

## ***Annex 17***

### ***Village Water Supply System and Related Data***

## Annex 17.

### - Preconditions on Village Water Supply System

#### (1) Present condition of village water supply

There are no data available to show the coverage rate of rural water supply by public waterworks. The coverage rates by communal enterprises (CEs) and village water supply services (VSs) are estimated by referring to the following papers;

- Dr. Pavle Filjanski : Evaluation for Improvement of the Water Supply and Reflection on the Hygienic-Epidemic Condition of the Rural Population in the Republic of Macedonia for the period of 1971-1990, June 1993, Skopje
- NEAP : Sectoral Report, Final Report, March 1996, Skopje
- RIHP : Condition of the Water Supply in the Republic of Macedonia with Water Quality and Protection of the Resources, 1995 Seminar, Ohrid

Village people are supplied by the following water supply organizations as shown in Table AN17.1 and Figure AN17.1.:

- City waterworks by communal enterprises (CEs)
- Village water supply services (VSs) with water meter and without chlorination
- Village water supply services (VSs) without water meter and chlorination
- Small communal organizations by public faucets and private by private wells

According to the Republic Institute of Health Protection (RIHP) regarding the rural water supply in Macedonia, the coverage as a basis of population by network service at home was improved to be 69.4 % in 1991 from 4.0 % in 1971 as shown Table AN17.2 and Figure AN17.2.

It is understood as a result of discussion with RIHP and MUPCE (Ministry of Urban Planning, Construction and Environment in the former system. It was reorganized as MUPC : Ministry of Urban Planning and Construction and Ministry of Environment at the end of 1998 ) that present condition of village water supply as of 1997 is recognized as shown in Table AN17.3. The number of villages and the population, which rural water supply development is required at the present, are 693 villages and 191,281 persons in total. Village water supply inventory for each municipality is shown in Appendix E. However, it is very difficult to estimate the population for each village using a trend analysis and the above-mentioned value of the population might be very uncertain. The high coverage rates as a basis of population by network service at home for each former municipality as of 1997 are recognized in the former municipalities of Berovo, Vinica, Valandovo, Delchevo, Kavadarci, Negotino and Demir Hisar. On the other hand, the low coverage rates as a basis of population served by network service at home for each former municipality as of 1997 are recognized as follows (Table AN17.3);

- 1) Skopje former municipality
- 2) Kumanovo former municipality
- 3) Strumica former municipality

- 4) Tetovo former municipality and
- 5) Gostivar former municipality
- 6) Prilep former municipality
- 7) Kichevo former municipality
- 8) Bitola former municipality
- 9) Kochani former municipality and
- 10) Veles former municipality

The high coverage rates regarding number of villages served by network service at home for each former municipality as of 1997 are recognized in the former municipalities of Berovo, Vinica, Delchevo, Valandovo, Debar, Struga, Resen and Krushevo (Table AN17.3);

On the other hand, the low coverage rates regarding number of villages served by network service at home for each former municipality as of 1997 are recognized as follows (Table AN17.3);

- 1) Kumanovo former municipality
- 2) Prilep former municipality
- 3) Skopje former municipality
- 4) Bitola former municipality
- 5) Kichevo former municipality
- 6) Veles former municipality
- 7) Strumica former municipality
- 8) Shtip former municipality
- 9) Gostivar former municipality and
- 10) Makedonski Brod former municipality

## (2) Development strategy of rural water supply

In line with one of the program pursuit to increase domestic water supply coverage, tertiary water supply system (level III) or network service at home would be provided for villages. However, there are very small villages in mountainous and isolated areas. Network service at home is not necessary for these small villages from the viewpoint of cost-effectiveness. There is no criteria for selection of type of water supply systems, secondary (level II by public faucets) or tertiary (network service at home) water supply systems in Macedonia. According to the field surveys, it is understood that the tertiary system is applied for the villages with 100 population or more and MCICs (Macedonian Center for International Cooperation) specialists have same opinion. Therefore, population shall be recognized to be a criterion for the selection of one type of water supply systems.

For each village, the potentiality of groundwater/spring water resources development is assessed based on the following criteria:

1) Groundwater/spring water development potentiality:

The potentiality of groundwater/spring water is classified in consideration of balance between water supply and water demand.

Case	Potentiality	
I	Surplus	High
		Moderate
		Low
II	Deficit	Deficit

2) Groundwater/spring water quality:

The water quality is classified in consideration of village water supply inventory of the Republic Institute of Health Protection.

Case	Potability	
A	Potable	Good
		Moderate
B	Not potable	Not potable

3) Share of sources:

The share of sources is classified in consideration of hydrogeological characteristics, water resources, and present use for drinking water. According to the results of the Water Utilization Survey, the most favorite drinking water for Macedonians is spring water. Therefore, spring water shall be principally utilized for drinking water. In the case that spring water potential is not sufficient against the water demand, groundwater as second priority shall be also exploited by wells. Further, in the case that groundwater/spring water resources potential will not meet the water demand, surface water shall be supplied to supplement the deficiency of the water demand.

Case	Exploitation of water sources		
	Spring water	Groundwater by well	Surface water
a)	100 %	-	-
b)	100 %	Depending on demand	-
c)	100 %	100 %	Depending on demand

(3) Demand projection of rural water supply

Although the statistical values contain uncertain data, especially village population, as above-mentioned, the coverage rates in 1991 and 1997 can be estimated as follows;

- The coverage rates in rural areas are 20 % contributed by CEs and 55 % by VSs.
- The total population not yet supplied by CEs and VSs is approximately 200,000.
- The total number of villages not yet supplied by CEs and VSs is approximately 700.

Condition in 1991	Number of		Percentage (%) of	
	Population	Villages	Population	Villages
Communal Enterprise (CEs)	121,409	108	14	6
Village Water Supply Service (VSs)	479,654	660	55	38
Not yet supplied by CEs&VSs	264,742	957	31	56
Total	866,345	1,725	100	100

Condition in 1997	Number of		Percentage (%) of	
	Population	Villages	Population	Villages
Communal Enterprise (CEs)	134,824	185	17	11
Village Water Supply Service (VSs)	470,452	882	59	50
Not yet supplied by CEs&VSs	191,281	693	24	39
Total	796,557	1,760	100	100

The demand projection of rural water supply is estimated based on the following assumption;

- Coverage percentage by CEs will be not changed in future, i.e. 20 % up to the final target year 2025.
- Coverage percentage by VSs is 55 % in 1996 and will be increased to 80 % up to the final target year 2025.

Rural population	1996	2005	2015	2025	Increase (2025 vs. 1996)
Covered by CEs	159,022	167,667	176,131	183,653	24,631
Coverage by CEs (%)	20	20	20	20	
Covered by VSs	437,311	503,002	616,460	734,613	297,302
Coverage by VSs (%)	55	60	70	80	
Total covered by CEs&VSs	596,333	670,669	792,591	918,266	321,933
Total rural population	795,111	838,336	880,657	918,266	123,155

Population to be covered up to each target year	-	2005	2015	2025	Total
Covered by CEs	-	8,645	8,464	7,522	24,631
Covered by VSs	-	65,691	113,458	118,153	297,302
Total	-	74,336	121,922	125,675	321,933

The average daily water consumption in Macedonia is currently about 150 liter/capita. The net domestic water consumption is assumed to be 250 liter/capita/day, which is equivalent to a gross figure after adding communal demands and system losses.

#### (4) Regional characteristics of development needs for rural water supply

Regional characteristics of the required numbers of villages and the population for rural water supply development are summarized as follows (Table AN17.4),

- The former municipalities of Kumanovo, Prilep, Skopje, Bitola, Kichevo, Veles, Strumica, Shtip, Gostivar and Makedonski Brod are arranged in order of amount regarding the required numbers of the villages
- The former municipalities of Skopje, Kumanovo, Strumica, Tetovo, Gostivar, Prilep, Kichevo, Bitola, Kochani and Veles are arranged in order in the case of the required number of the population.

Therefore, the former municipalities of Skopje, Kumanovo, Prilep, Bitola, Strumica and Kichevo should be selected as a top priority in order to achieve full coverage supplied by network service at home in consideration of present conditions of rural water supply.

- Skopje region : Skopje
- Northeastern region : especially Kumanovo and Kriva Palanka
- Pelagonija region : especially Prilep and Bitola
- Upper Treska River basin : especially Kichevo and Makedonski Brod
- Strumica region : especially Strumica and Radovich
- Upper Vardar River basin : especially Tetovo and Gostivar

Then the former municipalities of Veles, Shtip, Kochani, Ohrid and Gevgelija should be selected as a second priority.

- Bregalnica River basin : especially Veles, Kochani and Shtip
- Lower Vardar River basin : especially Gevgelija and Kavadarci
- Southwest mountainous area : especially Ohrid and Resen

As shown in Table AN17.3, 27,375 persons are suffered from water quality problems due to defect of village water supply systems in 47 villages. It is necessary to rehabilitate village water supply systems of these 47 villages and replace water supply facilities in the nearest future. It is also necessary to extend the water supply systems for natural increase of village population. Therefore, rural water supply extension and rehabilitation project should be proposed as a third priority.

The government of Macedonia made an official request to the government of Japan for the following rural water supply projects in 1998;

- Regional water supply Medzitlija in Bitola
- Regional water supply Petrovec in Skopje
- Regional water supply Belchista in Ohrid

However, the outline of the Belchista regional water supply project is not clear and it is understood that Belchista village has already been covered by a new village water supply service according to the interview to Ohrid Communal Enterprise.

Therefore, the following projects are proposed as a top priority;

- Skopje circle rural water supply project
- Regional water supply Petrovec in Skopje
- Kumanovo and Kriva Palanka circle rural water supply project

- Treska River upper reach rural water supply project
- Pelagonia circle rural water supply project
- Regional water supply Medzitlija in Bitola

The following projects are proposed as a second priority;

- Vardar River upper reach rural water supply project
- Vardar River lower reach and Strumica River basin rural water supply project
- Bregalnica River basin rural water supply project
- Southwest mountainous area rural water supply project

The following projects are proposed as a third priority;

- Nationwide rural water supply extension and rehabilitation project

Project profiles for each project including the following are shown in ANNEX16,

- Project name and the sector
- Target area and beneficiaries
- Brief description of the project
- Project components
- Total construction cost and benefits
- Related studies completed
- Responsible ministry
- Operational organization and financial plan of operation

### - Village Water Supply Systems

#### (1) Types and designs of Village Water Supply Systems

The following four (4) types of village water supply systems can be designed according to available water sources;

- 1) Spring intake system
- 2) Well/borehole system
- 3) River intake (Tyrolean intake) system
- 4) Mixed system

#### 1) Spring intake system (Figures AN17.3 and AN17.4)

According to MUPCE and RIHP, several springs are generally utilized as a water source for the existing village water supply system. The spring inventory shows that there are generally several springs within a village. Therefore, it is assumed that 3 springs can be designed as a water source and the total length of main pipeline (5 km) will be longer than that of secondary pipeline (3 km).

The spring is tapped with drains placed in a gravel pack and the top of the gravel pack should be

at least 3 m below the ground surface. Sanitary protection zone, an area extended along the drain gallery at each side and in the other direction to a distance of at least 50 m upstream should be protected against contamination from various pollutants and should be fenced in. The pipelines should be installed under permafrost layer for the protection of freezing. It is assumed that it is not necessary to construct a filter station except for a chlorination facility.

The following facilities of spring intake are designed;

- Spring intake: sanitary protection zone should be set up in the surroundings.
- Main pipeline with air valves, outlet valves and surge chambers: pipelines should be installed in the subsurface under the permafrost layer (a depth of about 1.5 m)
- Reservoir: the capacity is equivalent to 20 % of daily maximum water supply volume
- Secondary pipeline and joint shafts to connect consumer s houses.

## 2) Well/borehole system (Figure AN17.5)

According to the analyses of groundwater resources potentiality, groundwater resources are available in Quaternary and Neogene sand and gravel unconsolidated aquifers, which occur in Polog, Skopje, Kochani, Strumica, Pelagonija valleys and etc. The reliable supply of electricity is available in those valleys except for extension of three-phase electricity. Therefore, electrical pumping system should be adopted as a pumping system of groundwater.

The result of Groundwater Quality Survey by the JICA Study shows that the concentration of iron and manganese are often detected in groundwater taken from wells/boreholes and are higher than the Macedonian standards for drinking water. Therefore, a filter station, which can treat iron and manganese, and a chlorination facility, should be constructed for the well/borehole system. It is assumed that it is not necessary to install main pipelines into the well/borehole system. The pipelines should be installed under the permafrost layer for the protection of freezing.

The following design of well/borehole and the related facilities can be assumed,

Item	Design
- Well depth	50 m
- Well diameter	250 mm
- Pumping head of an electrical submersible pump	30 m
- Pumping capacity of an electrical submersible pump	10 l/sec
- Pumping cabin with electrical facilities (400 V and 50000W)	2 x 2 x 2 m

## 3) River (Tyrolean) intake system (Figures AN17.6 and AN17.7)

It is necessary to construct a filter station with a chlorination facility. The pipelines should be installed under the permafrost layer for the protection of freezing.



## - Village Water Supply Project

### (1) Costs of Village Water Supply Facilities

The construction costs of spring intakes, wells/boreholes, pipelines, reservoirs and filter stations are estimated based on reviews of the technical reports of village water supply systems, which were reported to MUPCE to obtain the governmental subsidies.

#### 1) Spring intake

The costs of spring intakes are estimated as follows;

Population	Demand (l/sec)	Cost (10 <sup>3</sup> MKD)
450	1.3	600
1320	3.8	1,000

The operation cost of the spring intake is not required, but the spring intake should be regularly washed and obstacles of the intake can be removed. The annual operation and maintenance costs of the spring water intake include:

- Operation : none
- Maintenance : 1 % of the investment cost of spring intake
- Lifetime : 40 years

#### 2) Well/borehole and well-pump station

The cost of well construction is estimated at 20,000 US\$, in the case that the designed well depth with a bottom cap of 1 m for sedimentation is 50 m, the designed pumping head is 30 m and that the designed diameter of the well is 250 mm.

The operation of well/borehole is not required for the well/borehole. Well screen should be regularly washed and rehabilitated in order to remove obstacles of the well screen. The annual operation and maintenance costs of the wells/boreholes include:

- Operation : none
- Maintenance : 1 % of the investment cost of well
- Lifetime : 40 years

The construction cost of a well-pump station is estimated at 28,000 US\$, in the case that the well-pump station is designed in a cabin with dimensions of 2 x 2 x 2 m, and that electromechanical equipment (400 V and 50,000 W) is installed.

The costs of an electrical submersible pumps are estimated at 3400 to 5100 US\$, in the case that the pumping heads are 25 to 50 m and the pump capacity is 10 l/sec. The electrical pumps require regular maintenance to be done by a mechanic. The annual operation and maintenance costs of the electrical pump include:

- Operation : salary and electricity consumed
- Maintenance : 1 % of the investment cost of the pump
- Lifetime : 15 years

### 3) Pipeline (PVC: Polyvinyl Chloride)

PVC (polyvinyl chloride) pipe is generally adopted in village water supply systems

- Main pipeline (225 or 125 mm in diameter, 10 or 6-bar waterproof) : 5 km
- Secondary pipeline (75 mm in diameter, 6-bar waterproof) : 3 km

It is understood that terminal facilities including faucets and pipes in the houses from the secondary network pipelines can be set up by consumers or village people.

The cost of the PVC pipeline network with a diameter of 225 mm is estimated at  $13.9 \times 10^6$  MKD, in the case that main pipelines are designed to be 5 km in length, and that secondary pipelines are designed to be 3 km. The cost of the PVC pipeline network with a diameter of 125 mm is estimated at  $2.5 \times 10^6$  MKD, in the case that main pipelines are designed to be 1 km in length, and that secondary pipelines are designed to be 1.5 km. The unit prices of pipelines per meter for each diameter are estimated as follows

Diameter of pipes (mm)	$10^3$ MKD/m
75	0.8
125	1.3
225	2.3

The annual operation and maintenance costs of the pipelines include:

- Operation : none
- Maintenance : 1 % of the investment cost of pipelines
- Lifetime : 40 years

### 4) Reservoir

The capacities of reservoirs are designed to be 20 % of daily maximum water supply volume, which is generally adopted in village water supply systems in Macedonia, to adjust daily unevenness of water demand.

Population of water supply	Capacity ( $m^3$ )	$10^6$ MKD
450	50	1.4
1320	130	2.6
5820	350	4.0

The annual operation and maintenance costs of the reservoir include:

- Operation : salary and electricity consumed
- Maintenance : 1 % of the investment cost of reservoir
- Lifetime : 40 years

## 5) Filter station

There is no need to construct a filter station in village water supply system in the case that spring water can be utilized as a water source. In the cases of a well/borehole and a river intake as a water source, however, a filter station should be designed to remove iron and manganese and chlorination facility should be necessary for disinfection.

Population of water supply	Capacity (m <sup>3</sup> /hr)	10 <sup>6</sup> MKD
450	10	1.65
1320	20	2.0
5820	40	2.5

The annual operation and maintenance costs of the filter station include:

- Operation : salary and electricity consumed
- Maintenance : 1 % of the investment cost of filter station
- Lifetime : 40 years

## (2) Benefit

### 1) Water charge for an economical analysis

According to the results of Water Utilization Survey by the JICA Study, the willingness to pay for water consumption is 1.5 to 2 times as high as the present average water charge (12 MKD/m<sup>3</sup>). Therefore, a market price of water charge is estimated at 18 MKD/m<sup>3</sup> for a financial analysis and an economic shadow price of water charge is also estimated at 16.2 MKD/m<sup>3</sup>.

### 2) Reduction in water-borne diseases

The benefits to the sufferers of water-borne diseases are the estimated reduction in water-borne diseases and the estimated increase in working chance. The benefits from the viewpoint of economic analysis are estimated and calculated as follows,

- Average sufferers of water-borne diseases: 0.15 % of total population
- Average daily earnings: 500 MKD/person
- An average annual business suspension: 7 days/year

### 3) Direct income compensation to farmers and foresters

The farmers and foresters, who are working for food and forest production in mountainous and isolated areas, play a great part for environmental protection and conservation of forests and natural landscapes. From the viewpoint of public economy, the farmers and foresters should be compensated for their uncountable contribution to environmental protection and green tourism which urban dweller will spend in mountainous and agricultural areas. The idea of this compensation to the farmers and foresters has been widely spread in European countries and the policy of the compensation finance or direct income compensation (negative income tax) finance, was accepted by EC countries in 1975.

The benefits of direct income compensation from the viewpoint of economic analysis are

estimated and calculated as follows,

- An average family size: 5 persons
- An average amount of direct income compensation: 200 MKD/month/person  
(This amount is equivalent to approximately 10% of an average monthly income of one farmer's family.)

Table AN17.1 CONDITION OF RURAL WATER SUPPLY IN 1991

No.	Municipality	Total population 1991	Number of villages 1991	Supplied by city water work with water meters		Network service at home								Without network service at home	
						Non-chlorinated									
						with water meters		without water meters							
				villages	population	villages	population	villages	population	villages	population	villages	population		
1	Skopje (5 municip.)	105,036	125	5	14,000	13	16,564	31	15,297	44	31,861	76	59,175		
2	Gostivar	86,033	90	6	11,575	12	34,195	33	21,543	45	55,738	39	18,720		
3	Tetovo	139,341	92	1	4,500	27	52,923	40	58,940	67	111,863	24	22,978		
4	Kichevo	29,352	80	6	3,533	3	5,316	22	3,393	25	8,709	49	17,110		
5	M. Brod	8,412	53	1	174	3	420	21	6,356	24	6,776	28	1,462		
6	Kumanovo	60,136	109	3	4,899	2	1,616	12	14,088	14	15,704	92	39,533		
7	Kratovo	4,858	30	0	0	1	493	1	282	2	775	28	4,083		
8	Kriva Palanka	14,302	51	2	1,131	0	0	31	10,364	31	10,364	18	2,807		
9	Veles	22,847	89	1	1,816	8	7,513	14	7,022	22	14,535	66	6,496		
10	Sveti Nikole	8,589	44	0	0	2	1,893	0	0	2	1,893	42	6,696		
11	Shtip	9,230	71	2	1,822	6	3,069	8	1,853	14	4,922	55	2,486		
12	Probishtip	8,509	36	2	1,760	2	2,566	8	2,564	10	5,130	24	1,619		
13	Kochani	22,831	45	10	10,882	3	2,128	9	4,983	12	7,111	23	4,838		
14	Vinica	9,479	15	0	0	12	8,386	2	619	14	9,005	1	474		
15	Delchevo	14,902	29	1	67	1	4,855	25	8,590	26	13,445	2	1,390		
16	Berovo	10,521	15	1	826	7	5,977	7	3,718	14	9,695	0	0		
17	Demir Hisar	12,078	37	2	722	0	0	25	10,544	25	10,544	10	812		
18	Knushevo	7,154	23	1	466	0	0	8	4,862	8	4,862	14	1,826		
19	Bitola	39,120	128	8	7,419	12	9,365	54	15,177	66	24,542	54	7,159		
20	Prilep	28,439	106	3	3,327	9	4,855	9	1,201	18	6,056	85	19,056		
21	Kavadarci	13,601	49	9	9,276	5	1,745	3	1,906	8	3,651	32	674		
22	Negotino	10,890	33	3	2,340	1	3,388	10	3,581	11	6,969	19	1,581		
23	Valandovo	7,846	28	1	267	7	6,109	2	537	9	6,646	18	933		
24	Gevgelija	20,138	34	4	3,802	14	14,703	0	0	14	14,703	16	1,633		
25	Ohrid	23,931	57	6	6,981	13	8,133	17	5,410	30	13,543	21	3,407		
26	Struga	47,608	51	17	22,470	9	18,218	12	6,066	21	24,284	13	854		
27	Debar	11,166	39	2	767	3	2,226	15	5,227	18	7,453	19	2,946		
28	Resen	13,566	43	8	4,548	3	574	20	6,935	23	7,509	12	1,509		
29	Radovish	15,797	49	3	2,669	8	7,130	8	3,662	16	10,792	30	2,336		
30	Strumica	60,093	74	0	0	11	17,145	16	12,799	27	29,944	47	30,149		
Total:		865,805	1,725	108	121,409	197	241,504	463	238,150	660	479,654	957	264,742		

Table AN17.2 IMPROVEMENT OF COVERAGE BY NETWORK SERVICE AT HOME IN VILLAGES IN THE PERIODS OF 1971-1991

No.	Name of the village	Number of villages 1991	Number of the population		Change rate (%)	Number of the population, 1971				Number of villages and population, 1991			
			1971			home / level 3	Private / level 1	public / level 2	home / level 3		villages	Other types	
			1971	1991					population	population		villages	population
1	Skopje	125	72,958	105,036	138.2	1,349	29,304	45,337	49	45,861	76	59,175	
2	Gostivar	90	65,734	86,033	137.5	2,378	30,934	32,422	51	67,313	39	18,720	
3	Tetovo	92	95,465	139,341	140.7	6,030	57,905	31,530	68	116,363	24	22,978	
4	Kichevo	80	28,795	29,352	101.9	235	11,965	16,595	31	12,242	49	17,110	
5	M. Brod	53	14,592	8,412	57.7	35	2,105	12,452	25	6,950	28	1,462	
6	Kumanovo	109	67,068	60,136	89.7	1,123	30,611	35,334	17	20,603	92	39,533	
7	Kratovo	30	11,349	4,858	42.8	58	501	10,790	2	775	28	4,083	
8	Kriva Palanka	51	24,878	14,302	57.5	461	2,515	21,902	33	11,495	18	2,807	
9	Veles	89	24,773	22,847	92.2	656	2,774	21,343	23	16,351	66	6,496	
10	Sveti Nikole	44	13,702	8,589	62.7	50	1,999	11,653	2	1,893	42	6,696	
11	Ship	71	13,451	9,230	68.6	220	2,62	10,611	16	6,744	55	2,486	
12	Probitip	36	12,018	8,509	70.8	3,405	2,693	5,920	12	6,890	24	1,619	
13	Kochani	45	26,563	22,831	85.9	228	5,301	21,034	22	17,993	23	4,838	
14	Vinica	15	10,452	9,479	90.7	140	1,107	9,205	14	9,005	1	474	
15	Delchevo	29	16,253	14,902	91.7	725	2,293	13,235	27	13,512	2	1,390	
16	Berovo	15	12,979	10,521	81.1	1,335	2,775	8,869	15	10,521	0	0	
17	Demir Hisar	37	15,653	12,078	77.2	1,085	4,187	10,381	27	11,266	10	812	
18	Krushevo	23	8,538	7,154	83.8	-	3,369	5,169	9	5,328	14	1,826	
19	Bitola	128	59,477	39,120	65.8	1,543	15,477	42,452	74	31,961	54	7,159	
20	Prilep	106	45,687	28,439	62.2	505	16,008	29,174	21	9,383	85	19,056	
21	Kavadarci	49	16,958	13,601	80.2	388	4,987	11,583	17	12,927	32	674	
22	Negotino	33	10,645	10,890	102.3	237	3,616	6,792	14	9,309	19	1,581	
23	Valandovo	28	6,421	7,846	122.2	209	2,854	3,358	10	6,913	18	933	
24	Gevgelija	34	18,070	20,138	111.4	3,898	7,612	6,560	18	18,505	16	1,633	
25	Ohrid	57	27,650	23,931	86.5	1,470	9,438	16,742	36	20,524	21	3,407	
26	Struga	51	37,363	47,608	127.4	5,064	15,468	16,831	38	46,754	13	854	
27	Debar	39	9,644	11,166	115.8	-	390	9,254	20	8,220	19	2,946	
28	Resen	43	16,698	13,566	81.2	449	7,564	8,685	31	12,057	12	1,509	
29	Radovich	49	16,286	15,797	97	210	4,302	11,774	19	13,461	30	2,336	
30	Strumica	74	53,874	60,093	111.5	767	14,851	38,256	27	29,944	47	30,149	
Total:		1725	857,026	865,805	101	34,253	294,535	525,238	770	601,063	956	264,742	
Total, %		100%	100%	100%		4.0%	34.7%	61.3%	44.6%	69.4%	55.4%	30.6%	

Data source : RIHP

Table AN17.3 NUMBERS OF VILLAGES AND POPULATION REQUIRED FOR DEVELOPMENT OF RURAL WATER SUPPLY AND IMPROVEMENT BY FORMER MUNICIPALITY

No	Name	Former Municipality		Required for development and improvement		Without network service at home				Village network service at home with water quality problem			
		Number of administrative divisions	Population 1997	Number of villages	Population	Total		Less than 100	Population	Total		Number of villages	Population
						Number of villages	Population			Number of villages	Population		
1	Skopje	180	558,213	81	53,519	68	38,996	49	37,942	19	454	13	15,123
2	Gostivar	93	115,276	33	16,491	31	16,245	11	15,581	20	864	2	246
3	Tetovo	92	179,883	17	19,886	17	19,886	16	19,886	1	0	0	0
4	Kichevo	80	53,741	47	13,616	46	13,606	23	12,912	23	694	1	10
5	Makedonski Brod	55	12,152	30	2,050	26	1,682	5	704	21	978	4	368
6	Kumanovo	110	131,558	82	34,767	80	32,345	44	30,196	36	2,149	2	2422
7	Kratovo	31	10,905	12	783	12	783	2	344	10	439	0	0
8	Kriva Palanka	52	25,307	18	2,521	17	2,426	8	1,951	9	475	1	95
9	Veles	90	66,829	45	3,545	45	3,545	12	2,873	33	672	0	0
10	Sveti Nikole	45	21,616	23	1,477	22	1,409	4	1,020	18	389	1	68
11	Ship	73	51,353	34	1,594	32	1,219	4	528	28	691	2	375
12	Probitip	37	16,766	15	1,534	13	909	4	662	9	247	2	625
13	Kochani	45	48,676	18	4,187	18	4,187	7	3,879	11	308	0	0
14	Vinica	16	19,438	0	0	0	0	0	0	0	0	0	0
15	Delchevo	31	26,149	2	206	2	206	1	127	1	79	0	0
16	Berovo	16	19,913	6	4,948	0	0	0	0	0	0	6	4,948
17	Domir Hissar	41	10,456	9	349	9	349	0	0	9	349	0	0
18	Krushevo	22	12,134	7	851	6	899	2	507	4	192	1	152
19	Bitola	130	108,789	56	7,820	54	7,546	23	6,883	31	863	2	274
20	Prilep	107	95,310	74	13,909	73	13,819	34	12,208	39	14,111	1	290
21	Kavadarci	50	42,494	19	206	19	206	0	0	19	206	0	0
22	Negotino	34	23,542	12	315	12	315	1	156	11	189	0	0
23	Valandovo	29	12,271	6	1,379	4	1,600	1	152	3	8	2	1219
24	Gevgellija	34	34,983	9	1,507	9	1,507	5	1,393	4	114	0	0
25	Ohrid	63	61,533	16	1,181	13	1,017	5	702	8	315	3	164
26	Struga	52	65,216	7	791	6	635	2	533	4	102	1	156
27	Debar	38	24,985	6	556	5	366	2	263	3	103	1	190
28	Resen	44	17,708	7	1,159	6	835	4	749	2	86	1	324
29	Radovish	50	31,237	13	1,477	13	1,477	4	1,227	9	250	0	0
30	Strumica	75	92,955	36	2,6032	35	2,5706	27	2,5442	8	264	1	326
TOTAL		1,785	1,981,398	740	218,658	693	191,281	300	176,620	393	12,661	47	27,375
												36	26,807
												11	568

Table AN17.4 DEVELOPMENT PRIORITY OF RURAL WATER SUPPLY BY FORMER MUNICIPALITY

Former Municipality					Without network service at home				Ranking by number of		Ranking by percent of		Total score	Overall ranking	
No	Name	Number of administrative divisions	Total population 1997	Rural population 1997	Total		Percent (%)		Villages	Population	Villages	Population			
					Number of villages	Population	Number of villages	Population							
1	Skopje	160	558213	223,285	68	38396	42.2	17.2	3	1	9	12	25	5	
2	Gostivar	93	115276	46,110	31	16245	33.3	35.2	9	5	16	5	35	8	
3	Telovo	92	179883	71,953	17	19886	18.5	27.6	14	4	23	7	48	12	
4	Kichevo	80	53741	21,496	46	13606	57.5	63.3	5	7	3	2	17	3	
5	Makedonski Brod	55	12,152	4,981	26	1682	47.3	34.6	10	12	6	6	34	7	
6	Kumanovo	110	131,558	52,823	80	32345	72.7	61.5	1	2	1	3	7	1	
7	Kratovo	31	10,905	4,362	12	783	38.7	18.0	19	20	12	10	61	15	
8	Kriva Palanka	52	25307	10,123	17	2428	32.7	24.0	14	11	17	8	50	13	
9	Veles	90	66,829	26,732	45	3545	50.0	13.3	6	10	4	16	36	9	
10	Sveti Nikole	45	21,616	8,646	22	1409	48.9	16.3	11	15	5	13	44	11	
11	Ship	73	51,353	20,641	32	1219	43.8	5.9	8	16	8	21	53	14	
12	Probishtip	37	16,766	6,708	13	909	35.1	13.6	16	18	15	15	64	16	
13	Kochani	45	48,676	19,470	18	4187	40.0	21.5	13	9	11	9	42	10	
14	Vinica	16	19,438	7,778	0	0	0.0	0.0	29	29	29	29	116	29	
15	Delchevo	31	26,149	10,460	2	206	6.5	2.0	28	26	28	27	109	28	
16	Berovo	16	19,913	7,965	0	0	0.0	0.0	29	29	29	30	117	30	
17	Demir Hisar	41	10,456	4,182	9	349	22.0	8.3	21	24	21	20	86	24	
18	Krushevo	22	12,134	4,854	6	699	27.3	14.4	23	21	18	14	76	19	
19	Bitola	130	108,789	43,616	54	7546	41.5	17.3	4	8	10	11	33	6	
20	Prilep	107	95,310	38,124	73	13619	68.2	35.7	2	6	2	4	14	2	
21	Kavadarci	50	42,494	16,998	19	206	38.0	1.2	12	26	13	28	79	21	
22	Negotino	34	23,542	9,417	12	315	35.3	3.3	19	25	14	24	82	22	
23	Valandovo	29	12,271	4,908	4	160	13.8	3.3	27	28	24	25	104	27	
24	Gevgellija	34	34,983	13,993	9	1507	26.5	10.8	21	13	19	19	72	18	
25	Ohrid	63	61,533	24,613	13	1017	20.6	4.1	16	17	22	22	77	20	
26	Struga	52	65,216	26,066	6	635	11.5	2.4	23	22	27	26	98	26	
27	Debar	38	24,995	9,998	5	366	13.2	3.7	26	23	26	23	98	25	
28	Resen	44	17,708	7,083	6	835	13.6	11.8	23	19	25	18	85	23	
29	Radovish	50	31,237	12,495	13	1477	26.0	11.8	16	14	20	17	67	17	
30	Strumica	75	92,955	37,182	35	25706	46.7	69.1	7	3	7	1	18	4	
TOTAL					1,795	1,991,398	796,557	693	191281						



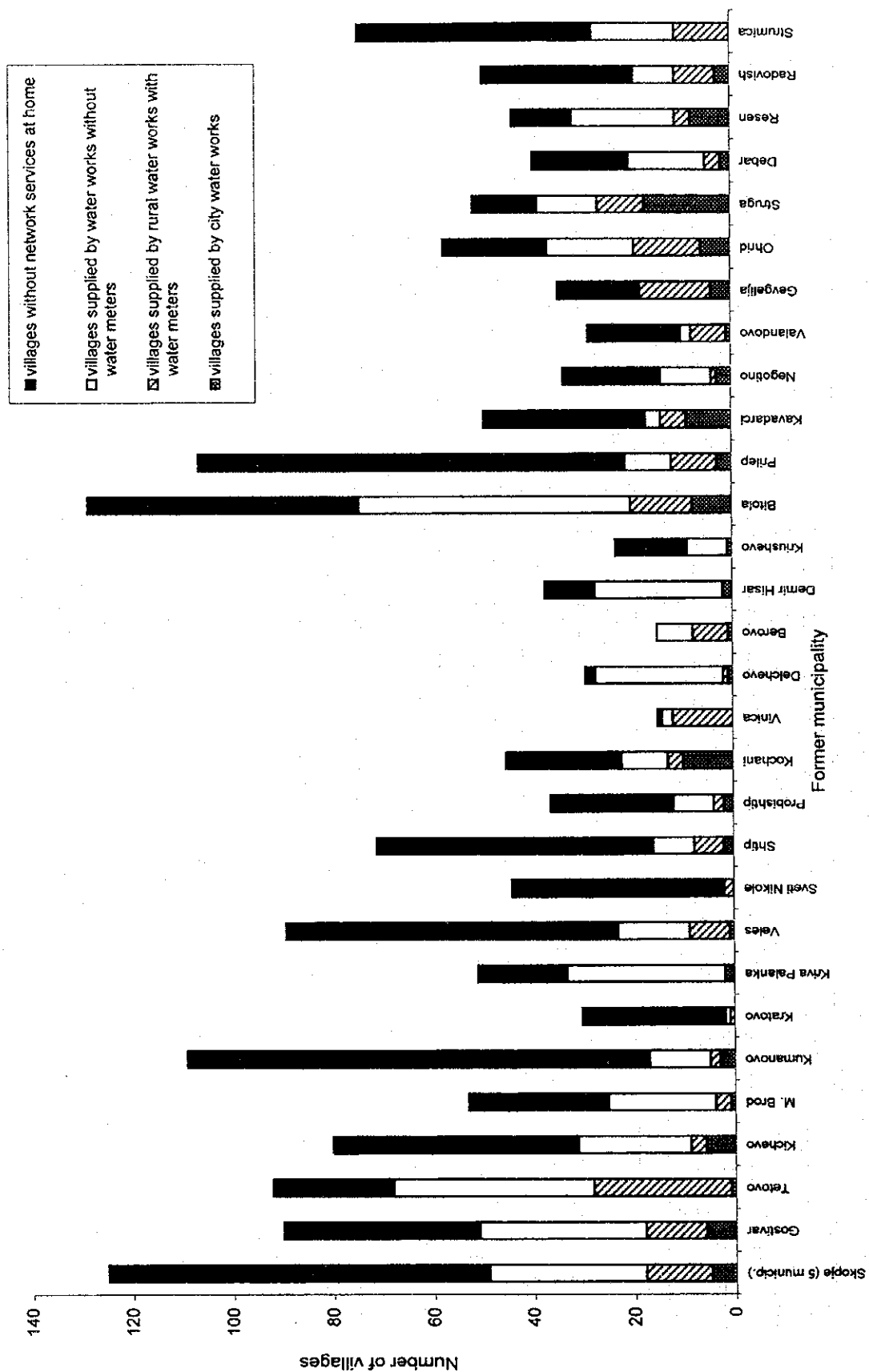


Figure AN17.1 NUMBERS OF VILLAGES BY WATER SUPPLY TYPE IN 1991

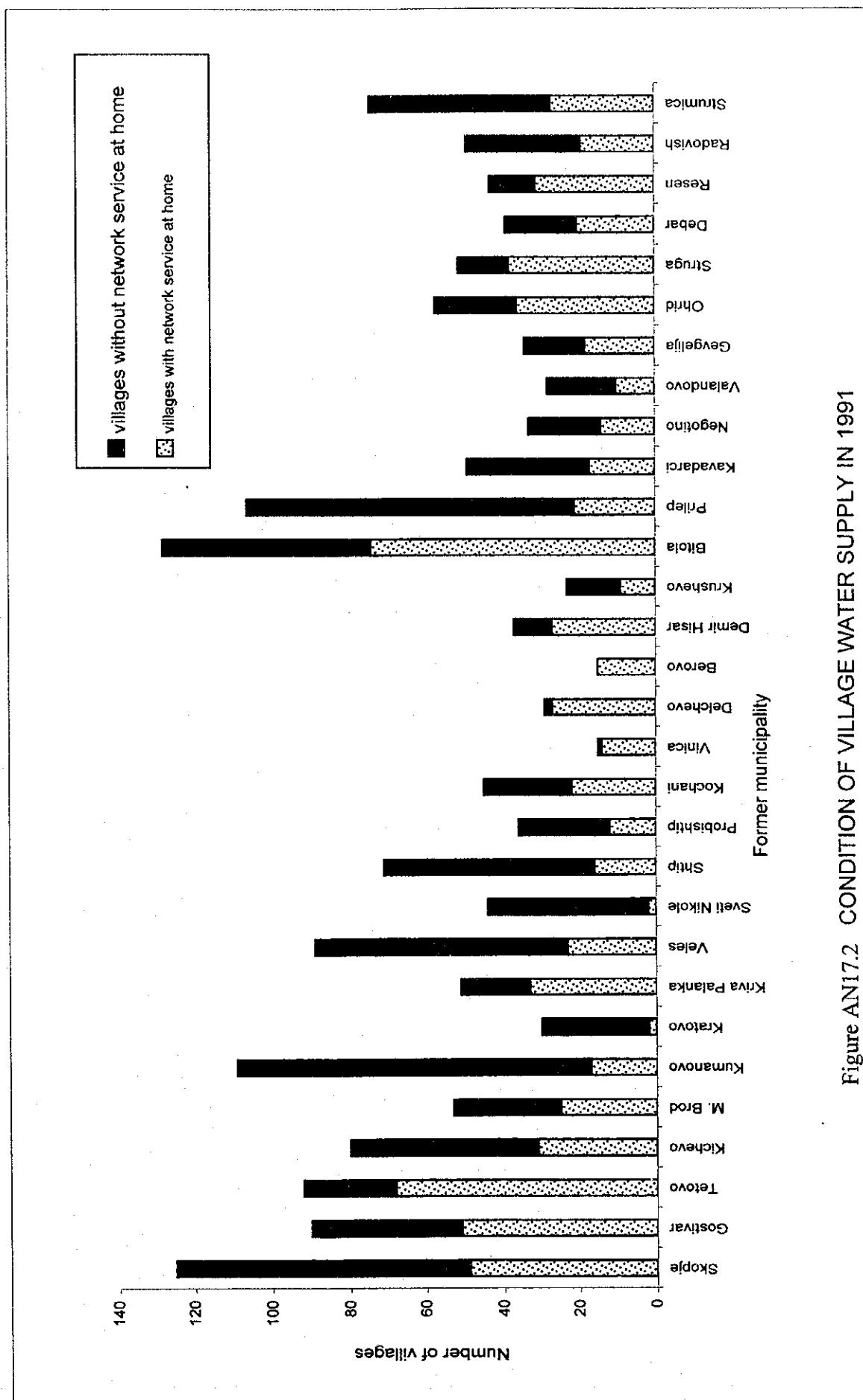


Figure AN17.2 CONDITION OF VILLAGE WATER SUPPLY IN 1991



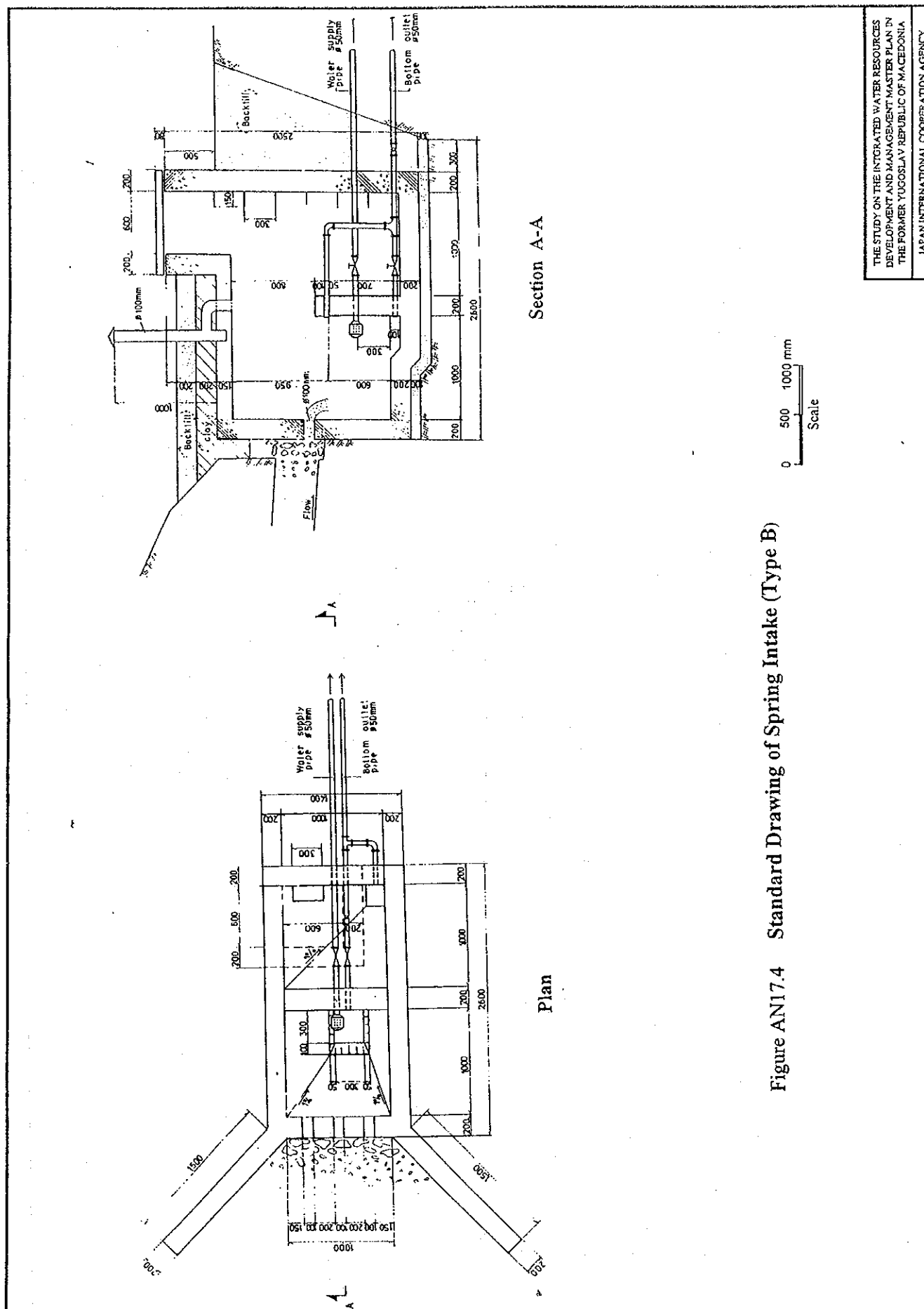
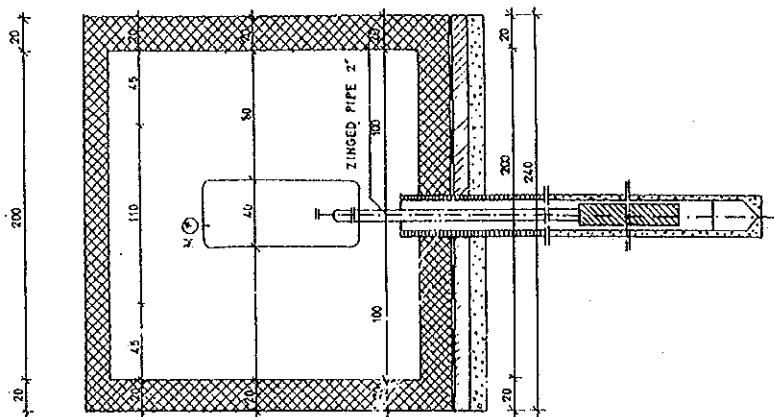
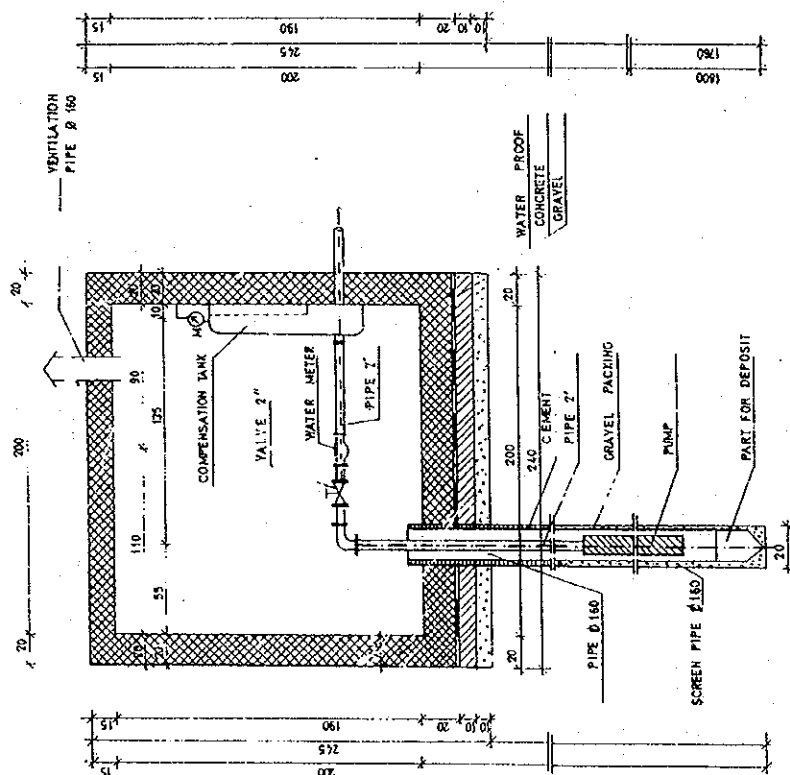


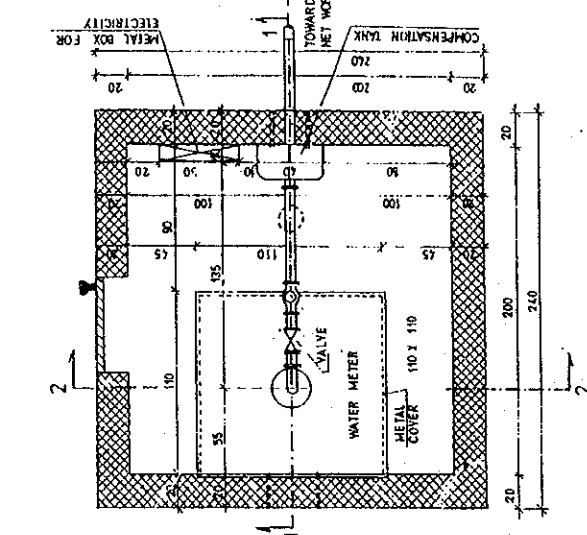
Figure AN17.4 Standard Drawing of Spring Intake (Type B)



Section 2-2



Section 1-1



Layout

Figure AN17.5 Standard Drawing of Domestic Well



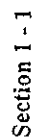
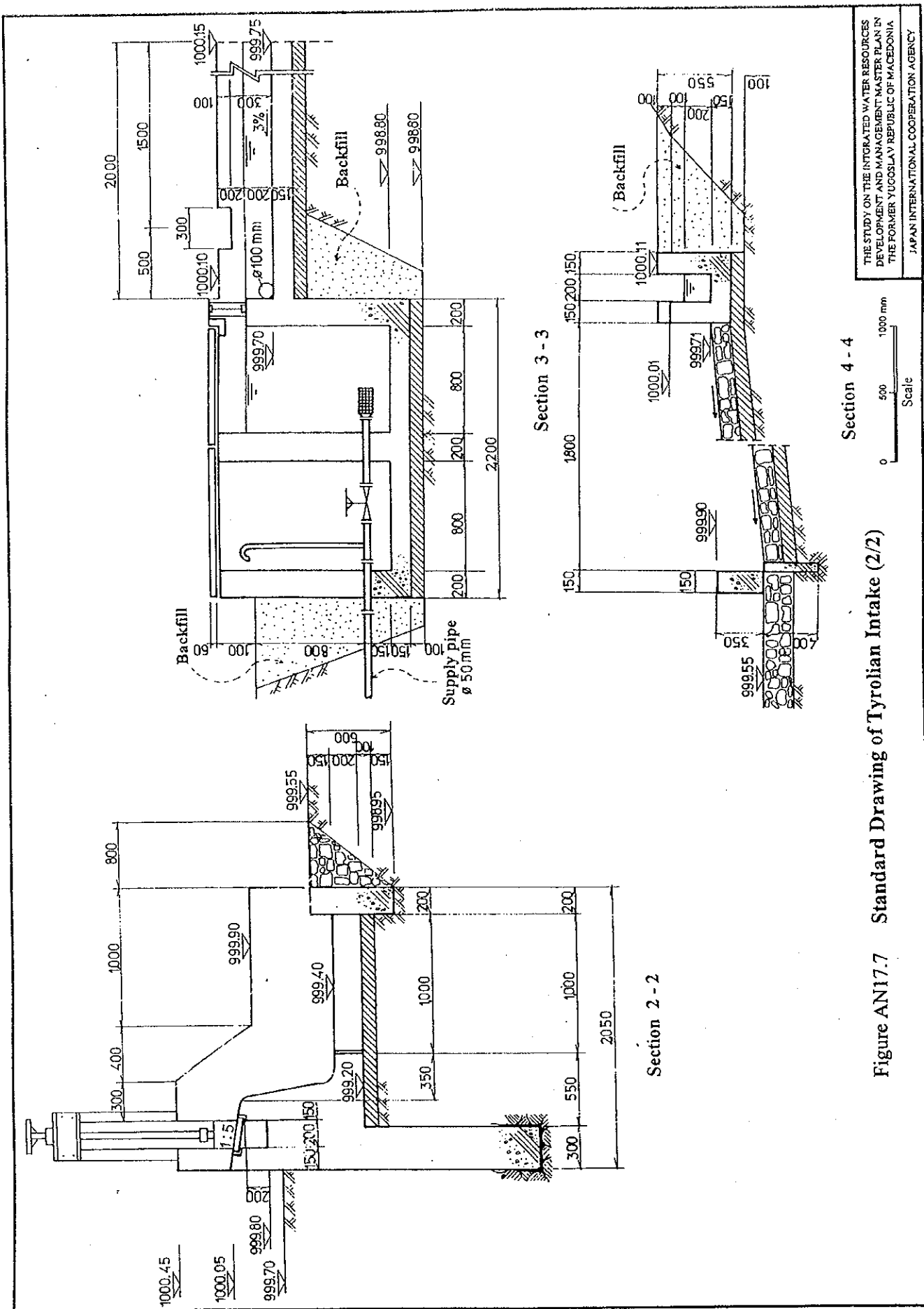


Figure AN17.6 Standard Drawing of Tyrolian Intake (1/2)

THE STUDY ON THE INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT MASTER PLAN IN THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

**JAPAN INTERNATIONAL COOPERATION AGENCY**



## ***Annex 18***

### ***Construction Cost and Related Data***



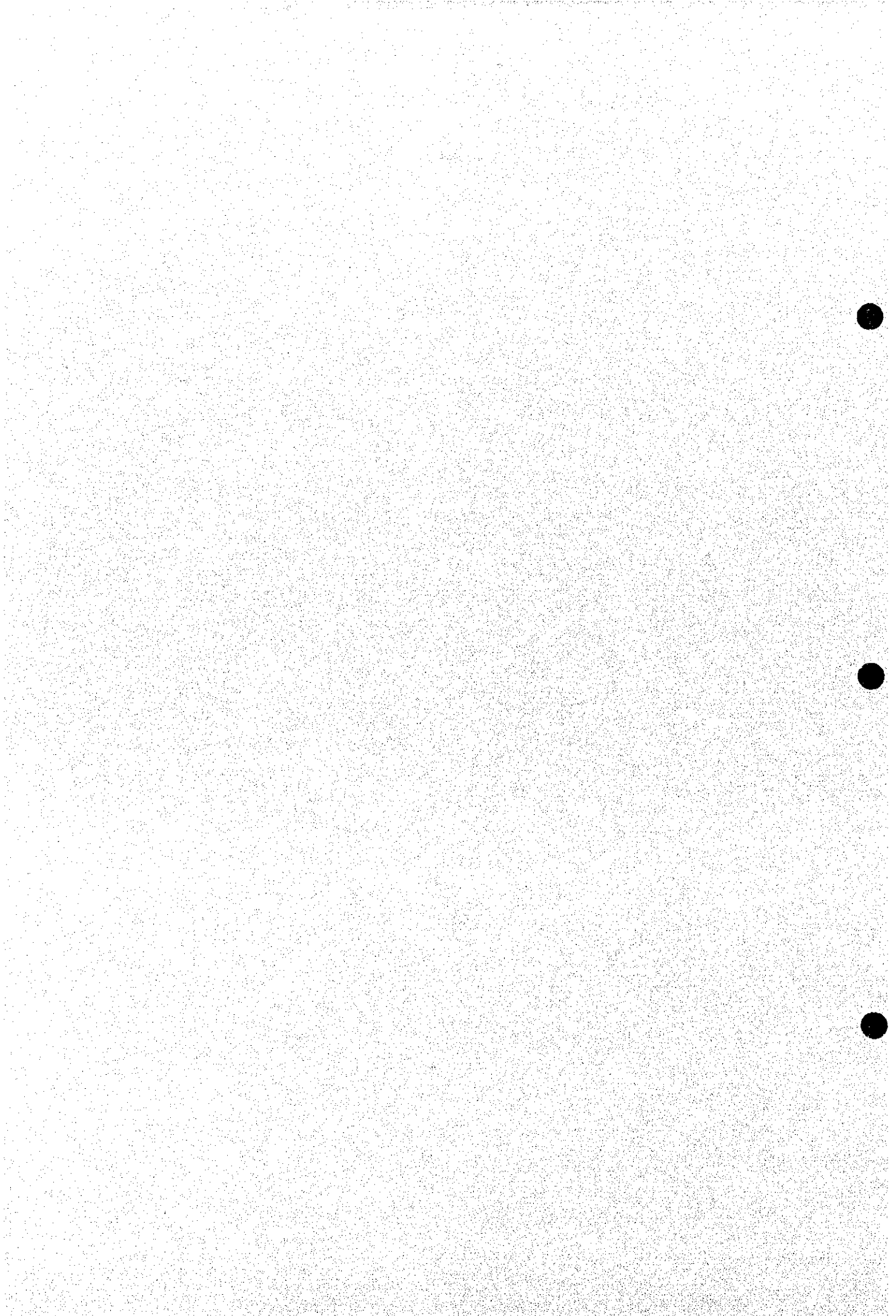


Table AN18.1 Construction Cost of Tyrolean Intake

No.	Name of Project	Design Capacity (lit/sec)	Cost	Currency	Project Design Year	Adjustment Factor	Adjusted cost for present value (1998)		Name of Construction and Design Company	Data Source
							(MKD)	(US\$)		
1	Main Design Project Intake of river Kozjachka until constructing the dam Bargala	250	2,750,000	MKD	1995	1.083	2,978,250	57,274	Water Development Institute Skopje	Water Development Institute Skopje
2	Main Design Project Tyrolean Intake for Water Supplying Radovich	30	1,369,000 <sup>(1)</sup>	MKD	1997	1.007	1,378,583	26,511	Rading - Skopje	Rading - Skopje
3	Main Design Project Tyrolean Intake of Pehchevska River for Water Supplying Pehchevo	30	829,000	MKD	1996	1.051	871,279	16,755	Environ - Skopje	Environ - Skopje
4	Main Design Project for Water Supplying village Slivovo - Ohrid	2	314,874	MKD	1996	1.051	330,933	6,364	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje
5	Main Design Project for Water Supplying village Modrich - Struga	1.5	251,000	MKD	1997	1.007	252,757	4,861	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje

(1) Name of the river cannot be identified.

Exchange rate : US\$1.0=MKD52.0=DEM1.6785 (Jan.15, 1999)

Note:

Table AN18.2 Construction Cost of Main Pipeline

No.	Name of Project	L (km)	Design Capacity (lit/sec)	D (mm)	Material	Cost	Currency	Project Design Year	Adjustment Factor	Adjusted cost for present value (1998)		Name of Construction and Design Company	Data Source
										(MKD/m)	(US\$/m)		
1	Main Design Project Main Supply Pipeline for Water Supplying Pehchevo from the Intake to the Filter Station	2.3		160	PVC	2,242,000	MKD	1996	1.051	1,024	19.7	Melioprojekt - Skopje	PWEE-WEM - Skopje
2	Main Design Project for Water Supplying village Arachinovo - Skopje, by wells	m' m'		324 273	Steel Steel	2,877 2,121	MKD MKD	1996 1996	1.051 1.051	2,877 2,121	55.3 40.8	Water Development Institute - Skopje	Water Development Institute - Skopje
3	Main Design Project Main Supply Pipeline for Water Supplying Makedonska Kamenica	3.2	40		PVC	9,949,000	MKD	1995	1.083	3,367	64.8	Rading - Skopje	Rading - Skopje
4	Main Design Project for Water Supplying of villages Illova, Stuka, Sekernak, Turnovo, Boriovo, Radovo and Bosilevo - Strumica	m' m' m' m' m'		280 225 160 110 90	PVC PVC PVC PVC PVC	1,540 1,010 520 250 180	MKD MKD MKD MKD MKD	1996 1996 1996 1996 1996	1.051 1.051 1.051 1.051 1.051	1,619 1,062 547 263 189	31.1 20.4 10.5 5.1 3.6	Water Development Institute - Skopje	Water Development Institute - Skopje
5	Main Design Project for Water Supplying of Delchevo - Main Supply	14.2	50-102	300-450	AC	63,943,000	DIN	1984	-	-	-	Melioprojekt - Skopje	PWEE-WEM - Skopje
6	Main Design Project for Water Supplying of Mine and TPP "Oslomej" Kichevo	3.4		355.6	Steel	1,005,000	DEM	1995	1.083	9,917	190.7	Granit Project - Skopje	Granit Project - Skopje
7	Main Design Project for Water Supplying of AE "Plodno Pole" and village Hamzali	2.5		800	AC	1,250,000	DEM	1993	-	-	-	Granit Project - Skopje	Granit Project - Skopje
8	Main Design Project for Water Supplying of Struga and surrounding villages from Gorna Belica springs	5.3 4.6		500 500	PVC PVC	1,387,000 <sup>(1)</sup> 731,000	DEM DEM	1996 1996	1.051 1.051	8,521 5,174	163.9 99.5	Institute for Studies and Design Beton - Skopje	Institute for Studies and Design Beton - Skopje
9	Patishaka Reka Water Supply Project	45.03		223 <sup>(2)</sup>	PVC	2,700,000	US\$	1995	1.083	-	64.9	Municipality of Kisela Voda	Regional Water Supply System "Patishaka Reka"
10	Kumanovo Water Pipeline Construction Project	10.78		757 <sup>(3)</sup>	Steel	5,500,000	DEM	1998	1.000	15,806	304.0	Prostor-Kumanovo Municipality	Kumanovo Municipality

Note: (1) Design pipes of 10 bar pressure. The rest of the pipes are designed by 6 bar pressure.

(2) Differences of price are due to inconvenient conditions.

(3) Average diameter estimated by weighted mean

Exchange rate : US\$1.0=MKD52.0=DEM1.6785 (Jan.15, 1999)

Table AN18.3 Construction Cost of Filter Station

No.	Name of Project	Design Capacity (lit/sec)	Cost	Currency	Project Design Year	Adjustment factor	Adjusted cost for present value (1998)		Name of Construction and Design Company	Data Source
							(MKD)	(US\$)		
1	Main Design Project for Water Supplying Filter Station - Shtip	500	123,500,000	DIN	1991	-	-	-	Megaproject Shtip	Vodovod "Isar"- Shtip
2	Main Design Project for Water Supplying Filter Station - Patishka Reka	80	23,618,000	MKD	1995	1.083	25,578,294	491,890	Rading - Skopje	Rading - Skopje
3	Main Design Project for Water Supplying Filter Station - Makedonska Kamenica	40	15,749,000	MKD	1995	1.083	17,056,167	328,003	Rading - Skopje	Rading - Skopje
4	Main Design Project for Water Supplying Filter Station - Radovish	30	15,685,000	MKD	1997	1.007	15,794,795	303,746	Rading - Skopje	Rading - Skopje
5	Main Design Project for Water Supplying Filter Station - Pehchevo	30	15,274,000	MKD	1996	1.051	16,052,974	308,711	Rading - Skopje	Rading - Skopje
6	Main Design Project for Water Supplying village Slivovo - Ohrid	2	1,979,000 <sup>(1)</sup>	MKD	1996	1.051	2,079,929	39,999	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje
7	Main Design Project for Water Supplying of villages Ilovica, Shruka, Sekernak, Turnovo, Boriovo, Radovo and Bosilevo - Strumica	40	21,191,000	MKD	1996	1.051	22,271,741	428,303	Water Development Institute - Skopje	Water Development Institute - Skopje

Note: <sup>(1)</sup> Only mechanical filtration of raw water

Exchange rate : US\$1.0=MKD52.0=DEM1.6785 (Jan.15, 1999)

Table AN18.4 Construction Cost of Service Reservoir

No.	Name of Project	Design Capacity (m <sup>3</sup> )	Cost	Currency	Project Design Year	Adjustment Factor	Adjusted cost for present value (1998)		Name of Construction and Design Company	Data Source
							(MKD)	(US\$)		
1	Main Design Project for Water Supplying of villages Illova, Shuka, Sekernak, Turnovo, Borovo, Radovo and Bosilevo - Strumica	I - 600 II - 300	7,935,000 <sup>(1)</sup> 4,704,000	MKD MKD	1996 1996	1.051 1.051	8,339,685 4,943,904	160,379 95,075	Water Development Institute - Skopje	Water Development Institute - Skopje
2	Main Design Project for Water Supplying village Arachinovo - Skopje, by wells	I - 600 II - 300	7,513,000 <sup>(2)</sup> 4,914,000	MKD MKD	1996 1996	1.051 1.051	7,896,163 5,164,614	151,849 99,320	Water Development Institute - Skopje	Water Development Institute - Skopje
3	Main Design Project for Water Supplying village Slivovo - Ohrid	40	1,171,000	MKD	1996	1.051	1,230,721	23,668	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje
4	Main Design Project for Water Supplying village Modrich - Struga	90	1,838,000	MKD	1997	1.007	1,850,866	35,594	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje
5	Main Design Project for Water Supplying village D. Orashje - Tetovo	90	1,864,000	MKD	1998	1.000	1,864,000	35,845	WMO Pelagonija Bitola, WU Skopje	WMO Pelagonija Bitola, WU Skopje
6	Main Design Project for Service Reservoir for Water Supplying Berovo	1,200	11,800,000	MKD	1998	1.000	11,800,000	226,923	Melioprojekt - Skopje	PE"Usluga" - Berovo
10	Main Design Project for Service Reservoir for Water Supplying Struga	4,600	410,650	DEM	1997	1.000	12,721,937	244,653	Institute for Studies and Design Beton - Skopje	Institute for Studies and Design Beton - Skopje
13	Main Design Project for Water Supplying of settlement Pero Chiche - Kumanovo	350	6,500,000	MKD	1998	1.000	6,500,000	125,000	Institute for Studies and Design Beton - Skopje	Institute for Studies and Design Beton - Skopje
14	Main Design Project for Water Supplying of village Zhilche - Tetovo	100	2,498,000	MKD	1997	1.007	2,515,486	48,375	Salonit - Skopje	Salonit - Skopje
15	Main Design Project for Water Supplying of village Ratae - Tetovo	170	3,778,000	MKD	1998	1.000	3,778,000	72,654	Salonit - Skopje	Salonit - Skopje

(1) Service reservoir I included civil works for pumping station.

Note:

Service reservoir II is for upper zone.

(2) Cost of the service reservoir I includes the construction cost of pumping station.

Exchange rate : US\$1.0=MKD52.0=DEM1.6785 (Jan.15, 1999)

Table AN18.5 Construction Cost of Pumping Station

No.	Name of Project	Design Capacity (lit/sec)	Head of pumping (m)	Cost	Currency	Project Design Year	Adjustment Factor	Adjusted cost for present value (1998)		Name of Construction and Design Company	Data Source
								(MKD)	(US\$)		
1	Main Design Project for Water Supplying of villages Ilovica, Shitka, Sekernak, Turnovo, Boriovo, Radovo and Bosilevo - Strumica	13		721,000 <sup>(1)</sup>	MKD	1996	1.051	757,771	14,573	Water Development Institute - Skopje	Water Development Institute - Skopje
4	Main Design Project for Water Supplying of village Zhilche - Tetovo	6		747,000	MKD	1997	1.007	752,229	14,466	Salonit - Skopje	Salonit - Skopje
5	Main Design Project for Water Supplying of village Ratae - Tetovo	3.33-6.66	96-57	1,485,000	MKD	1998	1.000	1,485,000	28,558	Salonit - Skopje	Salonit - Skopje

Note: <sup>(1)</sup> Only the cost of mechanical part is included. The civil part is included in the service reservoir cost.  
Exchange rate : US\$1.0=MKD52.0=DEM1.6785 (Jan.15, 1999)

Table AN18.6 Fill Dam Construction Cost and Embankment Volume

(1) Name of Dam	(2) Dam Cost (10 <sup>6</sup> US\$)	(3) Embankment Volume (10 <sup>6</sup> m <sup>3</sup> )	(4)=(2)/(3) Unit Cost (US\$/m <sup>3</sup> )	(5) Remarks
1 Lisiche	38.468 (breakdown in thousand cost) 290,000x15.7 = 4.553 2,190,000x8.19 = 17.936 170,000x17.9 = 3.043 660,000x19.6 = 12.936 3,310,000 = 38.436	3.31	11.6	
2 Knezevo (Zletovica)	33.94	1.6	21.2	
3 Vakuf	34.95	1.56	22.4	1977 price level
4 Prohor	38.96	2.24	17.4	1977 price level
5 Slupchanka	7.0	0.27	25.9	
6 Rechani	21.8	0.71	30.7	Dam height H=75m
7 Razlovci	21.6	0.94	23.0	1977 price level
8 Konsko	16.2	1.5	10.8	1977 price level
9 Strezevo	87.1	3.78	23.0	
10 Paligrad	8.3	1.7	4.9	

Table AN18.7 Tariff of Electricity

Users connected to the distribution line (Applied from Oct.1, 1998)

Unit: Denars

Tariff rate	Season	Time	35 KV	10 KV	Domestic		Remaining 04 KV		Street
					One tariff	Two tariff	I tariff degree	II tariff degree	
KW	winter		486.66	375.33			364.89	354.42	
	summer		324.44	250.22			243.05	236.27	
KWh	winter	day	1.43	1.58	1.84	2.29	1.74	3.17	2.72
		night	0.74	0.79	0.00	1.14	0.86	0.00	0.00
	summer	day	0.95	1.06	1.22	1.53	1.16	2.12	1.81
		night	0.50	0.52	0.00	0.76	0.57	0.00	0.00
KVAh	winter	day	0.37	0.35			0.43	0.79	
		night	0.17	0.21			0.22	0.00	
	summer	day	0.24	0.23			0.29	0.53	
		night	0.11	0.14			0.15	0.00	

Note: As tariff of electricity in the present study, 1.74/kWh is applied uniformly (As a whole day rate)

Data source: MOE- Department for prices, Dec.1998



Table AN18.8 Labour Price

Classification		Wage (MKD)	Note
Director or Manager	month	37,000	
Manager of division of construction supervision	month	33,000	
Manager of administration division	month	26,000	
Engineer for construction supervision	month	27,000	5~10 years experience
Supervision technician	month	19,000	
Driver	month	15,000	

Source: Prices collected by the Study Team, December 1998.

Cooperated by H.E.C Kozjak, Skopje

*Reference:*

Classification		Wage (MKD)	Note
Salaries and allowances			
Water master	month	6,000	
Worker in Agro-Kombinat	month	4,000~5,000	
Engineer in AK	month	13,000	
Pension from industry	month	4,000	Old system
Farmers' pension	month	2,000	New system
Farmers' pension	month	4,000	
School fee	month	3,000	
Allowances when unemployed	month	2,000	Secondary school
Total cost of scholization	month	5,000	Secondary school, including transportation, accom.
Paid labour in farmer's field	month	300	
Paid labour in AK	month	200	

Source: "Irrigation Restructuring and Rehabilitation Project, Post-Preparation Report", Feb.1997, FAO

Prices applied in the present study are as follows :

Classification		Wage (MKD)	Note
Manager/Senior staff	month	30,000	
Junior engineer	month	20,000	
Gauge keeper/Skilled labour	month	15,000	

Table AN18.9 Economic Benefit and Financial Revenue of the Hydro Power Sector

**Alternative Thermal Power Plant (22MW Thermal Power Plant)**

**1. Capacity Value**

1) Unit Construction Cost (UCC) (US\$/kW)*1)				1,000
2) UCC including Indirect Construction Cost IDC (US\$/kW)*2)	1,000	x	1.12886	= 1,129
3) Annual O/M Cost (% of UCC)	2.0	%		2.0
4) Life Time (Year)				30
5) Discount Rate (%)				8
6) Capital Recovery Factor (CRF)				0.088827

**7) Efficiency Component for Adjustment Factor** Efficiency Component on Hydro and Thermal (coal-fired steam) Power Plant

	Hydro		Coal-fired	
- Station use	0.3	%	7.0	%
- Transmission line loss	5.0	%	2.0	%
- Forced outage	0.5	%	8.0	%
- Scheduled outage	2.0	%	12.0	%

8) kW Value Adjustment Factor (AF1)

$$\frac{(1-0.003) \times (1-0.05) \times (1-0.005) \times (1-0.02)}{(1-0.07) \times (1-0.02) \times (1-0.08) \times (1-0.12)}$$

$$= \frac{0.997 \times 0.95 \times 0.995 \times 0.98}{0.97 \times 0.98 \times 0.92 \times 0.88}$$

$$= 1.20005$$

9) Capacity Value

$$= \text{UCC} \times (\text{CRF} + \text{O/M}) \times \text{AF1}$$

$$= 1,129 \times (0.088827 + 0.02) \times 1.20005$$

$$= 1,129 \times 0.108827 \times 1.20005$$

$$= \text{US\$ } 147/\text{kW}$$

**2. Energy Value** = US\$ 0.02/kWh

**3. Revenue (Power Tariff)\*3** = US\$ 0.048/kWh (in 1998)

**Annual Escalation Rate\*4)** = 3.5 %

\*1) ref. A paper of Macedonian Committee for Large -scale Electrical System - Sirge, Skopje

\*2) ref. A paper on other similar project

\*3) ref. Staff Appraisal Report ( Report No. 17064-MK )  
"Power System Improvement Project" January 23, 1998 para.2.17

\*4) ref. growth rate of pae capita GDP in Interim Report (Sep. 1998) p.5-5.

Table AN18.10 Inflation Rate<sup>(1)</sup>

Year	Previous year=100		
	Dec/Dec	Jan-Dec/Jan-Dec	Adjustment factor
1970		10.0	-
1971		17.4	-
1972		16.9	-
1973		19.9	-
1974		27.6	-
1975		26.4	-
1976		8.7	-
1977		15.5	-
1978	14.9	14.2	-
1979	23.2	21.0	-
1980	43.0	33.8	-
1981	41.3	47.2	-
1982	34.1	31.8	-
1983	56.0	39.9	-
1984	50.0	54.0	-
1985	75.5	72.0	-
1986	8.5	86.3	-
1987	168.6	115.1	-
1988	235.7	195.6	-
1989	2763.4	1246.0	-
1990	120.5	608.4	-
1991	229.7	114.9	-
1992	1925.2	1690.7	-
1993	229.6	349.8	-
1994	55.4	121.8	1.255
1995	9.2	15.9	1.083
1996	0.2	3.0	1.051
1997	4.5	4.4	1.007
1998 <sup>(2)</sup>	-1.0	0.7	1.000

Note: (1, Inflation rate is calculated from retail prices.

For the period 1970 - 1977, rates are calculated according to data of retail prices from "The 1993 Statistical Year Book" P.534, and the rates for 1978 - 1998 are estimated from competent statistical announcement documents.

(2, The rates are for January -October 1998. Rates are shifted for Oct/Dec and Jan-Oct/Jan-Dec.

*Date source : Statistical Office*

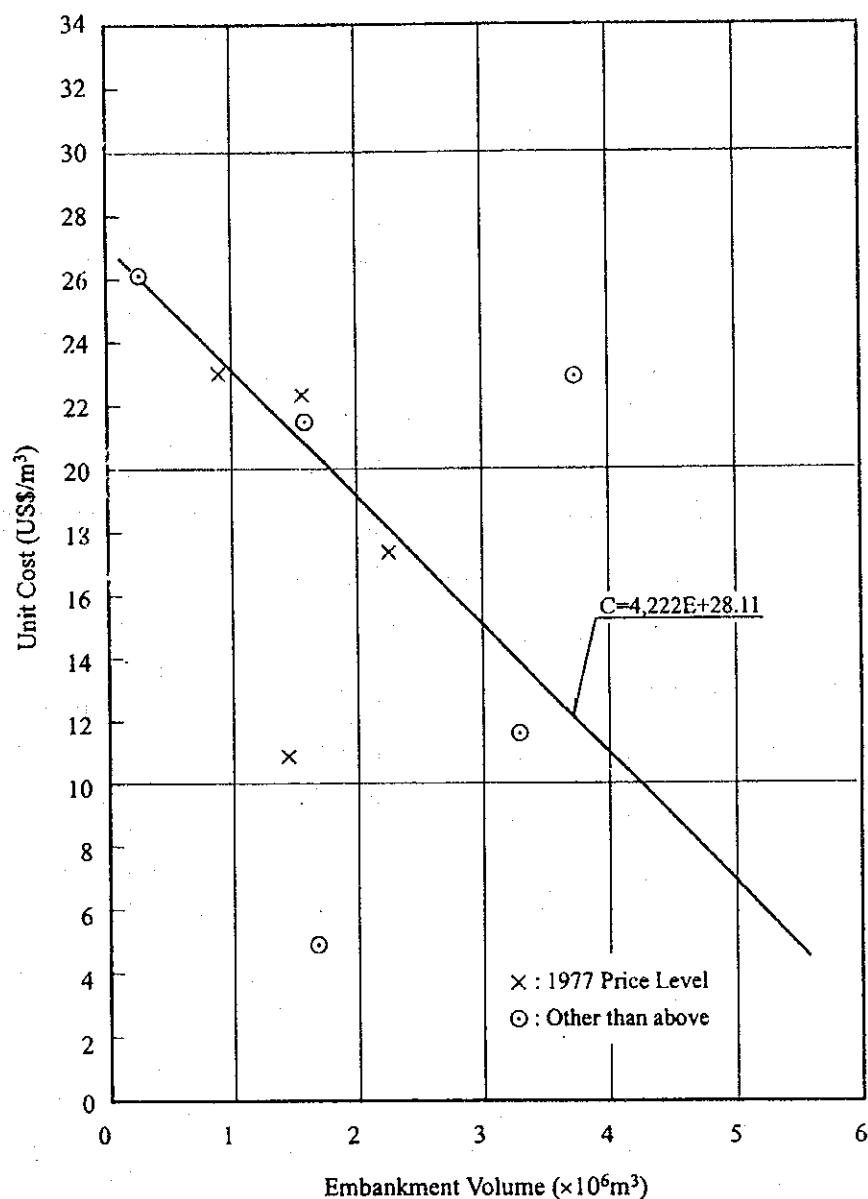


Figure AN18.1 Cost Curve of Rockfill Dam

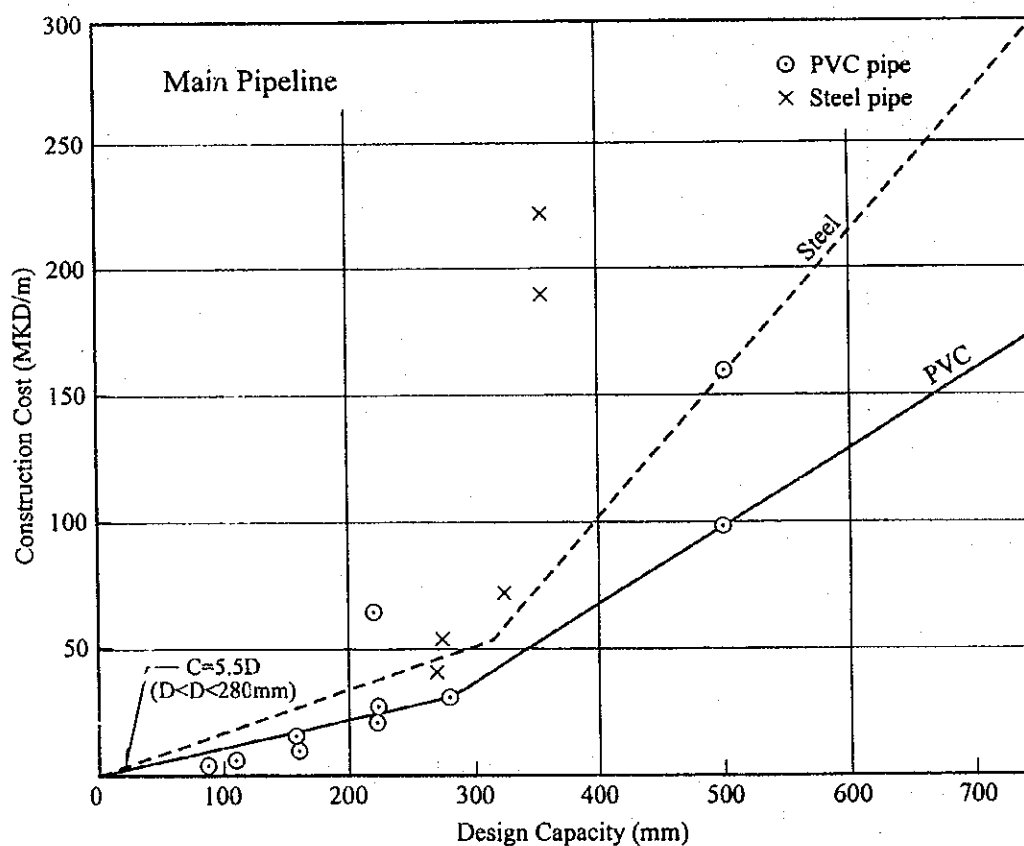
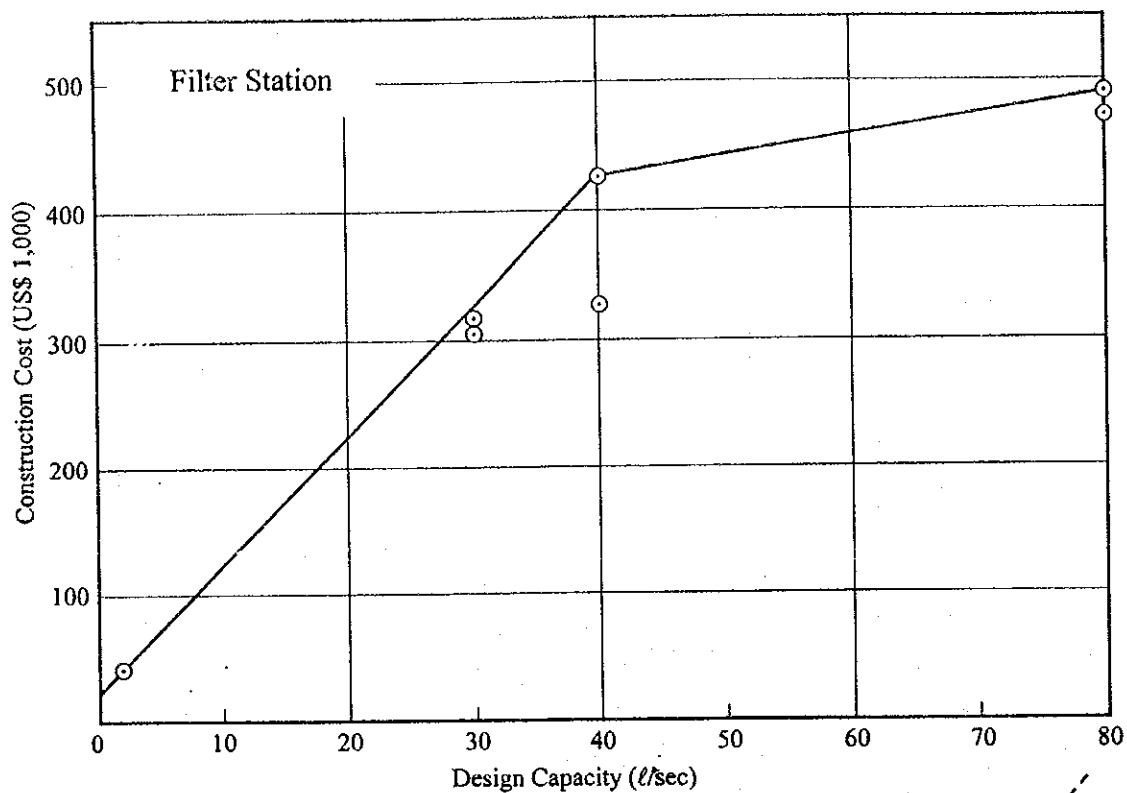


Figure AN18.2 Cost Curve of Filter Station and Main Pipeline

THE STUDY ON THE INTEGRATED WATER RESOURCES  
DEVELOPMENT AND MANAGEMENT MASTER PLAN IN  
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

JAPAN INTERNATIONAL COOPERATION AGENCY

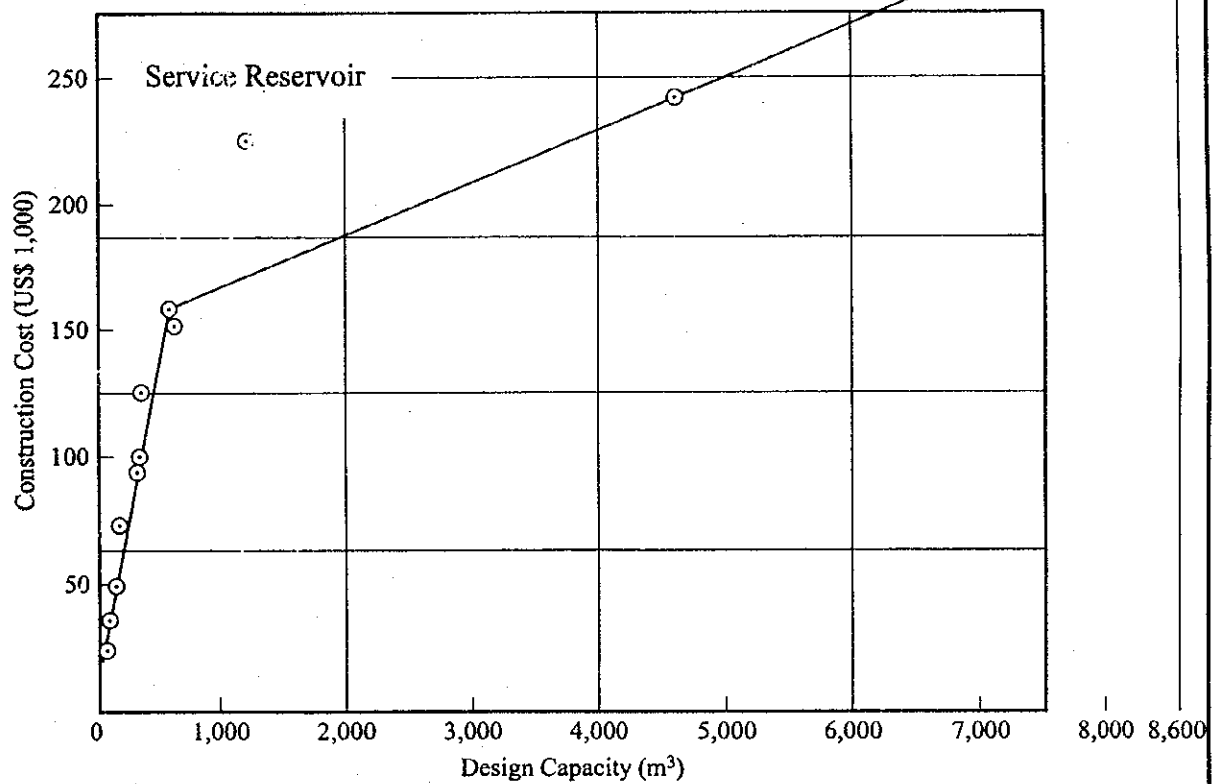
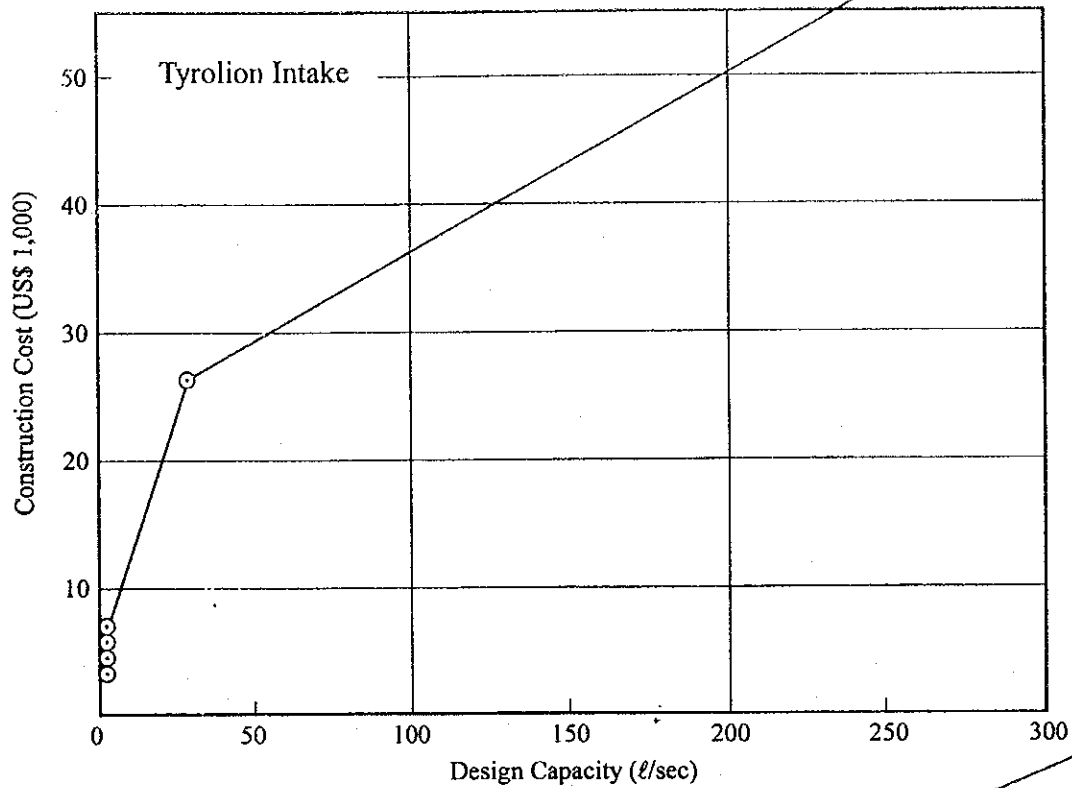


Figure AN18.3 Cost Curve of Tyrolean Intake and Service Reservoir

THE STUDY ON THE INTEGRATED WATER RESOURCES  
DEVELOPMENT AND MANAGEMENT MASTER PLAN IN  
THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

JAPAN INTERNATIONAL COOPERATION AGENCY



## ***Annex 19***

### ***Reference Data for Irrigation Projects***



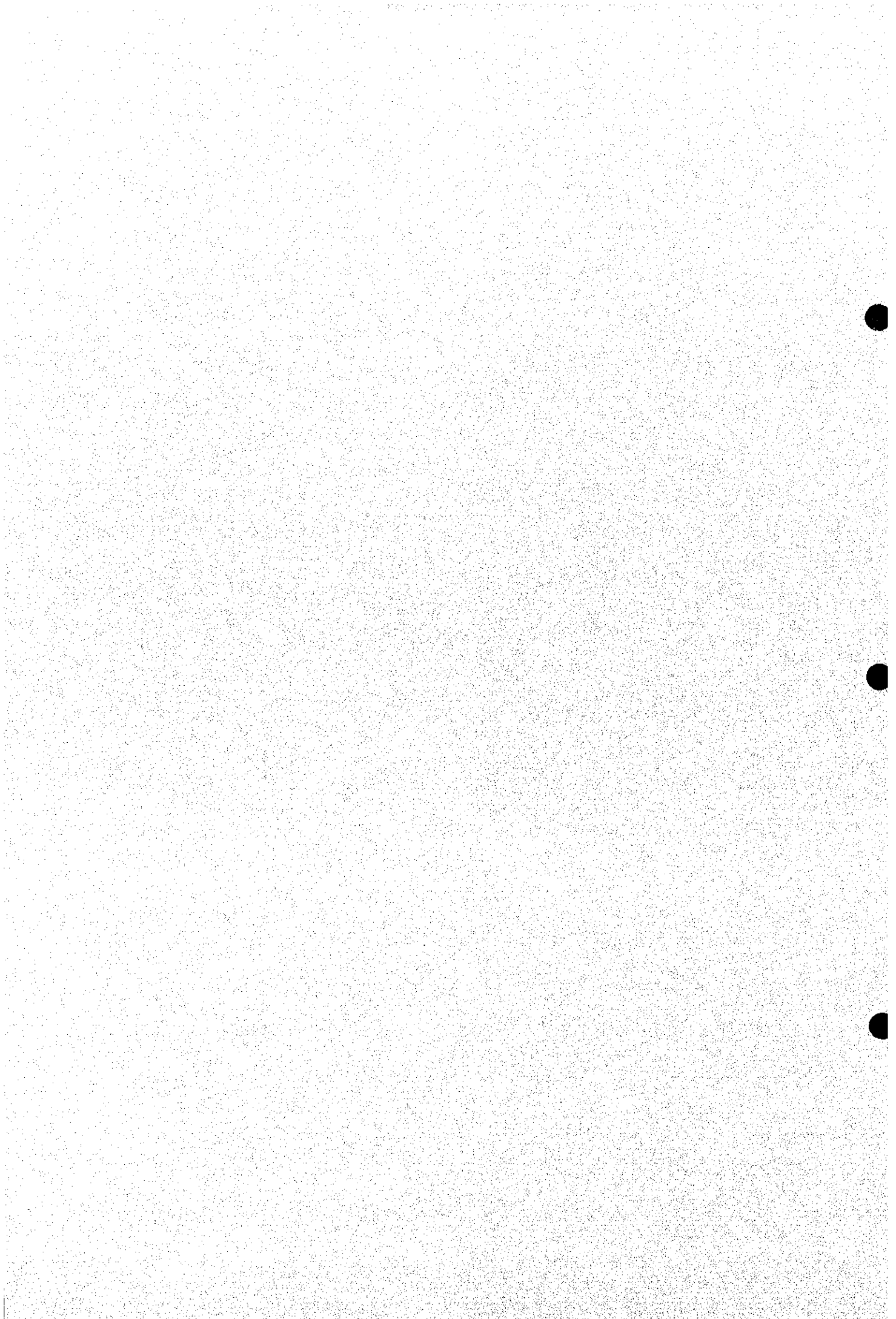


Table AN19.1 List of Irrigation Rehabilitation Project

	Project Name	Location	Organization	Existing irrigation area (ha)
1	Kicevsko Pole Irrigation System Rehabilitation Project	Kicevsko Pole	WMO "Kicevsko Pole"-Kichevo	1,450
2	Valandonovsko Pole Irrigation System Rehabilitation Project	Valandovsko Pole	ZK "Anska Reka"-Valandovo	3,624
3	Gevgelija Irrigation System Rehabilitation Project	Gevgelija	WMO "Povardarje"-Gevgelija	1,490
4	Prilep Irrigation System Rehabilitation Project	Prilep	WMO "Sterna"-Prilep	6,200
5	Kumanovdsko Pole Irrigation System Rehabilitation Project	Lipkovo-Glaznja	WMO "Kumanovo Pole"-Kumanovo	10,820
6	Mantovo Irrigation System Rehabilitation Project	Mantovo	WMO "Mantovo"-Radovish	5,581
7	Strumicko Pole Irrigation System Rehabilitation Project	Strumicko Pole	WMO "Strumicki Sliv"-Strumica	12,200
8	Irrigation System Betterment Project in Resen	Prespansko Pole	WMO "Prespansko Pole"-Resen	5,955
9	Ohridsko Pole Irrigation System Rehabilitation Project	Sistemi Ohridsko Pole	WMO "Ohridsko Ezero"-Ohrid	4,100
10	Strusko Pole Irrigation rehabilitation Project	Sistemi Strusko Pole	WMO "Cm Drim"-Resen	3410
Total				54,830

Table AN19.2 Cropping Model by Climate Regions

No.	Kind of crop	Climatic region											
		1		2		3a		3b		4		5	
		Area (ha)	Ratio	Area (ha)	Ratio	Area (ha)	Ratio	Area (ha)	Ratio	Area (ha)	Ratio	Area (ha)	Ratio
1	Wheat	20,875	0.90	33,784	0.80	35,491	0.60	14,445	0.50	216	0.10	2,198	0.25
2	Maize	8,111	0.35	12,670	0.30	17,744	0.30	4,333	0.15	108	0.05	2,198	0.25
3	Rice	0	0.00	0	0.00	0	0.00	4,333	0.15	0	0.00	0	0.00
4	Tobacco	0	0.00	10,558	0.25	2,958	0.05	1,445	0.05	0	0.00	0	0.00
5	Sunflower	0	0.00	0	0.00	5,915	0.10	2,888	0.10	0	0.00	0	0.00
6	Cabbage	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2,638	0.30
7	Tomatoes	1,159	0.05	2,111	0.05	2,958	0.05	1,445	0.05	43	0.02	879	0.10
8	Peppers	1,159	0.05	2,111	0.05	2,958	0.05	1,445	0.05	0	0.00	440	0.05
9	Other vegetables	10,428	0.45	6,334	0.15	2,958	0.05	2,889	0.10	65	0.03	1,319	0.15
10	Apples	0	0.00	6,334	0.15	0	0.00	0	0.00	0	0.00	0	0.00
11	Plums	0	0.00	2,111	0.05	0	0.00	0	0.00	1,509	0.70	0	0.00
12	S.Cheries	0	0.00	0	0.00	1,183	0.02	1,445	0.05	431	0.20	0	0.00
13	Other orchards	0	0.00	0	0.00	1,775	0.03	2,889	0.10	0	0.00	0	0.00
14	Grapes	0	0.00	0	0.00	20,702	0.35	5,778	0.20	0	0.00	3,956	0.45
Total		23,174	1.80	42,229	1.80	59,151	1.60	28,890	1.50	2,156	1.10	8,792	1.55

Table AN19.3 Cropping Pattern of Proposed Irrigation Schemes (New Development)

No.	Project name	Irrigation area (ha)	Climate region	Irrigation area by crops (ha)														Total
				Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S.Cherries	Other orchards	Grapes	
1	Construction of By-pass channel Raven - Reehica	8,000	1	7,206	2,800	0	0	0	0	0	400	400	3,600	0	0	0	0	14,406
2	Paligrad Multipurpose Dam Project - Phase II	1,800	3a	1,080	540	0	90	180	0	90	90	90	90	0	0	36	54	2,880
3	Kiselichka Dam Project	4,500	4	451	225	0	0	0	0	90	0	136	0	0	900	0	0	4,951
4	Vakuf Multipurpose Dam Project	24,000	3a	14,400	7,199	0	1,200	2,400	0	1,200	1,200	1,200	0	0	480	720	8,400	38,400
5	Pelince Dam Project	5,000	3a	3,000	1,500	0	250	500	0	250	250	250	0	0	100	150	1,750	8,000
6	Razloveci Dam Project	4,000	4	401	200	0	0	0	0	80	0	121	0	0	2,800	800	0	4,401
7	Blatec Dam Project	1,000	3b	500	150	150	50	100	0	50	50	100	0	0	50	100	200	1,500
8	Zletovica Multipurpose Dam Project - Phase II	3,100	3a	1,860	930	0	155	310	0	155	155	155	0	0	62	93	1,085	4,960
9	Construction of Irrigation of Sub-System "Shipisko Pole"	2,773	3b	1,337	416	416	139	277	0	139	139	277	0	0	139	277	555	4,160
10	Krapa Dam Project	8,000	2	6,400	2,400	0	2,000	0	0	400	400	1,200	1,200	400	0	0	0	14,400
11	Zhvan Dam Project	19,000	2	15,200	5,701	0	4,750	0	0	950	950	2,850	2,850	950	0	0	0	34,200
12	Obednik Dam Project	2,000	2	1,600	600	0	500	0	0	100	100	300	300	100	0	0	0	3,600
13	Kochishte Dam Project	4,500	2	3,600	1,350	0	1,125	0	0	225	225	675	675	225	0	0	0	8,100
14	Zhurche Dam Project	1,500	2	1,200	450	0	375	0	0	75	75	225	225	75	0	0	0	2,700
15	Konjarka Dam Project	3,000	3a	1,800	900	0	150	300	0	150	150	150	0	0	60	90	1,050	4,800
16	Petrushka Dam Project	5,000	5	1,250	1,250	0	0	0	1,500	500	250	750	0	0	0	0	2,250	7,750
17	Kovanska Dam Project	2,000	5	500	500	0	0	0	600	200	100	300	0	0	0	0	900	3,100
18	Konsko Multipurpose Dam Project	6,690	5	1,673	1,673	0	0	0	2,007	669	335	1,004	0	0	0	0	3,010	10,370
19	Podares Multipurpose Dam Project	4,000	3a	2,400	1,200	0	200	400	0	200	200	200	0	0	80	120	1,400	6,400
Total		109 863		65 908	29 984	566	10 985	4 467	4 108	5 922	5 069	13 382	5 250	7 699	2 706	1 605	21 229	179 079

Table AN19.4 Cropping Pattern of Proposed Irrigation Schemes (Rehabilitation)

No.	Project name	Irrigation area (ha)	Climate region	Irrigation area by crops (ha)														Total	
				Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S.Cheries	Other orchards	Grapes		
1	Kicevsko Pole Irrigation System Rehabilitation Project	1,450	3a	870	435	0	73	145	0	73	73	73	73	0	0	29	44	507	2,320
2	Kumanovsko Pole Irriaton System Rehabilitation Project	10,820	3a	6,492	3,246	0	541	1,082	0	541	541	541	541	0	0	216	325	3,787	17,312
3	Prilep Irrigation System Rehabilitation Project	6,200	2	4,960	1,860	0	1,550	0	0	310	310	930	930	930	310	0	0	0	11,160
4	Valandovsko Pole Irrigation System Rehabilitation Project	3,624	5	906	906	0	0	0	1,087	362	181	544	544	0	0	0	0	1,631	5,617
5	Gevgelija Irrigation System Rehabilitation Project	1,490	5	373	373	0	0	0	447	149	75	224	224	0	0	0	0	670	2,310
6	Ohridsko Pole Irrigation System Rehabilitation Project	4,100	2	3,280	1,230	0	1,025	0	0	205	205	615	615	615	205	0	0	0	7,380
7	Strusko Pole Irrigation System Rehabilitation Project	3,410	2	2,728	1,023	0	853	0	0	170	170	511	511	511	170	0	0	0	6,138
8	Mantovo Irrigation System Rehabilitation Project	5,581	3a	3,349	1,674	0	279	558	0	279	279	279	279	0	0	112	167	1,953	8,930
9	Strumicko Irrigation System Rehabilitation Project	12,200	3a	7,320	3,660	0	610	1,220	0	610	610	610	610	0	0	244	366	4,270	19,520
10	Irrigation System Betterment Project in Resen	5,955	2	0	0	0	0	0	0	0	0	5,955	5,955	0	0	0	0	0	5,955
Total		54,830		30,278	14,407	0	4,931	3,005	1,534	2,699	2,444	10,281	2,056	685	601	902	12,818	86,642	

Table AN19.5 Economic and Financial Return for Irrigation Projects (1/2) (New Development)

No.	Project name	Item	Unit value														Other orchards	S. Cherries	Plums	Apples	Other vegetables	Peppers	Tomatoes	Cabbage	Sunflower	Tobacco	Rice	Maize	Wheat	Total
			Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S. Cherries	Other orchards	Grapes														
1	Construction of Bypass channel Raven - Redica	Cropping area (ha)	7,206	2,800	0	0	0	400	400	3,600	0	0	0	0	0	14,406	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	34,590	15,400	0	0	0	16,004	8,802	71,998	0	0	0	0	0	0	146,795	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	363,200	146,302	0	0	0	75,219	264,068	1,223,965	0	0	0	0	0	0	2,072,755	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	269,806	103,181	0	0	0	75,219	237,662	1,101,568	0	0	0	0	0	0	1,787,436	0	0	0	0	0	0	0	0	0	0	0	0	
2	Paligrad Multipurpose Dam Project - Phase II	Cropping area (ha)	1,080	540	0	90	180	0	90	90	90	0	0	36	54	2,880	630	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	5,184	2,970	0	216	360	0	3,601	1,980	1,800	0	0	144	508	12,410	29,173	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	54,433	28,213	0	9,289	79,199	0	16,923	59,409	30,605	0	0	5,760	4,265	130,310	418,405	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	40,436	19,898	0	8,425	71,279	0	16,923	53,468	27,544	0	0	5,184	4,265	130,310	377,731	0	0	0	0	0	0	0	0	0	0	0	0	
3	Kiselickka Dam Project	Cropping area (ha)	451	225	0	0	0	0	90	90	136	0	0	3,150	900	0	4,951	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	2,164	1,240	0	0	0	0	3,590	0	2,713	0	0	34,015	3,598	0	47,321	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	22,722	11,778	0	0	0	16,873	0	46,127	0	0	1,360,620	143,933	0	0	1,602,053	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	16,879	8,307	0	0	0	16,873	0	41,514	0	0	1,224,558	129,540	0	0	1,437,671	0	0	0	0	0	0	0	0	0	0	0	0	
4	Vakuf Multipurpose Dam Project	Cropping area (ha)	14,400	7,199	0	1,200	2,400	0	1,200	1,200	1,200	0	0	480	720	8,400	38,400	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	69,121	39,597	0	2,880	4,800	0	48,007	26,404	24,004	0	0	1,920	6,770	165,473	388,976	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	725,768	376,172	0	123,859	1,055,982	0	225,634	792,121	408,062	0	0	76,799	56,866	1,737,469	5,578,732	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	539,142	265,301	0	112,337	950,384	0	225,634	712,908	367,256	0	0	69,119	56,866	1,737,469	5,036,416	0	0	0	0	0	0	0	0	0	0	0	0	
5	Pelince Dam Project	Cropping area (ha)	3,000	1,500	0	250	500	0	250	250	250	0	0	100	150	1,750	8,000	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	14,400	8,249	0	600	1,000	0	10,002	5,501	5,001	0	0	400	1,410	34,474	81,037	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	151,202	78,369	0	25,804	219,996	0	47,007	165,025	85,013	0	0	16,000	11,847	361,973	1,162,236	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	112,321	55,271	0	23,404	197,997	0	47,007	148,523	76,512	0	0	14,400	11,847	361,973	1,049,253	0	0	0	0	0	0	0	0	0	0	0	0	
6	Razdovci Dam Project	Cropping area (ha)	401	200	0	0	0	0	80	80	121	0	0	2,800	800	0	4,401	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	1,924	1,102	0	0	0	3,191	0	2,412	0	0	30,236	3,199	0	0	42,063	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	20,197	10,469	0	0	0	14,998	0	41,002	0	0	1,209,440	127,941	0	0	1,424,047	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	15,004	7,384	0	0	0	14,998	0	36,902	0	0	1,088,496	115,147	0	0	1,277,930	0	0	0	0	0	0	0	0	0	0	0	0	
7	Blitce Dam Project	Cropping area (ha)	500	150	150	50	100	0	50	50	100	0	0	50	100	200	1,500	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	2,400	825	900	120	200	0	2,001	1,100	2,000	0	0	200	940	3,940	14,626	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	25,200	7,837	18,898	5,162	43,985	0	9,403	33,011	34,000	0	0	8,003	7,896	41,370	234,764	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	18,720	5,527	11,249	4,682	39,586	0	9,403	29,710	30,600	0	0	7,202	7,896	41,370	205,946	0	0	0	0	0	0	0	0	0	0	0	0	
8	Zletovica Multipurpose Dam Project - Phase II	Cropping area (ha)	1,860	930	0	155	310	0	155	155	155	0	0	62	93	1,085	4,960	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	8,928	5,115	0	372	620	0	6,201	3,411	3,100	0	0	248	874	21,374	50,243	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	93,745	48,589	0	15,998	136,398	0	29,144	102,316	52,708	0	0	9,920	7,345	224,423	720,586	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	69,639	34,268	0	14,510	122,758	0	29,144	92,084	47,437	0	0	8,928	7,345	224,423	650,537	0	0	0	0	0	0	0	0	0	0	0	0	
9	Construction of Irrigation of Sub-System "Shipisko Pole"	Cropping area (ha)	1,387	416	416	139	277	0	139	139	277	0	0	139	277	555	4,160	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	6,655	2,287	2,495	333	554	0	5,548	3,051	5,546	0	0	555	2,607	10,926	40,538	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	69,880	21,731	52,404	14,314	121,970	0	26,075	91,541	94,282	0	0	22,192	21,896	114,719	651,002	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	51,911	15,326	31,193	12,982	109,773	0	26,075	82,387	84,854	0	0	19,973	21,896	114,719	571,087	0	0	0	0	0	0	0	0	0	0	0	0	
10	Krapa Dam Project	Cropping area (ha)	6,400	2,400	0	2,000	0	0	400	400	1,200	1,200	400	0	0	14,400	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Annual yield (ton)	30,721	13,201	0	4,800	0	0	15,997	8,798	23,999	21,119	4,319	0	0	122,954	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Financial benefit (MKD.10 <sup>3</sup> )	322,568	125,413	0	206,415	0	0	75,184	263,944	407,977	544,866	172,763	0	0	2,319,129	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Economic benefit (MKD.10 <sup>3</sup> )	239,622	88,449	0	187,213	0	0	75,184	237,549	367,180	489,957	155,487	0	0	1,840,641	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table AN19.5 Economic and Financial Return for Irrigation Projects (2/2) (New Development)

		Cropping area (ha)	15,200	5,701	0	4,750	0	950	2,850	2,850	950	0	0	0	34,200
11	Zhvan Dam Project	Annual yield (ton)	72,562	31,353	0	11,401	0	37,992	20,896	56,997	50,157	10,258	0	0	292,015
		Financial benefit (MKD.10 <sup>3</sup> )	766,098	297,856	0	490,235	0	178,562	626,866	988,946	1,294,056	410,313	0	0	5,032,952
		Economic benefit (MKD.10 <sup>3</sup> )	569,101	210,067	0	444,632	0	178,562	564,180	872,052	1,163,648	369,281	0	0	4,371,522
12	Obednik Dam Project	Cropping area (ha)	1,600	600	0	500	0	100	100	300	100	0	0	0	3,600
		Annual yield (ton)	7,680	3,300	0	1,200	0	3,999	2,200	6,000	5,280	1,080	0	0	30,738
		Financial benefit (MKD.10 <sup>3</sup> )	80,642	31,353	0	51,604	0	18,796	65,986	101,994	136,216	43,191	0	0	529,782
		Economic benefit (MKD.10 <sup>3</sup> )	59,905	22,112	0	46,803	0	18,796	59,387	91,795	122,489	38,872	0	0	460,160
		Cropping area (ha)	3,600	1,350	0	1,125	0	225	225	675	225	0	0	0	8,100
13	Kochishte Dam Project	Annual yield (ton)	17,280	7,426	0	2,700	0	8,998	4,949	13,499	11,879	2,429	0	0	69,161
		Financial benefit (MKD.10 <sup>3</sup> )	181,444	70,545	0	116,108	0	42,291	148,468	229,487	306,487	97,179	0	0	1,192,010
		Economic benefit (MKD.10 <sup>3</sup> )	134,787	49,753	0	105,307	0	42,291	133,622	206,539	275,601	87,461	0	0	1,035,360
		Cropping area (ha)	1,200	450	0	375	0	75	75	225	75	0	0	0	2,700
14	Zhurcha Dam Project	Annual yield (ton)	5,760	2,475	0	900	0	2,999	1,650	4,500	3,960	810	0	0	23,054
		Financial benefit (MKD.10 <sup>3</sup> )	60,481	23,515	0	38,703	0	14,097	49,489	76,496	102,162	32,393	0	0	397,337
		Economic benefit (MKD.10 <sup>3</sup> )	44,929	16,584	0	35,102	0	14,097	44,541	68,846	91,867	29,154	0	0	345,120
		Cropping area (ha)	1,800	900	0	150	0	150	150	150	0	60	90	0	4,800
15	Konjarka Dam Project	Annual yield (ton)	8,640	4,950	0	360	0	6,001	3,301	3,000	0	240	846	20,684	48,622
		Financial benefit (MKD.10 <sup>3</sup> )	90,721	47,022	0	15,482	0	28,204	99,015	51,008	0	9,600	7,108	217,184	697,342
		Economic benefit (MKD.10 <sup>3</sup> )	67,393	33,163	0	14,042	0	28,204	89,114	45,907	0	8,640	7,108	217,184	629,552
		Cropping area (ha)	1,250	1,250	0	0	0	1,500	500	250	750	0	0	2,250	7,750
16	Petushka Dam Project	Annual yield (ton)	6,000	6,875	0	0	0	75,011	19,995	5,505	15,002	0	0	44,321	172,710
		Financial benefit (MKD.10 <sup>3</sup> )	63,000	65,313	0	0	0	1,005,152	93,979	163,150	255,039	0	0	465,365	2,112,998
		Economic benefit (MKD.10 <sup>3</sup> )	46,800	46,063	0	0	0	907,638	93,979	148,635	229,535	0	0	465,365	1,938,014
		Cropping area (ha)	500	500	0	0	0	600	200	100	300	0	0	900	3,100
17	Kovanska Dam Project	Annual yield (ton)	2,400	2,750	0	0	0	30,005	7,998	2,202	6,001	0	0	17,728	69,084
		Financial benefit (MKD.10 <sup>3</sup> )	25,200	26,125	0	0	0	402,061	37,591	66,060	102,015	0	0	186,146	845,199
		Economic benefit (MKD.10 <sup>3</sup> )	18,720	18,425	0	0	0	363,055	37,591	59,454	91,814	0	0	186,146	775,206
		Cropping area (ha)	1,673	1,673	0	0	0	2,007	669	335	1,004	0	0	3,010	10,370
18	Konsko Multipurpose Dam Project	Annual yield (ton)	8,028	9,199	0	0	0	100,365	26,754	7,366	20,073	0	0	59,301	231,085
		Financial benefit (MKD.10 <sup>3</sup> )	84,294	87,388	0	0	0	1,344,894	125,743	220,971	341,242	0	0	622,659	2,827,191
		Economic benefit (MKD.10 <sup>3</sup> )	62,618	61,632	0	0	0	1,214,419	125,743	198,874	307,118	0	0	622,659	2,593,063
		Cropping area (ha)	2,400	1,200	0	200	0	400	200	200	200	0	80	1,400	6,400
19	Podares Multipurpose Dam Project	Annual yield (ton)	11,520	6,600	0	480	0	8,001	4,401	4,001	0	320	1,128	27,579	64,829
		Financial benefit (MKD.10 <sup>3</sup> )	120,961	62,695	0	20,643	0	37,606	132,020	68,010	0	12,800	9,478	289,578	929,789
		Economic benefit (MKD.10 <sup>3</sup> )	89,857	44,217	0	18,723	0	37,606	118,818	61,209	0	11,520	9,478	289,578	839,403
		Cropping area (ha)	0	0	0	0	0	0	0	0	0	0	0	0	5,200
20	Irrigation System Betterment Project in Resen	Annual yield (ton)	0	0	0	0	0	0	0	0	0	0	0	0	91,520
		Financial benefit (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	2,361,216
		Economic benefit (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	0	0	0	0	2,123,264
Total			6,171,613	2,866,507	117,704	2,199,127	3,747,897	5,446,708	2,469,463	6,472,960	9,059,388	4,630,194	6,410,053	836,127	99,919,660

Table AN19.6 Economic and Financial Return for Irrigation Projects (Rehabilitation)

Unit value		Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S. Cherries	Other orchards	Grapes	Total
Average annual yield (ton/ha)		2.2	2.7	1.6	1.1	0.9	25.0	22.0	10.0	10.0	8.2	5.4	2.0	4.7	13.3	
Financial price (MKD/kg)		10.5	9.5	21.0	43.0	220.0	13.4	4.7	30.0	17.0	25.8	40.0	40.0	8.4	10.5	
Economic price (MKD/kg)		7.8	6.7	12.5	39.0	198.0	12.1	4.7	27.0	15.3	23.2	36.0	36.0	8.4	10.5	

No.	Project name	Item	Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S. Cherries	Other orchards	Grapes	Total
1	Kicevsko Pole Irrigation System Rehabilitation Project	Cropping area (ha)	870	435	0	73	145	0	73	73	73	0	0	29	44	507	2,320
		Annual yield (ton)	1,914	1,174	0	80	130	0	1,595	725	725	0	0	58	205	6,749	13,356
		Financial benefit (MKD.10 <sup>3</sup> )	20,097	11,157	0	3,430	28,710	0	7,498	21,753	12,327	0	0	2,320	1,718	70,869	179,879
		Economic benefit (MKD.10 <sup>3</sup> )	14,929	7,869	0	3,111	25,839	0	7,498	19,578	11,094	0	0	2,088	1,718	70,869	164,592
2	Kumanovsko Pole Irrigation System Rehabilitation Project	Cropping area (ha)	6,492	3,246	0	541	1,082	0	541	541	541	0	0	216	325	3,787	17,312
		Annual yield (ton)	14,283	8,764	0	595	974	0	11,904	5,411	5,411	0	0	433	1,526	50,365	99,664
		Financial benefit (MKD.10 <sup>3</sup> )	149,967	83,254	0	25,593	214,232	0	55,948	162,325	91,984	0	0	17,312	12,819	528,833	1,342,266
		Economic benefit (MKD.10 <sup>3</sup> )	111,404	58,716	0	23,212	192,809	0	55,948	146,092	82,786	0	0	15,581	12,819	528,833	1,128,199
3	Prilep Irrigation System Rehabilitation Project	Cropping area (ha)	4,960	1,860	0	1,550	0	0	310	310	930	930	310	0	0	11,160	
		Annual yield (ton)	10,912	5,023	0	1,705	0	0	6,819	3,099	9,299	7,626	1,674	0	0	0	46,156
		Financial benefit (MKD.10 <sup>3</sup> )	114,579	47,714	0	73,320	0	0	32,047	92,980	158,091	196,740	66,946	0	0	0	782,417
		Economic benefit (MKD.10 <sup>3</sup> )	85,116	33,651	0	66,500	0	0	32,047	83,682	142,282	176,913	60,251	0	0	0	680,442
4	Valandovsko Pole Irrigation System Rehabilitation Project	Cropping area (ha)	906	906	0	0	0	1,087	362	181	544	0	0	0	0	1,631	
		Annual yield (ton)	1,993	2,446	0	0	0	27,184	7,971	1,814	5,437	0	0	0	0	21,687	68,532
		Financial benefit (MKD.10 <sup>3</sup> )	20,929	23,239	0	0	0	364,267	37,464	54,409	92,426	0	0	0	0	227,718	820,452
		Economic benefit (MKD.10 <sup>3</sup> )	15,547	16,390	0	0	0	328,928	37,464	48,969	83,183	0	0	0	0	227,718	758,198
5	Gevgelija Irrigation System Rehabilitation Project	Cropping area (ha)	373	373	0	0	0	447	149	75	224	0	0	0	0	670	2,310
		Annual yield (ton)	820	1,006	0	0	0	11,177	3,277	746	2,235	0	0	0	0	8,917	28,177
		Financial benefit (MKD.10 <sup>3</sup> )	8,605	9,555	0	0	0	149,768	15,403	22,370	38,001	0	0	0	0	93,626	337,327
		Economic benefit (MKD.10 <sup>3</sup> )	6,392	6,739	0	0	0	135,238	15,403	20,133	34,201	0	0	0	0	93,626	311,732
6	Ohridsko Pole Irrigation System Rehabilitation Project	Cropping area (ha)	3,280	1,230	0	1,025	0	0	205	205	615	615	205	0	0	7,380	
		Annual yield (ton)	7,216	3,321	0	1,128	0	0	4,509	2,050	6,150	5,043	1,107	0	0	30,523	30,523
		Financial benefit (MKD.10 <sup>3</sup> )	75,770	31,553	0	48,486	0	0	21,192	61,487	104,544	130,102	44,271	0	0	517,405	517,405
		Economic benefit (MKD.10 <sup>3</sup> )	56,286	22,253	0	43,976	0	0	21,192	55,338	94,090	116,991	39,844	0	0	449,970	449,970
7	Strusko Pole Irrigation System Rehabilitation Project	Cropping area (ha)	2,728	1,023	0	853	0	0	170	170	511	511	170	0	0	6,138	
		Annual yield (ton)	6,002	2,762	0	938	0	0	3,750	1,705	5,115	4,194	921	0	0	25,386	25,386
		Financial benefit (MKD.10 <sup>3</sup> )	63,018	26,243	0	40,326	0	0	17,626	51,139	86,950	108,207	36,820	0	0	430,729	430,729
		Economic benefit (MKD.10 <sup>3</sup> )	46,814	18,508	0	36,575	0	0	17,626	46,025	78,255	97,302	33,138	0	0	379,243	379,243
8	Mantovo Irrigation System Rehabilitation Project	Cropping area (ha)	3,349	1,674	0	279	558	0	279	279	279	279	0	0	112	167	8,930
		Annual yield (ton)	7,367	4,520	0	307	502	0	6,140	2,791	2,791	0	0	223	787	25,978	51,407
		Financial benefit (MKD.10 <sup>3</sup> )	77,354	42,943	0	13,201	110,502	0	28,858	83,728	47,446	0	0	8,929	6,612	272,774	692,346
		Economic benefit (MKD.10 <sup>3</sup> )	57,463	30,286	0	11,973	99,452	0	28,858	73,355	42,701	0	0	8,037	6,612	272,774	639,510
9	Strumicko Irrigation System Rehabilitation Project	Cropping area (ha)	7,320	3,660	0	610	1,220	0	610	610	610	610	0	0	244	366	4,270
		Annual yield (ton)	16,104	9,881	0	671	1,098	0	13,422	6,101	6,101	0	0	488	1,721	56,789	112,376
		Financial benefit (MKD.10 <sup>3</sup> )	169,094	93,872	0	28,857	241,556	0	63,084	183,028	103,716	0	0	19,520	14,454	596,281	1,513,461
		Economic benefit (MKD.10 <sup>3</sup> )	125,613	66,205	0	26,173	217,400	0	63,084	164,725	93,344	0	0	17,568	14,454	596,281	1,384,946
10	Irrigation System Betterment Project in Resen	Cropping area (ha)	0	0	0	0	0	0	0	0	5,955	0	0	0	0	0	5,955
		Annual yield (ton)	0	0	0	0	0	0	0	0	59,550	0	0	0	0	0	59,550
		Financial benefit (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	1,012,350	0	0	0	0	0	1,012,350
		Economic benefit (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	911,115	0	0	0	0	0	911,115
Total																	
			1,315,863	683,447	0	455,087	1,136,209	1,018,096	620,326	1,420,002	1,450,966	845,175	285,656	93,157	76,344	3,763,507	13,163,835

Table AN19.7 Water Charge (New Development)

Unit water charge (MKD/ha)																	
Project name		Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S.Cheries	Other orchards	Grapes	Total	
1	Construction of By-pass channel Raven - Rechica	Area (ha)	7,206	2,800	0	0	0	0	400	400	3,600	0	0	0	0	14,406	
		Water charge (MKD.10 <sup>3</sup> )	28,825	11,200	0	0	0	0	1,600	1,600	14,400	0	0	0	0	0	57,626
2	Paligrad Multipurpose Dam Project - Phase II	Area (ha)	1,080	540	0	90	180	0	90	90	90	0	0	36	54	630	
		Water charge (MKD.10 <sup>3</sup> )	4,320	2,160	0	360	720	0	360	360	360	0	0	144	216	2,520	11,520
3	Kiselichka Dam Project	Area (ha)	451	225	0	0	0	0	90	90	136	0	3,150	900	0	0	4,951
		Water charge (MKD.10 <sup>3</sup> )	1,803	902	0	0	0	0	359	359	543	0	12,598	3,598	0	0	19,803
4	Vakuf Multipurpose Dam Project	Area (ha)	14,400	7,199	0	1,200	2,400	0	1,200	1,200	1,200	0	0	480	720	8,400	38,400
		Water charge (MKD.10 <sup>3</sup> )	57,601	28,798	0	4,801	9,600	0	4,801	4,801	4,801	0	0	1,920	2,881	33,599	153,601
5	Pelince Dam Project	Area (ha)	3,000	1,500	0	250	500	0	250	250	250	0	0	100	150	1,750	8,000
		Water charge (MKD.10 <sup>3</sup> )	12,000	6,000	0	1,000	2,000	0	1,000	1,000	1,000	0	0	400	600	7,000	32,000
6	Razloveci Dam Project	Area (ha)	401	200	0	0	0	0	80	80	121	0	2,800	800	0	0	4,401
		Water charge (MKD.10 <sup>3</sup> )	1,603	801	0	0	0	0	319	319	482	0	11,199	3,199	0	0	17,603
7	Blatoc Dam Project	Area (ha)	500	150	150	50	100	0	50	50	100	0	0	50	100	200	1,500
		Water charge (MKD.10 <sup>3</sup> )	2,000	600	600	200	400	0	200	200	400	0	0	200	400	800	6,000
8	Zletovica Multipurpose Dam Project - Phase II	Area (ha)	1,860	930	0	155	310	0	155	155	155	0	0	62	93	1,085	4,960
		Water charge (MKD.10 <sup>3</sup> )	7,440	3,720	0	620	1,240	0	620	620	620	0	0	248	372	4,340	19,840
9	Construction of Irrigation of Sub-System "Shipisko Pole"	Area (ha)	1,387	416	416	139	277	0	139	139	277	0	0	139	277	555	4,160
		Water charge (MKD.10 <sup>3</sup> )	5,546	1,664	1,664	555	1,109	0	555	555	1,109	0	0	555	1,109	2,218	16,638
10	Krapa Dam Project	Area (ha)	6,400	2,400	0	2,000	0	0	400	400	1,200	1,200	400	0	0	0	14,400
		Water charge (MKD.10 <sup>3</sup> )	25,601	9,601	0	8,001	0	0	1,600	1,600	4,800	4,800	1,600	0	0	0	57,601
11	Zhivan Dam Project	Area (ha)	15,200	5,701	0	4,750	0	0	950	950	2,850	2,850	950	0	0	0	34,200
		Water charge (MKD.10 <sup>3</sup> )	60,801	22,802	0	19,001	0	0	3,799	3,799	11,399	11,399	3,799	0	0	0	136,801
12	Obedinik Dam Project	Area (ha)	1,600	600	0	500	0	0	100	100	300	300	100	0	0	0	3,600
		Water charge (MKD.10 <sup>3</sup> )	6,400	2,400	0	2,000	0	0	400	400	1,200	1,200	400	0	0	0	14,400
13	Kochishte Dam Project	Area (ha)	3,600	1,350	0	1,125	0	0	225	225	675	675	225	0	0	0	8,100
		Water charge (MKD.10 <sup>3</sup> )	14,400	5,401	0	4,500	0	0	900	900	2,700	2,700	900	0	0	0	32,400
14	Zhurche Dam Project	Area (ha)	1,200	450	0	375	0	0	75	75	225	225	75	0	0	0	2,700
		Water charge (MKD.10 <sup>3</sup> )	4,800	1,800	0	1,500	0	0	300	300	900	900	300	0	0	0	10,800
15	Konjarka Dam Project	Area (ha)	1,800	900	0	150	300	0	150	150	150	0	0	60	90	1,050	4,800
		Water charge (MKD.10 <sup>3</sup> )	7,200	3,600	0	600	1,200	0	600	600	600	0	0	240	360	4,200	19,200
16	Petrushka Dam Project	Area (ha)	1,250	1,250	0	0	0	1,500	500	250	750	0	0	0	0	0	7,250
		Water charge (MKD.10 <sup>3</sup> )	5,000	5,000	0	0	0	6,001	2,000	1,001	3,000	0	0	0	0	0	31,001
17	Kovanska Dam Project	Area (ha)	500	500	0	0	0	600	200	100	300	0	0	0	0	0	3,100
		Water charge (MKD.10 <sup>3</sup> )	2,000	2,000	0	0	0	2,400	800	400	1,200	0	0	0	0	0	12,400
18	Konsko Multipurpose Dam Project	Area (ha)	1,673	1,673	0	0	0	2,007	669	335	1,004	0	0	0	0	0	10,370
		Water charge (MKD.10 <sup>3</sup> )	6,690	6,690	0	0	0	8,029	2,675	1,339	4,015	0	0	0	0	0	41,479
19	Podares Multipurpose Dam Project	Area (ha)	2,400	1,200	0	200	400	0	200	200	200	0	0	80	120	1,400	6,400
		Water charge (MKD.10 <sup>3</sup> )	9,600	4,800	0	800	1,600	0	800	800	800	0	0	320	480	5,600	25,600
20	Irrigation System Betterment Project in Resen	Area (ha)	0	0	0	0	0	0	0	0	0	5,200	0	0	0	0	5,200
		Water charge (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	0	20,800	0	0	0	0	20,800
Total		329,539	149,922	2,829	54,923	22,336	20,538	29,610	25,344	67,911	31,449	38,494	13,530	8,023	106,144	900,593	



Table AN19.8 Water Charge (Rehabilitation)

No.	Project name	Wheat	Maize	Rice	Tobacco	Sunflower	Cabbage	Tomatoes	Peppers	Other vegetables	Apples	Plums	S.Cheries	Other orchards	Grapes	Total	Rate	Water charge
1	Skopsko Pole Irrigation System Rehabilitation Project	Area (ha)	870	435	0	73	145	0	73	73	73	0	29	44	507	2,320		
		Water charge (MKD.10 <sup>3</sup> )	3,480	1,740	0	290	580	0	290	290	290	0	116	174	2,030	9,280	0.4	3,712
		Area (ha)	6,492	3,246	0	541	1,082	0	541	541	541	0	216	325	3,787	17,312		
2	Kumanovsko Pole Irrigation System Rehabilitation Project	Water charge (MKD.10 <sup>3</sup> )	25,968	12,983	0	2,164	4,328	0	2,164	2,164	2,164	0	866	1,299	15,147	69,248	0.4	27,699
		Area (ha)	4,960	1,860	0	1,550	0	0	310	310	930	310	0	0	0	11,160		
		Water charge (MKD.10 <sup>3</sup> )	19,840	7,441	0	6,200	0	0	1,240	1,240	3,720	1,240	0	0	0	44,640	0.4	17,856
4	Valandovsko Pole Irrigation System Rehabilitation Project	Area (ha)	906	906	0	0	0	1,087	362	181	544	0	0	0	1,631	5,617		
		Water charge (MKD.10 <sup>3</sup> )	3,624	3,624	0	0	0	4,349	1,449	725	2,175	0	0	0	6,523	22,469	0.4	8,988
		Area (ha)	373	373	0	0	0	447	149	75	224	0	0	0	670	2,310		
5	Gevgelija Irrigation System Rehabilitation Project	Water charge (MKD.10 <sup>3</sup> )	1,490	1,490	0	0	0	1,788	596	298	894	0	0	0	2,682	9,238	0.4	3,695
		Area (ha)	3,280	1,230	0	1,025	0	0	205	205	615	205	0	0	0	7,380		
		Water charge (MKD.10 <sup>3</sup> )	13,120	4,921	0	4,100	0	0	820	820	2,460	820	0	0	0	29,520	0.4	11,808
7	Sirusko Pole Irrigation System Rehabilitation Project	Area (ha)	2,728	1,023	0	853	0	0	170	170	511	170	0	0	0	6,138		
		Water charge (MKD.10 <sup>3</sup> )	10,912	4,092	0	3,410	0	0	682	682	2,046	682	0	0	0	24,552	0.4	9,821
		Area (ha)	3,349	1,674	0	279	558	0	279	279	279	0	112	167	1,953	8,930		
8	Mantovo Irrigation System Rehabilitation Project	Water charge (MKD.10 <sup>3</sup> )	13,395	6,697	0	1,116	2,232	0	1,116	1,116	1,116	0	0	0	446	7,813	0.4	14,287
		Area (ha)	7,320	3,660	0	610	1,220	0	610	610	610	0	244	366	4,270	19,520		
		Water charge (MKD.10 <sup>3</sup> )	29,280	14,639	0	2,440	4,880	0	2,440	2,440	2,440	0	976	1,464	17,079	78,080	0.4	31,232
10	Irrigation System Betterment Project in Resen	Area (ha)	0	0	0	0	0	0	0	0	5,955	0	0	0	0	5,955		
		Water charge (MKD.10 <sup>3</sup> )	0	0	0	0	0	0	0	0	23,820	0	0	0	0	23,820	0.4	9,528

Table AN19.9 Net Return (1/2)

	Project name	Construction of Bypass Channel Raven-Rehica		Paligrad Multipurpose Dam Project - Phase II		Kiselichka Dam Project		Vakuf Multipurpose Dam Project		Pelince Dam Project	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income										
1.1	Production income	34,374	39,861	7,264	8,046	27,648	30,809	96,854	107,283	20,178	22,351
1.2	Water charge		1,108		222		381		2,954		615
	Sub-total	34,374	40,969	7,264	8,268	27,648	31,190	96,854	110,237	20,178	22,966
2.	Production cost	17,187	17,187	3,632	3,632	13,824	13,824	48,427	48,427	10,089	10,089
3.	and marketing cost	3,437	3,437	726	726	2,765	2,765	9,685	9,685	2,018	2,018
4.	Net return	13,750	20,345	2,906	3,909	11,059	14,601	38,742	52,125	8,071	10,859

	Project name	Razloveci Dam Project		Blatec Dam Project		Zletovica Multipurpose Dam Project - Phase II		Construction of Irrigation of Sub-System "Shtipsko"		Krapa Dam Project	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income										
1.1	Production income	24,576	27,386	3,960	4,515	12,510	13,857	10,982	12,519	35,397	40,752
1.2	Water charge		339		115		382		320		1,108
	Sub-total	24,576	27,724	3,960	4,630	12,510	14,239	10,982	12,839	35,397	41,860
2.	Production cost	12,288	12,288	1,980	1,980	6,255	6,255	5,491	5,491	17,698	17,698
3.	and marketing cost	2,458	2,458	396	396	1,251	1,251	1,098	1,098	3,540	3,540
4.	Net return	9,830	12,979	1,584	2,254	5,004	6,733	4,393	6,250	14,159	20,622

	Project name	Zhvan Dam Project		Obednik Dam Project		Kochishte Dam Project		Zhurche Dam Project		Konjarka Dam Project	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income										
1.1	Production income	84,068	96,787	8,849	10,188	19,911	22,923	6,637	7,641	12,107	13,410
1.2	Water charge		2,631		277		623		208		369
	Sub-total	84,068	99,418	8,849	10,465	19,911	23,546	6,637	7,849	12,107	13,780
2.	Production cost	42,034	42,034	4,425	4,425	9,955	9,955	3,318	3,318	6,053	6,053
3.	and marketing cost	8,407	8,407	885	885	1,991	1,991	664	664	1,211	1,211
4.	Net return	33,627	48,977	3,540	5,156	7,964	11,600	2,655	3,867	4,843	6,516

	Project name	Petrushka Dam Project		Kovanska Dam Project		Konsko Multipurpose Dam Project		Podares Multipurpose Dam Project	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income								
1.1	Production income	37,270	40,635	14,908	16,254	49,867	54,369	16,142	17,881
1.2	Water charge		596		238		798		492
	Sub-total	37,270	41,231	14,908	16,492	49,867	55,167	16,142	18,373
2.	Production cost	18,635	18,635	7,454	7,454	24,933	24,933	8,071	8,071
3.	and marketing cost	3,727	3,727	1,491	1,491	4,987	4,987	1,614	1,614
4.	Net return	14,908	18,869	5,963	7,548	19,947	25,247	6,457	8,687

Table AN19.9 Net Return (2/2)

		Kicevsko Pole Irrigation System Rehabilitation Project		Kumanovsko Pole Irrigation System Rehabilitation Project		Prilep Irrigation System Rehabilitation Project		Valandovsko Pole Irrigation System Rehabilitation Project		Gevgelija Irrigation System Rehabilitation Project	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income										
1.1	Production income	3,165	3,459	23,619	25,813	13,085	15,046	14,581	15,778	5,995	6,487
1.2	Water charge		71		533		343		173		71
	Sub-total	3,165	3,531	23,619	26,345	13,085	15,390	14,581	15,951	5,995	6,558
2.	Production cost	1,583	1,583	11,810	11,810	6,543	6,543	7,290	7,290	2,997	2,997
3.	and marketing cost	317	317	2,362	2,362	1,309	1,309	1,458	1,458	599	599
4.	Net return	1,266	1,631	9,448	12,174	5,234	7,539	5,832	7,202	2,398	2,961

		Ohridsko Pole Irrigation System Rehabilitation Project		Strusko Pole Irrigation System Rehabilitation Project		Mantovo Irrigation System Rehabilitation Project		Strumicko Irrigation System Rehabilitation Project		Irrigation System Betterment Project in Resen	
		Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )	Economic benefit (US\$.10 <sup>3</sup> )	Financial benefit (US\$.10 <sup>3</sup> )
1.	Gross income										
1.1	Production income	8,653	9,950	7,197	8,276	12,183	13,314	26,632	29,105	17,521	19,468
1.2	Water charge		227		189		275		601		183
	Sub-total	8,653	10,177	7,197	8,464	12,183	13,589	26,632	29,706	17,521	19,652
2.	Production cost	4,327	4,327	3,598	3,598	6,091	6,091	13,316	13,316	8,761	8,761
3.	and marketing cost	865	865	720	720	1,218	1,218	2,663	2,663	1,752	1,752
4.	Net return	3,461	4,985	2,879	4,146	4,873	6,279	10,653	13,727	7,009	9,139