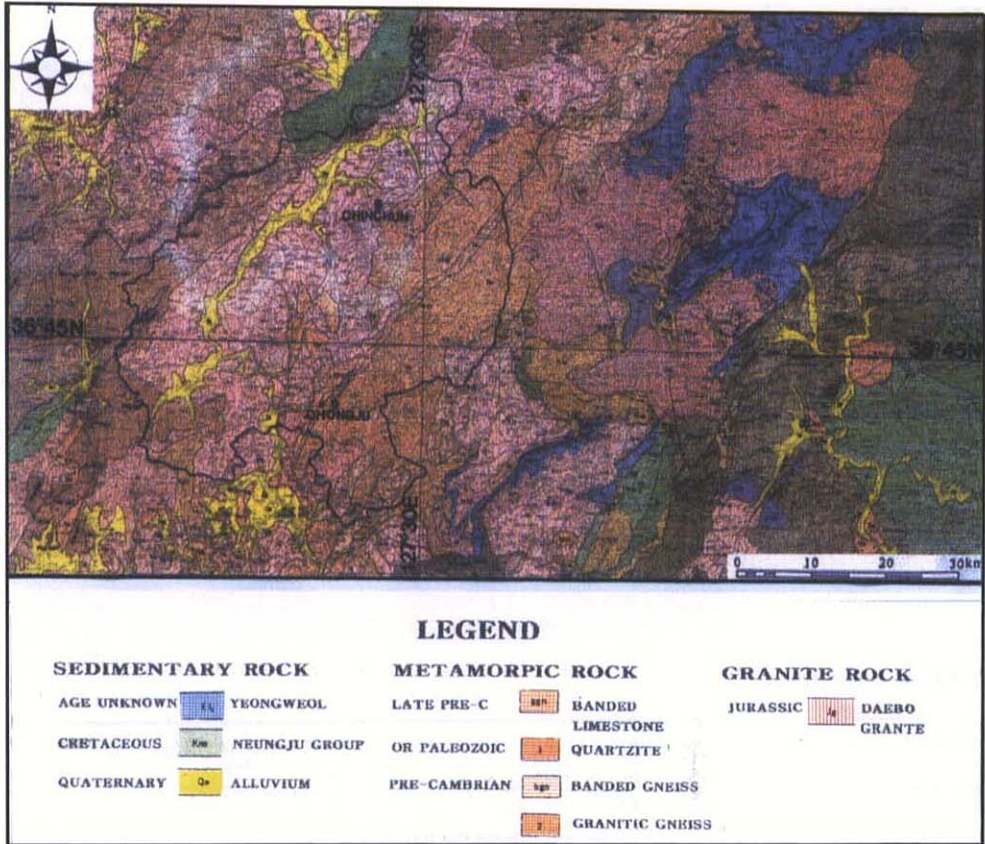


Geographical Survey, Ministry of Construction, Republic of Korea

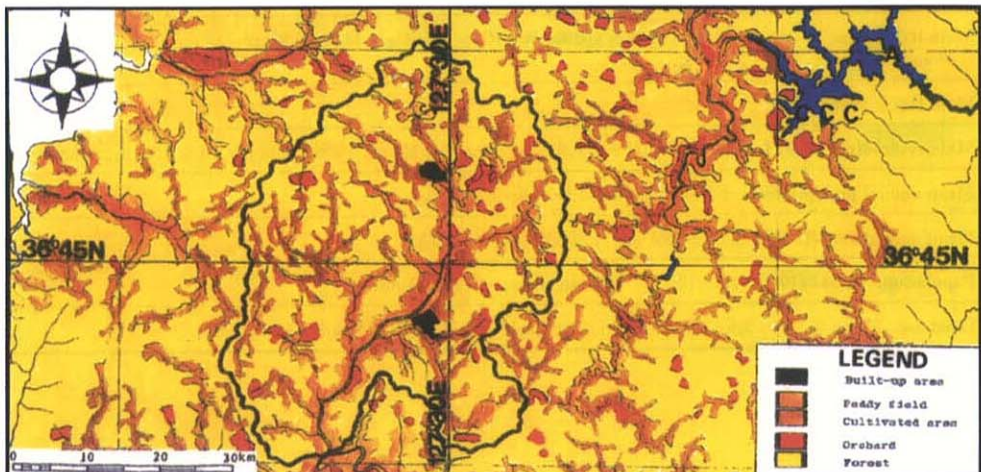
Table of Basic Data

Name: Miho River (Right branch of Geum River)		Serial No.: Republic of Korea-3
Location: Central South Korea	N 36° 31' 30" ~ 37° 02' 30"	E 127° 17' 30" ~ 127° 40'
Area: 1 861 km ²	Length of main stream: 89 km	
Origin: Mt. Mae (472 m)	Highest point: Mt. Mae (472 m)	
Outlet: Geum River	Lowest point: Confluence at Geum River (16 m)	
Main geological features: Cretaceous to Middle Mesozoic; Igneous rocks, Alluvial layer, Weather stone		
Main tributaries: Byongchun River (349 km ²), Chopyong River (131 km ²), Mushim River (184 km ²), Baegkok River (129 km ²)		
Main lakes: None		
Main reservoirs: Miho Triples (11.2 x 10 ⁶ m ³ , 1981), Miho (13.9 x 10 ⁶ m ³ , 1986), Baegkok (21.5 x 10 ⁶ m ³ , 1988)		
Mean annual precipitation: 1 220 mm (1967~1990) (basin average)		
Mean annual runoff: 25.4 m ³ /s at Seokwha (1 590 km ²) (1965~1990)		
Population: 86 544 (1987)	Main cities: Chongju, Umsong	
Land use: Forest (62.8%), Rice paddy (3.5%), Other agriculture (30.5%), Urban (3.7%) (1992)		

2. Geographical Information
 2.1 Geological Map



2.2 Land Use Map



1. General Description

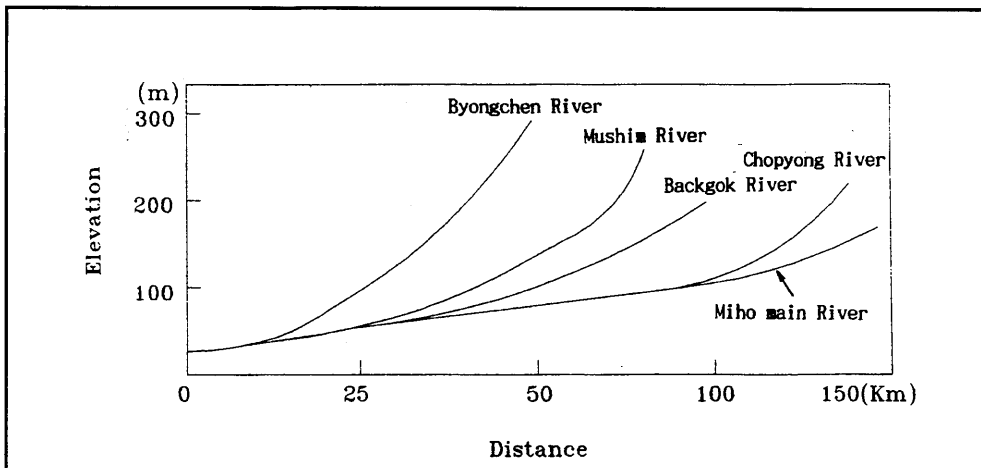
The Miho, which is the largest tributary of the Geum River, is located in the north-eastern part of the Geum Basin. It originates from Mt. Mae (472 m) and flows into the downstream of the Dae Chung Dam. The river is 89 km long and has a catchment area of 1 861 km². The basin average annual precipitation has been 1 220 mm during the period 1967~1990 while the average annual runoff at Seokwha (1 180 km²) has been 25.4 m³/sec during the period 1965~1990. The basin population in 1987 was 86 544. Miho triples dam having a storage capacity of 11.17 x 10⁶ m³ was constructed in the basin in 1981. The basin, which consists of a relatively low mountainous areas and well developed plains is the only area in Chungbuk Province which produces the famous rice and crops for special usage. Typical Korean villages can be easily found in this basin.

2.3 Characteristics of River and Main Tributaries

No.	Name of river	Length [km] Catchment area [km ²]	Highest peak [m] Lowest point [m]	Cities Population (1990)	Land use [%] (1991)
1	Miho (Main River)	82 1068	Mt. Mae, 472 -----	Naesu 15 000	A (33.5) F (57.0)
2	Byongchun (Tributary)	49 349	Mt. Gyejuk, 462 -----	Chonan City 40 148	O (5.8) U (3.7)
3	Mushim (Tributary)	33 184	Mt. Sundo, 547 -----	Chongju City 332 142	
4	Chopyong (Tributary)	40 131	Mt. Mujae, 579 -----		
5	Baegkok (Tributary)	22 129	Mt. Dosa, 598 -----	Chinchon 21 557	

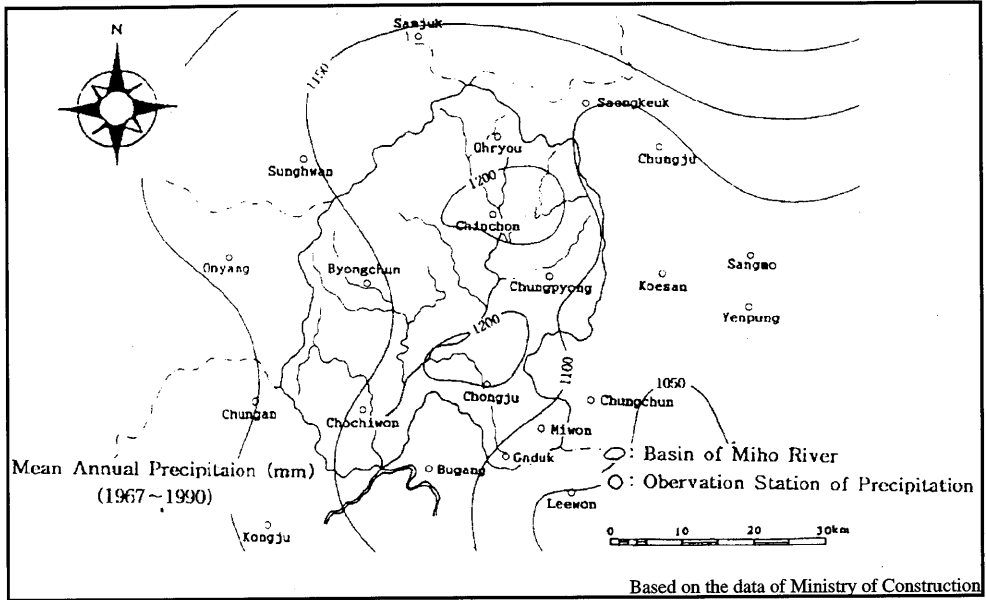
A: Agricultural field F: Forest O: Orchard U: Urban

2.4 Longitudinal Profiles



3. Climatological Information

3.1 Annual Isohyetal Map and Precipitation Observation Stations



3.2 List of Meteorological Observation Stations

No.	Station	Elevation [m]	Location	Observation period	Mean annual precipitation ¹⁾ [mm]	Mean annual evaporation ²⁾ [mm]	Observation items ³⁾
190*	Ohryou	80.0	N 36° 58' 18" E 128° 49' 10"	1973~present	1 106		P(TB)
189*	Chinchon	80.0	N 36° 51' 08" E 127° 26' 45"	1966~present	1 258		P(TB)
186*	Byongchun	60.0	N 36° 45' 30" E 127° 17' 55"	1960~present	1 158		P(TB)
188*	Jyongpyong	70.0	N 36° 46' 45" E 127° 35' 26"	1973~present	1 178		P(TB)
23**	Chongju	59.0	N 36° 38' 00" E 127° 26' 00"	1967~present	1 222	1 059.6	P(TB)
187*	Gaduk	130.0	N 36° 34' 18" E 127° 35' 22"	1971~present	1 022		P(TB)
191*	Bugang	40.0	N 36° 31' 35" E 127° 22' 19"	1960~present	1 121		P(TB)

*: Serial number used by Ministry of Construction

** : Serial number used by Weather Office, Korea Meteorological Agency

1) Period for the mean is from the beginning of the observation period to 1992

2) Measured by 20 cm pan

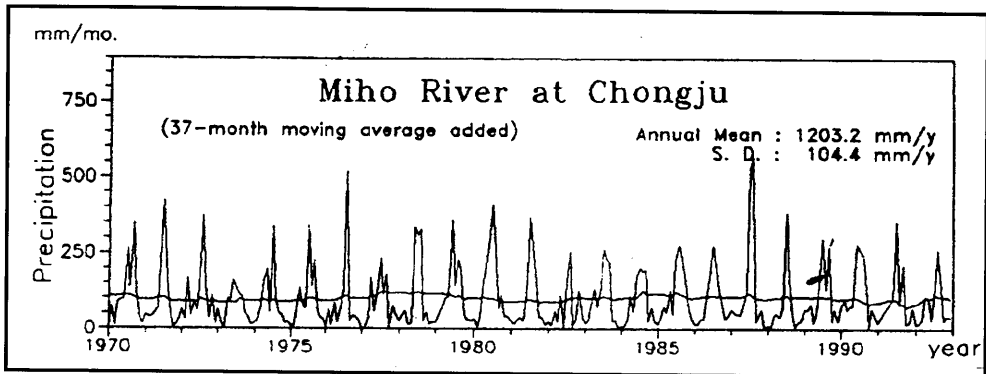
3) P: Precipitation, TB: Tipping bucket with recording chart.

3.3 Monthly Climate Data

Observation item	Observation station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Period for the mean
Temperature [°C]	Chongju	-3.4	-0.8	4.5	11.9	17.5	21.9	25.1	25.3	19.9	13.1	5.7	-0.7	11.7	1970~1991
Precipitation [mm]	Chongju	29.1	32.9	53.0	79.7	84.6	150.7	285.0	231.3	142.8	47.1	46.8	28.2	1 221.2	1970~1991
Evaporation [mm]*	Chongju	33.3	42.8	76.7	115.7	143.5	139.2	125.8	130.6	99.4	76.1	43.5	33.1	1 059.6	1970~1991
Duration of sunshine [hr]	Chongju	160	153	199	221	244	199	166	192	182	198	150	150	2 214.0	1970~1991

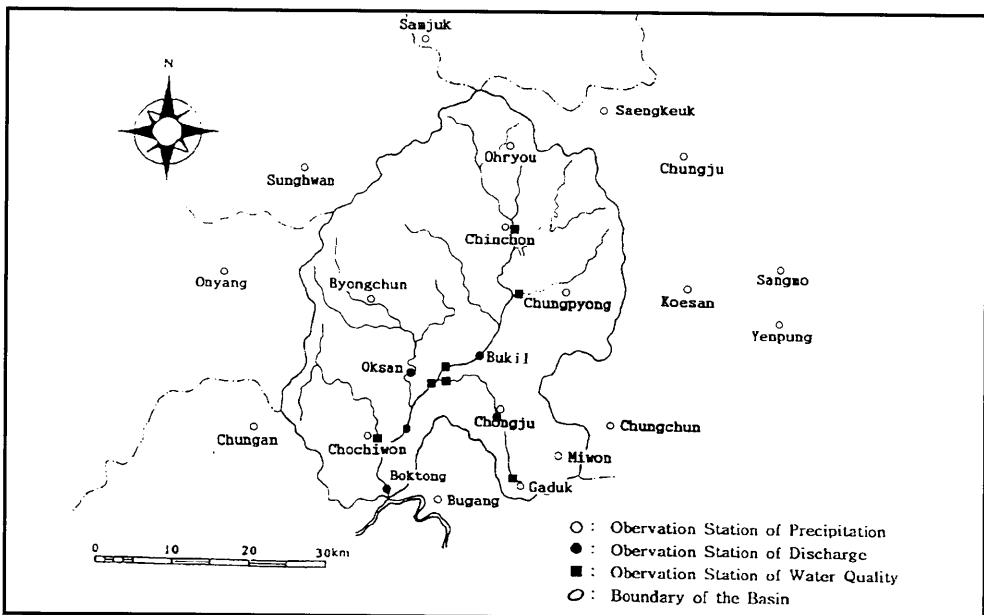
* measured by 20 cm pan

3.4 Long-term Variation of Monthly Precipitation



4. Hydrological Information

4.1 Map of Streamflow Observation Stations



4.2 List of Hydrological Observation Stations

No.*	Station	Location	Catchment area (A) [km ²]	Observation period	Observation items ¹⁾
101*	Bukil	N 35° 42' 40" E 127° 28' 38"	896	1993.6~present	H1
102*	Oksan	N 36° 40' 18" E 127° 21' 52"	365	1993.6~present	H1
110*	Chongju	N 36° 38' 35" E 127° 29' 06"	164	1981 ~present	H1
109*	Seokwha	N 36° 37' 11" E 127° 21' 15"	1 180	1918.7~present	H1, Q

No.*	\bar{Q} ²⁾ [m ³ /s]	Q max ³⁾ [m ³ /s]	\bar{Q} max ⁴⁾ [m ³ /s]	\bar{Q} min ⁵⁾ [m ³ /s]	\bar{Q} / A [m ³ /s/100km ²]	Q max / A [m ³ /s/100km ²]	Period of statistics
109*	27.8	11 425	193	4.83	2.36	614.24	1970~1992

*: Serial number used by Ministry of Construction²⁾

1) H1: Water level in recording chart

Q: Discharge

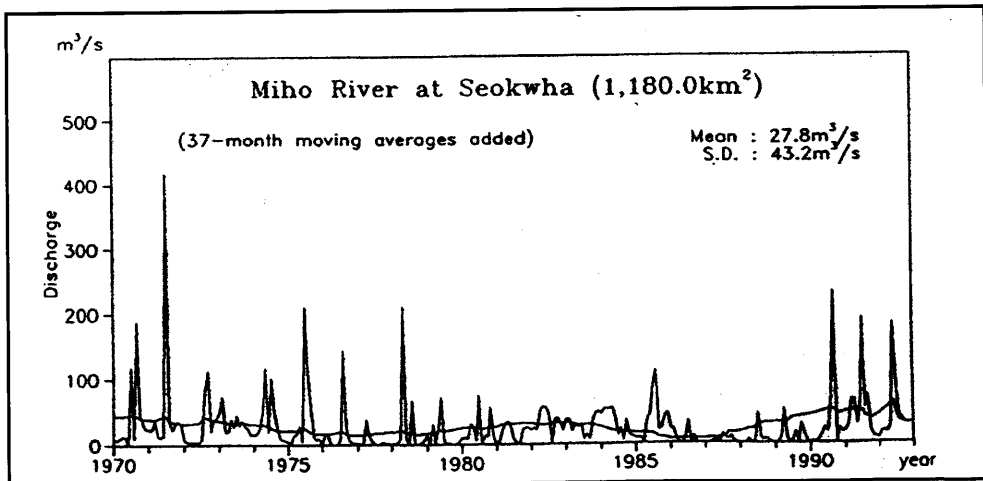
Mean annual discharge

3) Maximum discharge

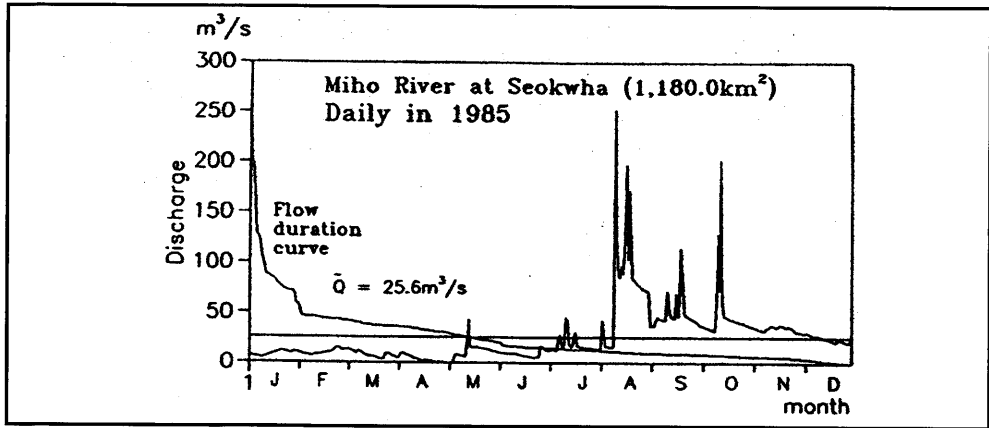
4) Mean annual maximum discharge

5) Mean annual minimum discharge

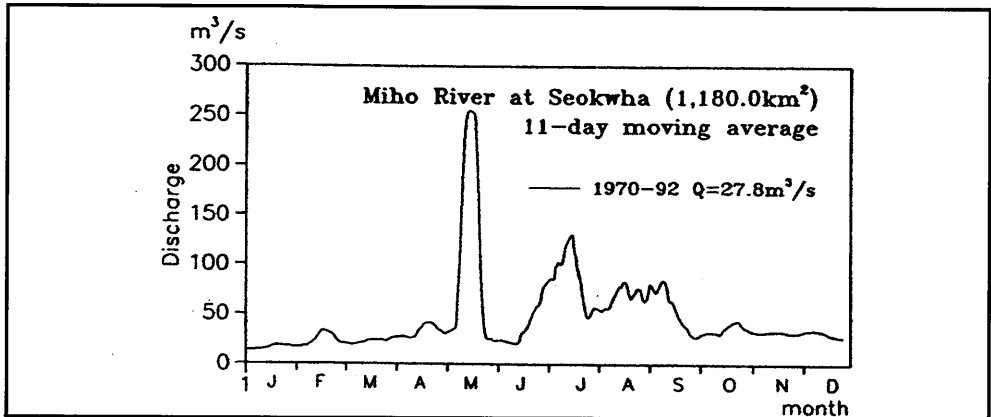
4.3 Long-term Variation of Monthly Discharge



4.4 Annual Pattern of Discharge



4.5 Unique Hydrological Features



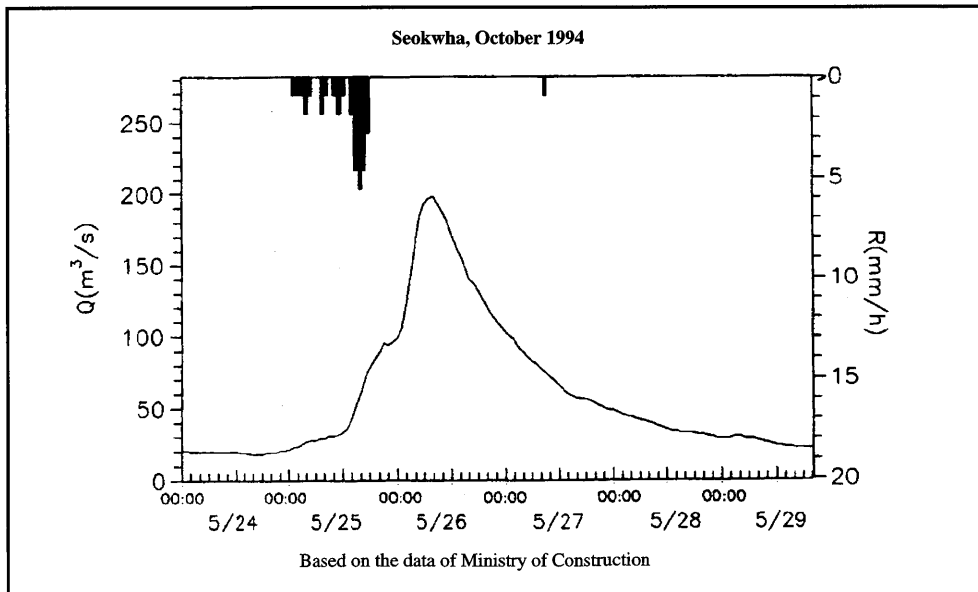
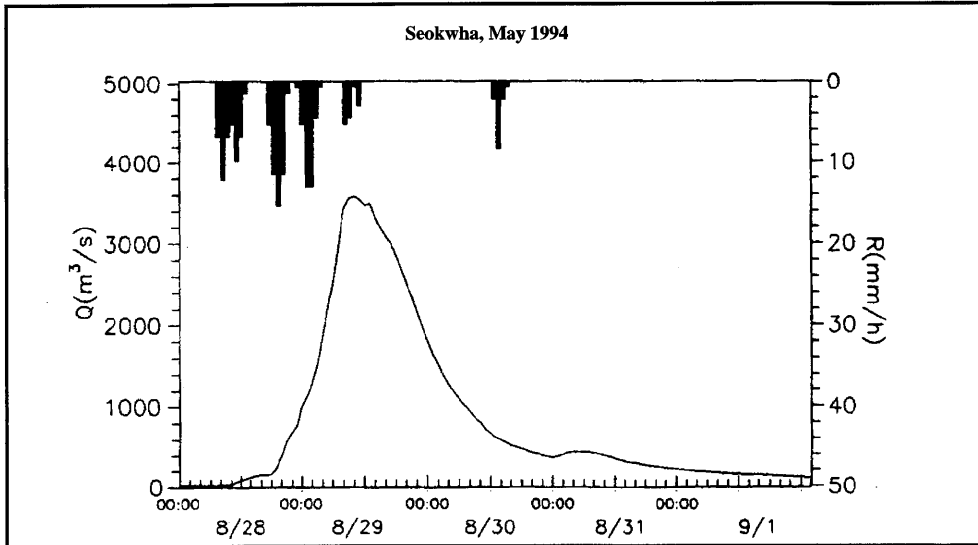
4.6 Annual Maximum and Minimum Discharges

At Seokwha [1 590 km²]

Year	Maximum ¹⁾		Minimum ²⁾		Year	Maximum ¹⁾		Minimum ²⁾	
	Date	[m ³ /s]	Month	[m ³ /s]		Date	[m ³ /s]	Month	[m ³ /s]
1970	9.04	1 150	8	1.1	1982	8.21	335	6	38.0
1971	7.17	2 764	5	2.2	1983	7.20	202	12	42.7
1972	8.19	1 350	4	3.0	1984	9.02	1 220	11	7.9
1973	7.01	766	4	9.2	1985	8.11	252	5	1.3
1974	7.09	1 349	6	9.2	1986	7.19	531	8	1.2
1975	7.08	1 349	11	3.0	1987	4.15	531	2	1.1
1976	8.06	617	1	3.0	1988	7.13	389	7	1.0
1977	4.25	326	8	1.0	1989	4.07	403	9	1.1
1978	5.21	11 425	6	2.0	1990	9.12	2 623	7	1.1
1979	6.26	1 521	8	2.2	1991	7.25	785	12	1.0
1980	7.22	1 749	11	3.1	1992	8.27	1 127	6	1.3
1981	7.12	472.3	5	29.4					

1), 2) Instantaneous observation by recording chart.

4.7 Hyetographs and Hydrographs of Major Floods



5. Water Resources

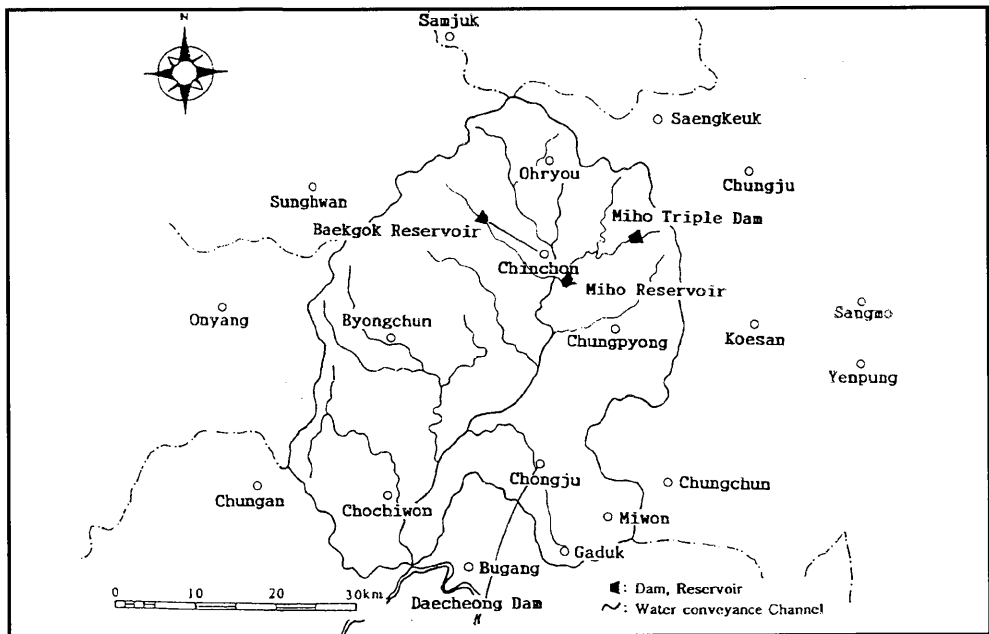
5.1 General Description

The Miho catchment occupies about 12% of the Geum river basin. The river provides drinking, industrial and irrigation water to the cities in the basin and in neighbouring basins. Therefore, the water availability is of critical concern particularly in the dry season. Raw water for the Jyongpyong, Chinchon, Bukil, and Youngun water treatment plants are supplied respectively from the Bogang, the Beakgok, the Seokwha, which are tributaries of the Miho. The shortage of water, especially in the dry season, is met by transfers through pipelines from the Daechong Dam.

In the recent past, the water quality in the river has been deteriorating as a result of increased discharge of untreated sewage and industrial waste water coming from spawning small industrial complexes in the basin. Chongju sewerage treatment plant is the only waste water treatment plant in the basin. Without sufficient supply from the Daechong Dam, severe water shortages are anticipated in the future.

The average annual precipitation in the basin is about the same as the average for the whole country. Since the precipitation is mostly concentrated in summer season from June to September, flooding and/or droughts are likely to occur every year. There have been 11 occurrences of floods with discharges in excess of 1 000 m³/s or 0.847 m³/s/km² at Seokwha (1 180 km²) during the 23 years from 1970 to 1992, i.e. approximately once in 2 years. The minimum discharges of around 1.0 m³/s at Seokwha have occurred ten times in that period. The maximum-minimum discharge ratio in the river is indicated to be very high as shown in the above figures.

5.2 Map of Water Resources Systems



5.3 List of Major Water Resources Facilities

Major Reservoirs

Name of river	Name of dam (reservoir)	Catchment area [km ²]	Gross capacity [10 ⁶ m ³]	Effective capacity [10 ⁶ m ³]	Purpose ¹⁾	Year of completion
Miho	Miho Triples:					
	Yonggae	74.8	4.26		A	1981
	Muguk	131.5	3.07		A	1981
	Keumseok	76.7	3.84		A	1981
Baekgok	Baekgok	84.8	21.50		A	1988
Miho	Miho	133.0	13.87		A	1986

Major Interbasin Transfer

Name of transfer line	Names of rivers and places connected		Length [km]	Maximum capacity [m ³ /s]	Purpose ¹⁾	Year of completion
	From	To				
Bogang - Jyongpyong City	Bogang River	Jyongpyon City	1.2	0.31	W	1981
Baegkok - Chinchon City	Baegkok River	Chinchon City	1.5	0.25	W	1982
Seokwha - Bukil City	Seokwha River	Bukil City	2.2	0.20	W	1987
Mushim - Youngun Intake	Mushim River	Youngun Plant	0.4	0.61	W	1956
Sungam - Ohchang City	Sungam River	Ohchang City	2.0	0.20	W	1985
Daechong Dam - Chongju City Conveyance Channel	Geum River	Chongju City	12.0	4.40	I, W	1971
Daechong Dam - Chongju City Conveyance Channel	Geum River	Chongju Chonan Onyang	56.0	2.50	I, W	1987

1) A: Agricultural use, I: Industrial use, W: Municipal water supply,

5.4 Major Floods and Droughts

Major Floods [1 180 km²]

Date	Peak discharge [m ³ /s]	Rainfall [mm] Duration	Meteorological cause	Dead and missing	Major damages (Districts affected)
1979. 6.25	1 521	232 6.24~6.27	Typhoon	- 1	Chinchon, Chongwon City
1980. 7.22	2 275	175 7.21~7.23	Typhoon	- 1	Chinchon, Umsong City
1985. 8	478	127 8.01~8.10	Typhoon	- -	Chongwon, Chongju City
1987. 7.22	2 327	313 7.21~7.23	Typhoon	1 2	Chinchon, Chongju City
1989. 9.15	908	260 9.14~9.16	Typhoon	- 1	Chongju, Chongwon City
1990. 9.10	3 070	413 9.09~9.11	Typhoon	1 1	Chinchon, Chongju City

Major Droughts

Period	Affected areas	Major damages and counteractions
1982.10.28 ~ 3	Chongju, Chinchon City	Water supply cut ratio at the first stage: 10%
1988. 6.26 ~ 2	Chongju City	Water supply cut ratio at the first stage: 10%
1989. 5.09 ~ 1	Jyongpyong City	Water supply cut ratio at the first stage: 30%
1992. 6.29 ~ 3	Chongju City	Water supply cut ratio at the first stage: 10%
1994. 6.14 ~ 2	Chongju City	Water supply cut ratio at the first stage: 10%
1994. 7.12 ~ 3	Chongju City	Water supply cut ratio at the first stage: 10%
1994. 6.14 ~ 7	Chongju City	Dead fish at downstream of Mushimchun

5.5 Groundwater and Water Quality

River Water Quality ¹⁾ at Seokwha ²⁾ in 1993

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH	7.1	7.1	7.3	7.0	7.4	7.2	7.4	6.9	7.2	7.1	7.2	7.3
BOD [mg/l]	6.2	8.4	8.7	8.0	8.2	7.4	9.0	7.3	6.8	6.2	6.0	6.5
COD _{Mn} [mg/l]	5.9	8.5	8.9	8.9	8.4	8.5	7.2	7.6	6.3	6.1	5.9	5.9
SS [mg/l]	6	6	6	9	7	8	7	8	6	6	8	7
Coliform group ³⁾ [MPN/100ml]	5.0 x 10 ³	8.0 x 10 ³	5.0 x 10 ³	7.0 x 10 ³	1.1 x 10 ⁴	1.1 x 10 ⁴	1.1 x 10 ⁴	1.3 x 10 ³	1.4 x 10 ³	1.3 x 10 ³	7.0 x 10 ³	2.2 x 10 ³
Discharge ⁴⁾ [m ³ /s]	6.88	17.65	18.44	15.39	25.28	8.98	9.56	9.97	10.00	9.34	9.11	9.50

1) Observed once a month on a dry day normally several days after rainfall.

2) Location near Chongju City 12 km from the river mouth.

3) Measurement method: BGLB (brilliant green lactose bile) method.

4) Discharge on the water quality observation date.

6. Socio-cultural Characteristics

The Miho is located in the middle of the country and plays a very important role for highway and railroad traffic on routes such as the Seoul-Busan highway, Seoul-Taejon highway, Seoul-Busan railroad and Seoul-Kwangju railroad. Chongju, which is the capital city of Chungbuk Province is the centre of political, economic, social, and cultural activities in the central part of the country. The city has two impressive museums, one of which is the antique museum that has the first metal printing letters in the world.

7. References, Databooks and Bibliography

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