

*Appendix D*

*River Environment*

## Appendix D RIVER ENVIRONMENT

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## Appendix D RIVER ENVIRONMENT

### D.1 Present Conditions

#### D.1.1 Overview of River Environment in the Country

The flows of the Vardar, Crn Drim, and Strumica Rivers are the most in Macedonia, and the remaining river flows account for significantly smaller flows. The maximum flow appears in May and the minimum occurs in August. The duration of the flow is as follows.

(unit : 10<sup>6</sup>m<sup>3</sup>/year)

River Basin	Catchment Area (km <sup>2</sup> )	Average Discharge	97% (355 days)	75% (265 days)	50% (175 days)	25% (90 days)
1. Vardar	22,301	4,289	691	1,958	3,157	5,557
2. Treska	1,880	735	164	303	558	1,006
3. Pchinja	2,794	375	25	110	259	517
4. Bregalnica	2,897	353	35	123	218	407
5. Crna	4,256	706	57	164	419	984
6. Crn Drim	1,899	738	303	628	697	842
7. Strumica	1,401	120	3	28	60	136

Source: Study Team/Hydrology

The condition of the environment of the Vardar river deteriorates as the river enters Skopje and continues until after Veles. In June 1998, the Vardar at the confluence of the Pchinja had a large number of fish-kill because of a high flux of chemical discharge into the river waters. The Vardar River at a number of places receives huge amounts of chemical discharges which at times, wipes out all the living organisms, it then slowly regenerates. This is a severe and very complex problem and has not been analyzed even though this will be considered as an environmental catastrophe in other countries in Europe. This periodic wiping out of all living organisms is related to discharges mostly by the chemical, fertilizer and metallurgical industry.

The condition of water quality in Vardar and other rivers in eastern Macedonia varies with seasons and locations. In general, the rivers have a high pollution assimilation capacity during the rainy season due to the higher flow rate and dilution effect. During the dry season, the deterioration is rapid and high and some of the rivers even become below ecological minimum.

The river environment in the Strumica, and Crna rivers, because of agricultural run-offs, household, and industry discharges has an alarming deterioration. The main rivers in the eastern part of the country, including the Vardar downstream from Skopje, the Pchinja, Bregalnica, Crna, and Strumica were severely polluted. In addition, the smaller rivers in eastern Macedonia are also severely polluted, including Kumanovska, Dragor, Grashnica, Topolka, Topolnica, and Kishelika.

Some of the above rivers, because of high levels of pollution after receiving

wastewater discharges have become wastewater collectors (dead rivers), these include, Dragor downwards from Bitola, and Kumanovka after Kumanovo. The quality of water in the Vardar, Crna Reka, Strumica, and Bregalnica, after receiving communal and industrial wastewater from the cities of Tetovo, Skopje, Veles (Vardar), Prilep, Bitola, (Crna Reka), Kochani, Shtip (Bregalnica), and Strumica (Strumica) becomes mostly out of class in the dry season.

The most intense pollution of surface waters in the country has been from the industry, especially, chemical, food processing, leather, metal processing and metal (ferrous and non-ferrous metallurgy) industries, followed by livestock (hog farms). In addition, the mining flotation of lead and zinc ores in Kamenica, Probishtip, close to Sasa mines, Buchim and Jugochrom metallurgy plants make the river environment severely polluted.

In contrast to eastern Macedonia, the western part has some very clean rivers, including the Crn Drim and Radika Rivers. Probably, Radika is one of the cleanest river in South Eastern Europe.

The Water Quality Survey, March 1998, had found that the river waters overall had:

- (1) The water temperature had varied from 3.0 to 16.1 degrees Celcius.
- (2) The pH values range from 5.0 to 10.65 and ranged from slightly acidic to alkaline.
- (3) The electrical conductivity ranged from 44.6 to 8200 (micro S/cm).
- (4) The river waters contained high numbers of coliform bacteria.

In addition, the Water Quality Survey had also sampled heavy metals, however, the measurements were not in the areas near to heavy metal pollution, and the results appear to give a picture, which does not include the mining and metallurgy 'hot spots'. The sampling sites of this survey were same as those of HMI regular sampling sites.

#### D.1.2 Fundamental Problems

- (1) Water quality – The river water quality due to discharges from the industry into the Vardar deteriorates rapidly in Skopje and Veles areas. In the future, with industrial production picking up they would exceed at most monitoring stations by many times if unabated because of higher pollution loads.
- (2) Pollution control – At present, there is no centralized wastewater treatment facility for domestic sewerage. Although some of the industry has its own wastewater facilities, most of the industry does not have efficient

wastewater treatment plants. There is also a total lack of transparency in how the old public sector industry deals with wastewater issue. Going by the discharge analysis only 6% of wastewater in Macedonia is treated, much more and better treatment capacity needs to be built for the industry, perhaps, as a collective system in Skopje and Veles.

- (3) Mining metallurgy wastes – The contamination of river waters in eastern Macedonia, because of the large mining and metallurgy discharges should be treated separately from the above, in addition to reclaiming valuable metals by innovative recycling the abatement methods should be linked to the upgrade of their extraction and provision of environmental technology. This waste will also be a direct threat to the groundwater quality in the very near future.

## **D.2 Environmental Surveys**

### **D.2.1 Environmental Survey (1)**

The Survey (1) was divided into the Ecology and Biodiversity Inventory Survey, and the Resettlement Survey:

#### **(1) Ecology and Biodiversity Inventory Survey**

- 1) The Survey would principally target to make a base level inventory of ecosystem in the entire area of Macedonia, especially for major river three basins i.e. the Vardar, Crn Drim and Strumica, and the natural and artificial lakes.
- 2) The survey would undertake data collection including the major aquatic ecosystems, fauna, and flora of the respective watersheds and habitats types. Based on the available data, the ecosystem of the survey area shall be initially be identified. In addition, representative or dominant, keystone and indicator species shall be classified.
- 3) The Survey would conduct field interviews and field reconnaissance of all areas for preliminary data gathering.
- 4) The streams and lakes/reservoirs along rivers have potential for fishery/ aquaculture development. The species of fish and macro-invertebrates under the existing conditions and their intensity, distribution, status and economic importance shall be determined based on available data.
- 5) The development potential of fishery/aquaculture along with any introduction of non-indigenous species and other constraints such as, water quality would be elaborated to the extent possible.

## (2) Resettlement Survey

To facilitate basic data for water resources development project in the future, information regarding resettlement of the past major projects, and present national policy shall be collected. The data collected shall cover the following:

- 1) Policy and basic consideration of relocation caused by a development program.
- 2) Resettled population and relocated structures / monuments etc.
- 3) Location / types of relocation lands and the overall relationship between the original dwelling lands and the proposed dwelling lands to be allocated.
- 4) The process of land retitling and settler's registration
- 5) Compensation method and its amount.

## (3) Results and Findings of Environmental Survey (1)

The Environmental Survey (1) was carried out to establish a preliminary base level inventory of flora and fauna in the national territory of Macedonia. A taxonomy of flora and fauna in the natural lakes (Ohrid, Prespa, and Dojran) and preliminary information for Vardar River were inventoried. However, not all the information presented was collected only for this survey, secondary sources were also used to complete the gaps.

## (4) Findings of the Ecology and Biodiversity Inventory Survey

### (a) Flora in the Rivers and Lakes

The river basins were not very rich in macrophytic vegetation, while the Lakes Ohrid and Prespa were richer. Dojran Lake was found to be lacking in macrophytic vegetation in comparison. In Ohrid and Prespa Lake plants of Sharaceae and Potamogetonaceae were dominant, while in south-west part of Ohrid and western Prespa, *Phragmites communis* (reed) were dominant. Lake Dojran was relatively poor in macro-vegetation, with no reed growth. In addition, most artificial lakes and rivers had poor growth of macro-vegetation.

In the case of microscopic plants (algae) and phytoplankton, Ohrid and Prespa Lakes had a rich distribution, with dominant types as Schlorophyceae and Bacillariophyceae. Ohrid Lake uniquely had pelagic zone endemic species. The presence of plankton and other micro-organisms in the artificial lakes was scarce. The Vardar and other rivers were found to be quite poor in plankton, the polluted portions, more so. Algae (Chlorophyceae and Cuanophyceae) are richly found, however in

non-polluted portions of the Vardar, Treska and Crna Rivers.

(b) Fauna in the Rivers and Lakes

Ohrid Lake was found to have a large number of endemic species, of these Ohrid trout (*S. letnica*), eels (*A. anguilla* and *A. alborella*) have a high economic value, while the others have greater biological and taxonomic value.

There has been a problem of non-endemic species introduced into Lakes Ohrid and Prespa, because of the lack of control over them. During the survey period two types of carp and California trout had been found in Ohrid and Prespa. In addition, cat fish and soncarka were found in Prespa also.

There has been a drastic reduction in fish, crustaceans and gastropods in Lake Dojran.

Dojran Lake has carp, sheat-fish and other endemic species, their catch now has been halved since 1988, due to the drastic reduction of lake waters.

Mostly due to the bad quality of river waters, the fish have been decreasing in the rivers specially the large fish. The reservoirs have been under utilized for cultivated fish.

The fish fauna in Vardar river has decreased due to increased pollution during the last 30 years. There were 29 species of 11 families in 1968, these have now been reduced to 17 species of 5 families. The dominant species in all of Vardar River were found to be Chub (*Leuciscus cephalus*) and Nose-carp (*Chondrostoma nasus*).

It was found that due to the increased pollution and lowering of water quality, trout and river crab (*Potamobius astacus*), previously existing species in upper and middle Vardar River had now become extinct. The most endangered fish in all of the survey were found to be present in Vardar river between Skopje and Veles.

(5) The Resettlement Survey

A complete or partial relocation of settlements was imposed by the construction of the following reservoirs: Glaznja (Kumanovo), Strezevo (Bitola), and Mavrovo (Gostivar) in the Vardar River basin; and the reservoir Globocica in the Crn Drim River basin. There was relocation of settlements, with the construction of the reservoirs Mantovo (Radovish), Vodoca (Strumica) and Turija (Strumica) in the Strumica river basin. The following are provided as example from the results of the resettlement survey.

Due to the construction of the reservoir Glaznja (Kumanovo) in 1971 two



settlements were affected, the structures relocated and the population resettled as follows:

**Resettlement: Glaznja Reservoir on the Upper Vardar River Basin**

	Before Construction (Census 1971)		After Construction (Census 1994)	
	Glaznja	Dumanovce	Glaznja	Dumanovce
Population	252	605	76	9
Households	44	99	11	5
Apartments	40	84	21	11(6 Weekend )

During the construction of the reservoir Glaznja (Kumanovo), 33 households (77%) of the village Glaznja were relocated, while 90 households (91%) of the village Dumanovce. The houses of these families were resettled.

During the construction of Tikvesh reservoir (1968) the village Brushani was completely flooded and the population was resettled in Kavadarci.

**Resettlement: Tikvesh Reservoir, Brushani Village**

	Before Construction (Census 1971)	After Construction (Census 1994)
Population	302	0
Households	65	0
Apartments	65	0

In 1984, during the construction of Strezevo reservoir (Bitola), in the Vardar River tributary, two villages Strezevo and Sviniste were dislocated to the newly constructed settlement in Bitola.

**Resettlement: Strezevo Reservoir (Bitola) Vardar River Lower Basin**

	Before Construction (Census 1971)		After construction (Census 1994)	
	Strezevo	Sviniste	Strezevo	Sviniste
Population	366	139	0	0
Households	48	30	0	0
Apartments	48	29	12 (7 Weekend)	0

The population from the inundated areas in most cases was resettled in urban and non-urban settlements on the territory of the same municipality.

The most organized resettlement of the inhabitants was carried out from Strezevo and Svinishte in the newly constructed buildings in urban settlements of the municipality of Bitola. The inhabitants from Strezevo village were resettled in Gorno Orizari, while those from Svinishte were in Brusnik settlement. For the inhabitants of these villages, individual houses of approximately the same living area with facilities including, electricity, water, asphalt roads, telephone, and grocery stores, etc. were constructed. Beside the individual living house, each household was provided an area of about 500 m<sup>2</sup> to produce vegetables for each family's requirements. Similarly other resettled areas were provided with adequate compensation and facilities.

#### (6) Method and Amount of Indemnity

The indemnity of the property was carried out by previous appraisal of the land and the living facilities. For the land, each proprietor was provided cash reimbursement for the amount of the appraised value, and if the property was affected by the reservoir, as was the case with Strezevo village settlement, new buildings were constructed for all owners. Alternatively, cash reimbursement of the appraised value, upon agreement was provided.

In other cases, indemnity had been carried out, by providing land of almost equal quality, if requested by the affected party. Based upon the survey, the statements made by the affected population, in most cases they were satisfied with the appraisal value. However, in some few cases the provided indemnity was insufficient, and in large number of cases they were unsatisfied.

#### D.2.2 Results and Findings of Environmental Survey (2)

The Environmental Survey (1) for the Vardar river had carried only the preliminary investigation, the Environmental Survey (2) has carried out in June – July, 1998, a more comprehensive analysis on the condition of biodiversity and chemical physical parameters of Vardar and Strumica Rivers.

##### (1) Objectives

The Survey was carried out with the following objectives:

- 1) To set targets for biodiversity conservation and identify keystone and indicator species;
- 2) To evaluate the decrease of all the fish in recent years;
- 3) To survey historical fish catch record and the present one for determination of the indigenous species;
- 4) To bring forward the awareness of and attention of freshwater biodiversity issues;
- 5) To collect good and current data for making appropriate environmental decisions;
- 6) To understand better the economic values of freshwater biodiversity;
- 7) To propose understandings on better mitigation measures and management, and
- 8) To provide base level scientific data for future environmental assessments in the Vardar and other major river basins.

## (2) Scope of Work

The scope of work had consisted of:

- 1) To collect current (June-July, 1998) real time data of biodiversity, including fish, fauna, and flora in the national territory of Macedonia;
- 2) To identify indicator species of fish for biological evaluation of river environment, and
- 3) To quantify the impact of industry and mining pollution on surface biodiversity and ecology in the Vardar River basin.

The Survey (2) collected and analyzed the samples for the following data categories:

Physical and chemical parameters, including heavy metals.

The total number of heterotrophic, micro-organisms.

Qualitative and quantitative composition of micro algal organisms and their relation to pollution.

Inventory of major vegetation along the sampling sites on the rivers and their relationship to the biodiversity and its significance for the river ecosystem.

Inventory of fish and analysis of fish (blood and organs) for heavy metals.

## (3) Area of Study

The Environmental Survey (1) had focused on the flora and fauna of the major lakes and carried out only preliminary survey of Vardar River. The Environmental Survey (2) has focused on the 300 km plus, length of the Vardar River, where 10 sampling sites were investigated and analyzed in detail. The sampling sites on Vardar River were designated T1 to T10 and are briefly described below:

T1 – Vrutok (EL.670 m) is near the source of the river and is considered as a reference site. It is clean with low anthropogenic influences and fast flow.

T2 – Zelino (EL.495 m), located before the old bridge on the Tetovo – Skopje highway, it receives the agricultural run-off from the Polog valley making for high pollution loads. There is a large amount of the village garbage disposed on the river banks.

T3 – Jegunovce (EL.425 m), receives the discharges from the large chromium metallurgy complex, the river bed has greyish white layer of accumulation.

T4 – Skopje (EL.260 m), the site has considerable deterioration in all parameters, with many industries discharging untreated wastewater.

T5 – Dracevo (EL.200 m) the entire impact of the pollution from Skopje is located here. The slaughter house wastewater precipitates fats in the bottom of river bed preventing the growth of micro and macro flora.

- T6 – Vardar after Pchinja (EL.190 m) the pollutant loads from the Pchinja make the Vardar further deteriorated. Just weeks before the sampling, big fish kills were reported in this area.
- T7 - Veles (EL.160 m) the sampling site was located close to the city right after ZLETOVO lead and zinc smelter's, and cooking oil plant's discharges into the main river. Together the situation had become very bad resulting in juvenile fish kills. The BOD readings were quite high and low for dissolved oxygen.
- T8 – Chemical Industry Veles (CIV) (EL.150 m) the sampling site had almost no trace of life forms, it was observed that the large tank to store sulfuric acid were being rinsed out. The process of complete wipe-out and re-population of biota is not uncommon in this "hot zone" of Vardar river.
- T9 – Demir Kapija (EL.100 m) the location has rapid water flow and the river depth is large closer to the cliff side, it makes proper sampling very difficult. Since this is after T7 & T8 there is scarce algal flora.
- T10 – Gevgelia (EL.50 m) the sampling site was located right after the city and the last in Macedonia. The conditions are better at this site for water quality than Skopje to Veles even with the addition of Gevgelia wastewater.

In addition, 2 sampling sites were included on Strumica River, (S1 – Jargulica and S2 – Novo Selo) one in the mountains near the source and one near the border with Bulgaria.

#### (4) Methodology of Analysis

The Vardar River is a complex natural water ecosystem, which is impacted by the diversity of human activity. Both biological and chemical analyses were carried out at selected areas is presented below. The main organism to monitor the overall environmental parameters of the entire length of the river was carried out by using the diatom flora (*Bacillariophyta*). These organisms are: (a) the most numerous and dominant, (b) the most relevant bioindicators, (c) microflora that are directly influenced by physical and chemical parameters.

- 1) The quantitative and qualitative probes of diatom microflora sampled including growth on stones, water plants, and sand particles were preserved and mounted on slides.
- 2) The analysis of the bacterial microflora was performed using agar / petri-dish with incubation of 5 days and, appropriate dilution. The plates had 30 to 300 colonies, which were counted under microscopes.
- 3) Oxygen content and BOD were measured using oxy-meter 'Hanna Instruments' and "Winkler Method". The heavy metals, and Nitrogen-Ammonia were measured by Atomic Absorption and Kjeldahl method respectively.
- 4) The fish specimen were obtained at all sampling sites, and preserved in 4%

Formaldehyde. The fish were identified by using, a key – Vukovic (1971).

(5) Results

(a) Vegetation

The status of vegetation along the Vardar river connected with water ecosystem was found to compose of two types: (1) More or less natural vegetation; (2) Implanted vegetation developed in connection with human activities. There is also vegetation whose source has been separated, i.e., many plants from the higher oak belt are growing in the Vardar river catchment. The Survey (2) lists the following categories of vegetation: (1) Tree, shrub and liana species; (2) Plants connected with water; (3) Species coming from other vegetation zones; (4) Implanted vegetation.

(b) Fish

The Survey (2) has inventoried the following 24 species of fish in the Vardar river sampling sites in June 1998:

**Vardar Fish Species Identified at Sampling Sites for Environmental Survey (2)**

1	<i>Salmo trutta macedonicus</i>
2	<i>Salmo gairdneri irideus</i>
3	<i>Rutilus macedonicus</i>
4	<i>Leuciscus cephalus</i>
5	<i>Phoxinus phoxinus</i>
6	<i>Chondrostoma nasus vardarensis</i>
7	<i>Gobio gobio lepidolaemus</i>
8	<i>Gobio kessleri</i>
9	<i>Gobio uranoscopus</i>
10	<i>Barbus barbus macedonicus</i>
11	<i>Barbus meridionalis</i>
12	<i>Alburnus alburnus macedonicus</i>
13	<i>Alburnoides bipunctatus</i>
14	<i>Vimba vimba melanops</i>
15	<i>Rhodeus cereus amarus</i>
16	<i>Cyprinus carpio</i>
17	<i>Carassius carassius</i>
18	<i>Carassius auratus gibelio</i>
19	<i>Noemacheilus barbatulus vardarensis</i>
20	<i>Cobitis taenia vardarensis</i>
21	<i>Silurus glanis</i>
22	<i>Perca fluviatilis macedonica</i>
23	<i>Pseudorasbora parva</i>
24	<i>Ictalurus nebulosus</i>

In comparison to the above results the Environmental Survey (1) had inventoried 17 fishes in Vardar river February 1998. In 1972, Dimovski and Grupce had inventoried 30 species of fish. For the Strumica river 7 species of fish were inventoried in July 1998 by the Survey (2) team.

(6) Conclusions

1) The Survey (2) was carried out resulting in the identification of

indicator and keystone species. For Class II waters the indicator species are Salmon (*Salmo trutta macedonicus*, and *Salmo gairdneri irideus*).

- 2) The absence of a large variety of fish species from the Vardar downstream were indicative of adverse environmental conditions. This was also confirmed by the increased presence of *Carassius carassius*, *Gobio gobio*, and *Barbus meridionalis*, species known for their resistance towards increased eutrophication and pollution
- 3) The Survey also provides a base level of data for environmental assessments. The biodiversity data compiled for the Vardar and Strumica River ecosystems, including vascular vegetation, was reliable for further analysis.
- 4) The human pollution impacts have been recorded on the entire length of the Vardar river, the data of microflora, vascular vegetation and fish communities shows survival of the most tolerant forms – the indicator species. However, there have been findings of complete washout of microflora, including bacteria through massive fluxes of pollution in Vardar river.
- 5) The Strumica river appears to be highly eutrophied, mostly it is due to intensive agricultural activity and discharges from Radovich and Strumica. The river at its source, however, appeared to have class II water quality.

### **D.3 Supplemental Environmental Survey for IEE**

#### **D.3.1 Introduction**

The Supplemental Environmental Survey for Initial Environmental Examination (IEE) was conducted by selected Macedonian consultants. It will form a key input to the IEE for the Study on Integrated Water Resources Development Master Plan (the Study) currently, under formulation. The IEE will aim at the following: (1) identification of adverse impacts of alternative projects to surrounding environment, (2) initial examination of such impacts, and (3) suggested recommendation of Environmental Impact Assessment (EIA) at the feasibility stage. The objectives for the Supplemental Survey briefly are as follows:

- 1) To collect environmental data/information of alternative project sites;
- 2) To collect additional data/information required regarding resettlement, health protection, economical improvement and other natural environments, and
- 3) To conduct supplemental identification of environmental impacts which will accrue due to development activity.

### D.3.2 Scope of the Work

The survey work will consist of:

#### (1) Collection and Identification of Environmental Parameters

A detailed checklist has been developed based on actions affecting environmental resources and values which includes six categories. The categories are environmental problems due to project location, design, problems associated with construction, environmental problems related to project operation, potential beneficial aspects, and a critical review criteria. The checklist parameters have three columns for information collection and separate columns for IEE evaluation:

- 1) Actions affecting environmental resources and values
- 2) Damage to environment
- 3) Recommended feasible protection measures

#### (2) Initial Evaluation of Environmental Parameters

After the collection and identification of environmental parameters as described above, an initial evaluation will be carried out by filling IEE columns in the checklist for each of the proposed projects provided in the table below.

**Proposed Alternative Projects for Initial Environmental Examination (IEE)**

	Project	Purpose of Water Use	Activities & Construction	Municipality
1	Slupchanka Dam Project	Municipal Water	Slupchanka Dam Water Supply Pipeline	Kumanovo
2	Vakuf Multipurpose Dam Project	Municipal, Industrial, Agricultural Water	Vakuf Dam, Filter Station, Pipeline	Kumanovo
3	Patishka Reka Water Supply Project	Municipal Water	Intake, Filter Station, Pipeline	Skopje
4	Petrovec Water Supply Project	Municipal Water	3 Wells, Pumping, & Filter Station, etc.	Skopje
5	Zletovica Multipurpose Dam Project	Hydropower, Municipal, Industrial, & Agricultural Water	Knezevo Dam, Water Supply, Irrigation Systems & Powerhouse	Probishtip, Shtip, Zletovo, Lezovo, Sveti Nicole, Karbinci, Kratovo
6	Vardar River Lower Reach/Strumica River Basin Rural Water Supply Project	Municipal Water	Intake and Water Supply Facilities	Gevgelija, Dojran Bogdanci, Valandovo
7	Studencica Supplemental Water Supply Project	Municipal Water	Intake at Pitran Spring & Pipeline	Kichevo, Krushevo, Prilep

8	Southwest Mountainous Area Rural Water Supply Project	Municipal Water	Intake & Water Supply Facilities	Medzitlija & other villages
9	Peloagonija Circle Rural Water Supply Project	Municipal Water	Improvement of Studencica Water Supply & Local Supply	Kichevo, Prilep Krushevo, Bitola Demir Hisar
10	Rechani Multipurpose Dam Project	Municipal Water	Intake & Pipeline & System to Transfer Water of Golema Reka	Kochani, Vinica
11	Razlorci Dam Project	Municipal & Agricultural Water	Razlorci Dam & Water Supply Improvement	Berovo, Delchevo
12	Paligrad Multipurpose Dam Project	Municipal Water, Hydropower, Flood Protection etc.	Paligrad Dams & 19,000 ha. Irrigation	Skopje
13	Podaresh Dam Construction Project	Municipal & Agricultural Water	Podaresh Dam & Water Supply System	Radovish
14	Konsko Dam Project	Municipal, Industrial, Agricultural Water	Konsko Dam	Gevgelija, Valandovo
15	Irrigation System Betterment Project in Resen	Agricultural Water	Improvement of the Existing System	Resen
16	Strumica Area Irrigation Rehabilitation Project	Agricultural Water	Improvement of the Existing System	Strumica
17	Water Supply Pipeline for Tetovo- River Pena Intake	Municipal water	River intake and Pipeline	Tetovo
18	Studena Voda Groundwater Development Project	Municipal water	Wells and Pipeline	Tetovo
19	Kiselichka Dam Project	Municipal water, Agricultural	Kiselichka Dam	Kriva Palanka
20	Blatec Dam Project	Agricultural water	Blatec Dam	Kochani, Vinica
21	Construction of Irrigation of Shtip Sub-system "Shtipsko Pole"	Agricultural water	Extension of Existing System	Shtip
22	Krapa Dam Project	Municipal water, Agricultural	Krapa Dam and Pipeline	Prilep, Debreshte, Desovo, Dolneni, Slivje, Crnilishte
23	Zhvan Dam Project	Agricultural water	Zhvan Dam	D.Hisar
24	Obednik Dam Project	Agricultural water	Obednik Dam	D.Hisar
25	Kochishta Dam Project	Agricultural water	Kochishta Dam	Krushevo



26	Zhurche Dam Project	Agricultural water	Zhurche Dam	D.Hisar
27	Konjarka Dam Project	Agricultural water	Konjarka Dam	Bitola
28	Petrushka Dam Project	Agricultural water	Petrushka Dam	Valandovo, Gevgelija
29	Kovanska Dam Project	Agricultural water	Kovanska Dam	Gevgelija
30	Oraovica Dam Project	Municipal water	Oraovica Dam	

### D.3.3 IEE Conclusions and Recommendations

General conclusion is that there is no sufficient data and information for the listed project, in order to make more detailed IEE. According to the additional information, some of the problems are addressed, proposed some measures, and some recommendation are given.

General recommendation concerns to the projects for providing water supply in the cities or villages and improvement of the living standards of the population. The water supply is only one component of the issue "environmental aspects of healthy drinking water". The second component is that the used water must be discharged in the systems for sewerage, or even worse if there is no sewerage systems directly, like it is very often into the river. From one side we bring clean water to the population, but we must think in the same time that the used water need treatment and purification before it is discharged into the recipients. That is why, the general recommendation will be to plan in the same time water supply together with sewerage systems and treatment plants.

Other general recommendation is regarding the erosion problems. It is recommended to prepare separate study on erosion in the catchment areas of the proposed dams, in order to get more detailed information about the condition of the erosion in that region, and also to propose measures for erosion protection.

#### (1) Slupchanka Dam Project

General conclusion is that this project will not have negative impact on the environment. But, it is recommended to prepare detailed study for encroachment into precious ecology and on loss of ecological values. Erosion problems should be studied in a separate study, in order to define erosion protection measures.

Construction should be done strictly according to the tender documents and monitored.

During the operation stage careful planning should be done on optimal use of the reservoir.

(2) Vakuf Multipurpose Dam Project

Vakuf Dam Project is very serious project and the approach to its realization must be very carefully planned. The first problem is the great scope of resettlement in the flooded area: presumed at 500 households, quarry, other facilities, forests and agricultural land. Therefore, carefully planned resettlement program should be applied. The erosion in the catchment area should be analyzed in separate study.

The construction should be done strictly following the tender documents, with very careful construction monitoring.

The most important recommendation for the operation is to make plan for optimal use of the reservoir. An EIA will be required.

(3) Patishka Reka Water Supply Project

General conclusion is that the project will not have any negative impact on environment. The erosion should be analyzed in one short study. Construction should be done according to the tender documents, and during the operation there will be no environmental problems.

(4) Petrovec Water Supply Project

This is another rural water supply project with full positive conclusion about the impact on environment.

(5) Zletovica Multipurpose Dam Project

Zletovica project is very important project with high priority in Macedonia. Fortunately the general conclusion is positive. There is no resettlement, and no other adverse effect on environment regarding the site location. The erosion should be more carefully studied in the catchment area in order to propose erosion protection measures. The construction must be very seriously managed and monitored, strictly according to the tender documents. Also it is very important to have carefully prepared plan for optimal use of the stored water.

(6) Vardar River Lower Reach/Strumica River Basin Rural Water Supply Project

This is rural water supply project to be developed in the lower reach of the Vardar River and Strumica river. No adverse affect cannot be foreseen.

(7) Studenchica Supplemental Water Supply Project

Beside the positive general conclusion of the project, only investigation on

water right allocation should be done. The water economy agreement is issued from the Ministry of Agriculture, Forestry and Water Economy, what means that the utilization of the spring is allowed.

(8) Bitola Regional Water Supply Project

This project is very important project for the villages on Kozuf Mountain and the cross board passing Medzitlija. The local underground water is acid, so it can not be used for drinking. The project itself is extension of the Bitola water supply system, using the same water resources. According to the IEE there is no negative impact on environment due to this project.

(9) Rechani Multipurpose Dam Project

The project for water supply of Kochani and Vinica will not have negative impact on environment. The erosion should be analyzed in the area, the construction should be done in accordance to the tender documents, while possible down stream variation should be analyzed in separate hydrological study.

(10) Razlovci Dam Project

The project is consists of Razlovci Dam, water supply pipeline, and irrigation system. General conclusion is that the project will not have negative impact on the environment, and the recommendations are for detailed erosion study in the area, construction should follow the tender documents and it should be monitored, and to prepare plan for optimal multipurpose reservoir use.

(11) Paligrad Multipurpose Dam Project

The dam Matka will be located in continuation of dam Kozjak. There will be no resettlement, and no significant effect of erosion because Kozjak reservoir will accept the sediments in its storage.

The construction should be very strictly done in accordance to the tender documents, and it should be monitored. There is a need for study on downstream flow variations and its effect on downstream users, and also plan for optimal multipurpose use of the stored water. There is no resettlement, and for analyzing the erosion in the area separate study on erosion is recommended.

The construction should be done in accordance to the tender documents should be properly monitored.

Due to possible problems of the downstream flow variation and disturbance to other possible users in the future, a study is recommended.

(12) Rechani Multipurpose Dam Project

The project comprises the dam Rechani on the river Orizarska, and beside the water supply will provide water for irrigation and for hydropower. The general conclusion is that the project has no negative impact on environment. It is recommended to study erosion in the catchment area, and to make careful plan for optimal multipurpose use of the stored water.

(13) Podaresh Project

Podaresh dam is planned on river Plavaja, and according to the IEE there are some possible environmental problems, which should be analyzed more carefully in separate studies.

There is no resettlement, and the erosion should be analyzed in more details.

Construction should be done in accordance to the tender documents, and monitored.

(14) Konsko Dam Project

According to the analyses on this project, there is no resettlement in the flooded area, but there is loss of ecological values. The recommendation is that special attention should be made on proper construction and management of the dam that is going to be located in the Strictly Preserved Area. Major disturbances on the water levels and environmental parameters may be expected, so that this project needs very careful planning if conduct at all.

The erosion possible problems should be analyzed in separate study. The construction should be done in a manner like it was stressed at other dams.

The development of the irrigated agriculture and improved water supply of 4 communities will significantly improved the living standards of the population. It is important to have plan for optimal multipurpose use of the water from the reservoir Konsko. An EIA will be required.

(15) Irrigation System Betterment Project in Resen

According to the analysis of the project, there is no negative impact on environment. The rehabilitation will decrease the quantity of the used water from the Prespa Lake which is already suffering from much lower water level than normal, and will prevent the formation of the wet land and swamps due to very high water losses through the canal lining.

(16) Strumica Area Irrigation Rehabilitation Project

The general conclusion for this project is the same as the project in Resen. The rehabilitation will have only positive impact on environment, actually will

decrease the water losses and reduce the quantity of the used water for irrigation. Also, it will specially help to recharge the underground waters of the Strumica valley, which are rather extracted in the last period, because the farmers in order to save the wells, extract the water from the wells, and now they are dry or the water level is very low.

#### (17) Water Supply Pipeline for Tetovo-River Pena Intake

The water will be captured immediately after hydropower station "Pena" on approximately 535m El. and ducted to the existing reservoir on approximately 525m EL. north of Tetovo. The necessary structures (filter station, pumps) will be located within the protected zone of the hydropower station, and the pipeline until the reservoir will strictly follow the road Shipkovica-Tetovo. There will be no resettlement and other adverse effect due to the site location.

There is a local road (not paved) going from Shipkovica village to Tetovo. Since the pipeline is following the road it will not effect the local infrastructure.

There will be no negative effects on the local flora or fauna because the project uses the existing protection zone of the hydropower station, where the riverbed is regulated and all other necessary environmental needs are already met. There is some pollution from the mountain villages and barns, but is very small scale and the water quality is no more than class II. The geology is mainly schist.

#### (18) Studena Voda Groundwater Development Project

The zone of the source (wells) and the pump station is in Tetovsko Pole plain about 4 km east from Tetovo. The zone of the wells, both narrow and broader, is located on arable agricultural land. The narrower zone around the wells is located in orchards with morelo cherry trees. To construct the wells no more than 0.5 ha of the land has to be expropriated to secure a permanent protection zone for the wells. The pipeline is located in Tetovsko Pole plain on a stretch of about 4 km, and during construction it will require temporary expropriation on this stretch, which is about 6 m wide. In the urbanized part of the city the pipeline does not effect any facilities and there is no need for resettlements.

The existing reservoir will be used to accumulate the water.

The construction of the Studena Voda system does not effect any existing road nor other infrastructure. The pipeline route is adjusted to the existing infrastructure.

The area is small so there is no significant plants nor wildlife, except the orchards i.e. morelo cherry trees. The water from the wells is class I, therefore it is planned to be used as drinking water.

(19) Kiselichka Dam Project

Reservoir area is 90 ha., and the catchment area of the reservoir is 81.8 km<sup>2</sup>, and the storage capacity of the reservoir is 20 million m<sup>3</sup>. No resettlements, only few outdated facilities of little value will be flooded. Local road Dubrovnic-Kratov Dol will be flooded. Mostly pines, then downstream oaks, beeches and hazel trees, and pastures with grass, bellflowers and other herbs. Squirrels, foxes, boars, wolves, few dears. Small river fish of Cyprinidae family. River Kiselichka upstream dam site is class I. Foundation geology: Mica schist. The annual sediment quantity that will enter into the reservoir will be about 64,800 m<sup>3</sup>. An EIA will be required.

(20) Blatec Dam Project

The catchment area of the reservoir is 82.8 km<sup>2</sup>. Part of the road Vinica -Berovo will be flooded, stretch Blatec-Laki. This area has pines, low forests with oaks and horn-beams and poplars along the river, and some beeches. Squirrels, foxes, boars, wolves, few dears.

River Osojnica has small river fishes of both Salmonidae and Cyprinidae family.

Upstream of the dam the water quality of river Osojnica is class I. Foundation geology: Orthogneiss. The annual sediment quantity that will enter into the reservoir will be about 23,190 m<sup>3</sup>. An EIA will be required.

(21) Irrigation Construction of Subsystem Shtipsko Pole Left Side

This system is just an extension of the existing one, so the area that is covered by this system is already planned and has no significant social, infrastructure or environment negative effect.

(22) Krapa Dam Project

The reservoir area is 62 ha. And the catchment area of the reservoir is 33.5 km<sup>2</sup>, and the storage capacity of the reservoir is 10.4 (18.6) million m<sup>3</sup>. Floods only insignificant local road, which is already in a bad condition. On the right side mainly black oaks, on the left side mainly pastures with grass, bellflowers and other herbs. Squirrels, foxes, boars, wolves, few dears. There are also few small river fishes. Upstream of the dam the water quality of river Krapska is class I. The annual sediment quantity that will enter into the reservoir is about 16,000 m<sup>3</sup>. An EIA will be required.

(23) Zvan Dam Project

The reservoir area is 560 ha and the catchment area of the reservoir is 381.58 km<sup>2</sup>, and the storage capacity of the reservoir is 117.3 million m<sup>3</sup>. Part of

Dolenci village will be flooded. Floods only insignificant local road, which is already in a bad condition. Forests with oaks, and pastures with grass, bellflowers and other herbs. Squirrels, foxes, boars, wolves, few dears. Few small river fishes. Upstream of the dam the water quality of river Crna is class I. The annual sediment quantity that will enter into the reservoir will be about 110,000 m<sup>3</sup>. An EIA will be required.

(24) Obednik Dam Project

The reservoir area is 52 ha and the catchment area of the reservoir is 19.5 km<sup>2</sup>, and the storage capacity of the reservoir is 6.3 million m<sup>3</sup>. Floods only insignificant local road, which is already in a bad condition. Upstream there are pines, and downstream oaks. Fauna comprises of squirrels, foxes, boars, wolves, few dears. There are few small river fishes. Upstream of the dam the water quality of river Crna is class I. The annual sediment quantity that will enter into the reservoir will be about 2,500 m<sup>3</sup>. An EIA will be required.

(25) Kochishte Dam Project

The reservoir area is 124 ha and the catchment area of the reservoir is 59.57 km<sup>2</sup>, and the storage capacity of the reservoir is 6.3 million m<sup>3</sup>. Floods only insignificant local road, which is already in a bad condition. Mainly forests with oaks. Squirrels, foxes, boars, wolves, few dears. Few small river fishes. Upstream of the dam the water quality of river Zhaba is class I. The annual sediment quantity that will enter into the reservoir will be about 17,500 m<sup>3</sup>. An EIA will be required.

(26) Zurche Dam Project

The reservoir area is 53 ha and the catchment area of the reservoir is 27.21 km<sup>2</sup>, and the storage capacity of the reservoir is 8.5 million m<sup>3</sup>. Floods only insignificant local road, which is already in a bad condition. Mainly forests with oaks. Squirrels, foxes, boars, wolves, few dears. Few small river fishes. Upstream of the dam the water quality of river Ostrilska is class I. The annual sediment quantity that will enter into the reservoir will be about 4,200 m<sup>3</sup>. An EIA will be required.

(27) Konjarka Dam Project

The reservoir area is 16 ha and the catchment area of the reservoir is 59.87 km<sup>2</sup>, and the storage capacity of the reservoir is 3.2 million m<sup>3</sup>. Floods only insignificant local road, which is already in a bad condition. Upstream hop-hornbeams and hornbeams, downstream mainly oaks. There are squirrels, foxes, boars, wolves, and few dears. Few small river fishes. Maybe some small river salmon upstream. Upstream of the dam the water quality of river Konjarka is

class I. The annual sediment quantity that will enter into the reservoir will be about 41,900 m<sup>3</sup>. An EIA will be required.

(28) Petrushka Dam Project

The reservoir area is 132 ha and the catchment area of the reservoir is 61 km<sup>2</sup>, and the storage capacity of the reservoir is 27.25 million m<sup>3</sup>. Some agricultural land will be flooded. Local road Miravci-petrovo will be flooded. Upstream hop-hornbeams and hornbeams, downstream pines, and on the middle stretch some agricultural land. Squirrels, foxes, boars, wolves, few dears. River fishes of Cyprinidae family, and of Salmonidae family more upstream. Upstream of the dam the water quality of river Petrushka is class I. Foundation geology: Spilite. The annual sediment quantity that will enter into the reservoir will be about 9,700 m<sup>3</sup>. An EIA will be required.

(29) Kovanska Dam Project

The reservoir area is 97 ha and the catchment area of the reservoir is 51 km<sup>2</sup>, and the storage capacity is 14.4 million m<sup>3</sup> (depending which variant will be selected). About 30 ha of arable agricultural land will be flooded, rest is mainly scrub forest. The local road Negorci-Kovanci will be flooded, which is already 50% deteriorated. There will be no resettlements. The local road Negorci-Kovanci will be flooded, which is already 50 % deteriorated. Mainly on higher places pines, hornbeams, then scrub forest, and some wild chestnut trees along the riverbanks. Squirrels, foxes, boars, wolves, few dears. There are small river fishes. Upstream of the dam the water quality of river Kovanska is class I-II. The annual sediment quantity that will enter into the reservoir will be about 15,200 m<sup>3</sup>. An EIA will be required.

(30) Oraovica Dam Project

The reservoir area is 112 ha and the catchment area of the reservoir is 38 km<sup>2</sup>, and the storage capacity of the reservoir is 5 million m<sup>3</sup>. Does not flood anything. No flooding of roads. On the upper part of river Oraovica mainly low forest i.e. hop-hornbeams, hornbeams and some oaks, and on the left bank also some hornbeams. Squirrels, foxes, boars, wolves, few dears. There are small fishes from Cyprinidae family. Upstream of the dam the water quality of river Oraovicka is class I. Foundation geology: Pre-Cambrian Schist. The annual sediment quantity that will enter into the reservoir will be about 12,500 m<sup>3</sup>. An EIA will be required.



#### D.3.4 Overall IEE Evaluation

##### (1) Environmental Issues associated with implementation of Project

(An EIA is recommended and necessary for the projects below)

1. Vakuf Multipurpose Dam Project	The issue of resettlement include 500 + households, a quarry, and agricultural lands. The land erosion in the catchment area should be investigated. EIA will be required.
2. Konsko Dam Project	Loss of ecologically valuable land There will be no resettlement in the flooded area. EIA will be required
3. Kiselichka Dam Project	EIA will be required
4. Blatec Dam Project	EIA will be required
5. Krapa Dam Project	EIA will be required
6. Zvan Dam Project	EIA will be required
7. Obedink Dam Project	EIA will be required
8. Kochiste Dam Project	EIA will be required
9. Zurche Dam Project	EIA will be required
10. Konjarka Dam Project	EIA will be required
11. Petrushka Dam Project	EIA will be required
12. Kovanska Dam Project	EIA will be required
13. Oraovica Dam Project	EIA will be required
14. Podaresh Dam Project	As it is located on fragile ecology around the region on Plavaja River environmental study need to be carried out.

##### (2) Environmental Constraints & Unknown

(More detailed 'Environmental Studies' are recommended for the projects below)

1. Water Supply Project	Studies for encroachment of ecologically valuable land need to be carried.
2. Patiska Reka Water Supply	The erosion problem should be analysed.
3. Zletovica Multipurpose Dam Project	A plan for optimal use of water will be required for the high altitude Knezevo dam.
4. Studencica Supplemental Water Supply Project	An analysis of water rights allocation is recommended.
5. Razlovci Dam Project	Study of land erosion is recommended.
6. Paligrad Multipurpose Dam Project	The 2 dams are in close proximity, land erosion and downstream flow variation needs to carried out.
7. Rechani Multipurpose Dam Project	Land erosion control neds to be carried out.

(3) No Adverse Environmental Impacts Foreseen

(Since there is little impact the projects are not in the scope of further IEE or EIA)

1. Skopje Circle Rural Water Supply Project	No negative environmental impact is foreseen
2. Bitola Regional Water Supply Project	No negative environmental impact is foreseen
3. Irrigation System Betterment Project in Resen	No negative environmental impact is foreseen. The project will also benefit Prespa lake which has lower water level at present.
4. Strumica Area Irrigation Rehabilitation Project	No negative environmental impact is foreseen. The project will help to decrease existing water losses.
5. Water Supply Pipeline for Tetovo-River Pena Intake	No negative environmental impact is foreseen, and the project will reduce water losses.
6. Studena Voda Groundwater Development Project	No negative environmental impact is foreseen, and the project will reduce water losses.
7. Construction of Irrigation Subsystem 'Shtipsko Pole'	No negative environmental impact is foreseen, and the project will reduce water losses.

**Table D.1 Checklist of Environmental Parameters for Slupchanka Multipurpose Dam Project**

1. Name of Project : Slupchanka Dam Project

(Related Municipality : Kumanovo )

Actions Affecting Environmental Resources and Values	IEE (D)			Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Small	Moderate		
<b>A. Environmental Problems due to Project Locations</b>					
1. Resettlement	No resettel.				
1.1. Serious social inequities	No				
2. Encroachment into precious ecology	o				2. Detailed study needed
2.1. Loss of ecological values	o				2.1. Detailed study needed
3. Encroachment on historical/cultural values	No				
3.1. Loss of these values	No				
4. Watershed erosion silt Runoff			x		4. Watershed management program and erosion protection measures
4.1. Shortened reservoir life		x			4.1. Erosion protection measures
5. Effects on groundwater Hydrology		x			5. Careful planning plus provision of water supply system
5.1. Economic loss	No				
6. Migrating valuable fish Species	No				
6.1. Decrease in fish species Catch	No				
7. Inundation of mineral Resources	No				
7.1 Loss of these values	No				
8. Other inundation losses or adverse effects	No				
8.1. Depends on type of Effect					
<b>B. Environmental Problems Related to Design</b>					
1. Road erosion	No				
1.1. Impairment of water quality and land values	No				
2. Reservoir site preparation	No				
2.1. Affects reservoir water quality including nutrients for fishery	No fish				
3. Water right conflicts	No				
3.1. Serious social conflicts	No				
4. Fish screens	No				
4.1. Loss of fish stock	No				
<b>C. Environmental Problems Associated with Construction Stage</b>					
1. Soil erosion/silt runoff	No				
1.1. Impairment of water quality and land values	No				
2. Other construction hazards					
(a) safety of workers			x		Strictly following the Tender Docum.
(a1) hazards to workers' health/safety					Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x		Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	x				Strictly following the Tender Docum.
(c) water-oriented diseases	No				
(c1) hazards to health of workers and nearby Communities	No				
(d) dust/odors/fires/noise/ Vibrations			x		Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors			x		Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)			x		Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors			x		Strictly following the Tender Docum.
(f) environmental aesthetics	No				
(f1) loss of scenic values	No				

3.	Construction monitoring								
3.1.	Without it construction contractor not likely to observe constraints				x		3. Appropriate construction monitoring according to Tender Documents (very strictly)		
<b>D. Environmental Problems Relating to Project Operation</b>									
1.	Downstream flow variations	No							
1.1.	Disturbance to down- fisheries, and other uses	No				Possible effect is expected			
2.	Downstream erosion	No							
2.1.	Erosion of banks and river bottom damaging down- stream riverside facilities	No							
3.	Lack of reservoir management					x	3. Appropriate reservoir management according to the law		
3.1.	Social conflict in reservoir community	No							
4.	Eutrophication (aquatic,weeds)					x	Possible increase of determined III kat.		
4.1.	Heavy evaporation plus impairment of fishing and power generation								
5.	Downstream water quality						Positive effects are expected		
5.1.	Impairment of downstream water quality from flow restrictions	No					5. Careful operations planning to minimize problem		
6.	Insect vector disease hazards	No							
6.1.	Community health hazard	No							
7.	Reservoir bank stability	No							
7.1.	Impairment of reservoir uses and water quality	No							
8.	Operation monitoring								
8.1.	Without it, operators not likely to comply with constraints					x	8. Careful planning/design and operation according to the law		
<b>E. Potential Environmental Enhancement Measures</b>									
1.	Reservoir fishery enhance- development					x	Positive effect		
1.1.	Considerable extra reservoir fishery potential realized					x	Positive effect		
2.	Drawdown agriculture development					x	Positive effect		
2.1.	Considerable extra agricultural production realized					x	2. Appropriate management of drawdown agriculture		
3.	Downstream community water supply						x	Positive effect	
3.1.	Improvement in community living standards					x	Positive effect		
4.	Downstream aquaculture	No							
4.1.	Improvement in community living standards	No							
5.	Forestry/wildlife reserves						x		
5.1.	Conservation of forests/ wildlife	No						5.1. Use of project for establishment of reserves to offset losses	
6.	Recreation							x	
6.1.	Improvement in community quality of life including the poor							x	6.1. Planning for optimal multipurpose reservoir use
<b>F. Critical Review Criteria</b>									
1.	Loss of irreplaceable natural resources	No							
2.	Accelerated use of resources for short-term gains	No							
3.	Endangering of species							x	
4.	Undesirable rural-to-urban migration	No							
5.	Increase in affluent/poor people gap	No							

**Table D.2 Checklist of Environmental Parameters for Vakuf Multipurpose Dam Project**

2. Name of Project : Vakuf Multipurpose Dam Project

(Related Municipality : Kumanovo )

Actions Affecting Environmental Resources and Values	IEE (D)			Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Significant Effect			
		Small	Moderate	Major	
<b>A. Environmental Problems due to Project Locations</b>					
1. Resettlement				x	1. Carefully planned resettlement program including "hard" budget
1.1. Serious social inequities			x		
2. Encroachment into precious ecology	No				
2.1. Loss of ecological values		x			
3. Encroachment on historical/cultural values	No				
3.1. Loss of these values	No				
4. Watershed erosion silt Runoff		x			4. Watershed management program and erosion protection measures
4.1. Shortened reservoir life		x			
5. Effects on groundwater Hydrology				water level variation	5. Careful planning plus mitigation measures
5.1. Economic loss	No				
6. Migrating valuable fish Species	No				
6.1. Decrease in fish species Catch	No				
7. Inundation of mineral Resources			x	quarry	7. Mines before inundation if feasible
7.1 Loss of these values					
8. Other inundation losses or adverse effects	No				
8.1. Depends on type of Effect					
<b>B. Environmental Problems Related to Design</b>					
1. Road erosion	No				
1.1. Impairment of water quality and land values	No				
2. Reservoir site preparation					
2.1. Affects reservoir water quality including nutrients for fishery	No				
3. Water right conflicts	No				
3.1. Serious social conflicts	No				
4. Fish screens	No				
4.1. Loss of fish stock	No				
<b>C. Environmental Problems Associated with Construction Stage</b>					
1. Soil erosion/silt runoff	No				
1.1. Impairment of water quality and land values	No				
2. Other construction hazards					
(a) safety of workers			x		Strictly following the Tender Docum.
(a1) hazards to workers' health/safety			x		Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x		Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	No				
(c) water-oriented diseases	No				
(c1) hazards to health of workers and nearby Communities	No				
(d) dust/odors/fires/noise/ Vibrations			x		Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors			x		Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)			x		Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors			x		Strictly following the Tender Docum.
(f) environmental aesthetics	No				
(f1) loss of scenic values	No				

3. Construction monitoring						
3.1. Without it construction contractor not likely to observe constraints				x		3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>						
1. Downstream flow variations				x		1. Minimum adverse effects
1.1. Disturbance to down- fisheries, and other uses	x					
2. Downstream erosion						
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	x					2. Careful design to control problems plus monitoring and erosion protection measures
3. Lack of reservoir management				x		3. Appropriate reservoir management
3.1. Social conflict in reservoir community	x					
4. Eutrophication (aquatic,weeds)				x	Serious problems could be expected	4. Construction of waste water treatment plants prior to dam construction
4.1. Heavy evaporation plus impairment of fishing and power generation					since the water is III-IV category	4.1 Phenomena are usually Temporary
5. Downstream water quality	o				Unknown, probably poor	
5.1. Impairment of downstream water quality from flow restrictions					Unknown	5. Careful operations planning to Minimize problem
6. Insect vector disease hazards	o				Possible	
6.1. Community health hazard	o				Possible	6. Careful monitoring plus use of Appropriate control measures
7. Reservoir bank stability	No					
7.1. Impairment of reservoir uses and water quality	No					
8. Operation monitoring						
8.1. Without it, operators not likely to comply with constraints				x		8. Careful planning/design according to the law
<b>E. Potential Environmental Enhancement Measures</b>						
1. Reservoir fishery enhance- development				x	Positive effect	1. Appropriate reservoir fishery Management
1.1. Considerable extra reservoir fishery potential realized		x				
2. Drawdown agriculture development				x		
2.1. Considerable extra agricultural production realized				x		2. Appropriate management of drawdown agriculture
3. Downstream community water supply				x	Positive effect	3. Planning for optimal use of stored water
3.1. Improvement in community living standards				x	Positive effect	
4. Downstream aquaculture				x	Positive effect	
4.1. Improvement in community living standards				x	Positive effect	
5. Forestry/wildlife reserves		x				
5.1. Conservation of forests/ wildlife	No					5. Use of project for establishment of reserves to offset losses
6. Recreation				x	Positive effect	
6.1. Improvement in community quality of life including the poor				x	Positive effect	6. Planning for optimal multipurpose Reservoir use
<b>F. Critical Review Criteria</b>						
1. Loss of irreplaceable natural resources	No					
2. Accelerated use of resources for short-term gains	No					
3. Endangering of species	No					
4. Undesirable rural-to-urban migration	No					
5. Increase in affluent/poor people gap	No					

**Table D.3 Checklist of Environmental Parameters for Patishka Reka  
Water Supply Project**

3. Name of Project : Pateska Reka Water Supply Project

(Related Municipality : Skopje )

Actions Affecting Environmental Resources and Values	IEE (D)				Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Significant Effect				
		Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	No					
1.1. Serious social inequities	No					
2. Encroachment into precious ecology	No					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	No					
3.1. Loss of these values	No					
4. Watershed erosion silt Runoff	x					4. Watershed management program
4.1. Shortened reservoir life						
5. Effects on groundwater Hydrology	x					5. Careful planning plus mitigation measures
5.1. Economic loss	No					
6. Migrating valuable fish Species	No					
6.1. Decrease in fish species Catch	No					
7. Inundation of mineral Resources	No					
7.1 Loss of these values	No					
8. Other inundation losses or adverse effects	No					
8.1. Depends on type of Effect						
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	No					
1.1. Impairment of water quality and land values	No					
2. Reservoir site preparation						
2.1. Affects reservoir water quality including nutrients for fishery	No					
3. Water right conflicts	No					
3.1. Serious social conflicts	No					
4. Fish screens	No					
4.1. Loss of fish stock	No					
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	No					
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers		x				Strictly following the Tender Docum.
(a1) hazards to workers' health/safety		x				Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities		x				Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities	No					
(d) dust/odors/fires/noise/ Vibrations			x			Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors			x			Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)			x			Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors			x			Strictly following the Tender Docum.
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3. Construction monitoring						
3.1. Without it construction contractor not likely to observe constraints				x		3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>						
1. Downstream flow variations	x					1. Minimum adverse effects
1.1. Disturbance to down- fisheries, and other uses	x				No fisheries	
2. Downstream erosion						
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	No					
3. Lack of reservoir management						
3.1. Social conflict in reservoir community	No					
4. Eutrophication (aquatic,weeds)	No					
4.1. Heavy evaporation plus impairment of fishing and power generation	-					
5. Downstream water quality	x					
5.1. Impairment of downstream water quality from flow restrictions	No					5. Careful operations planning to minimize problem
6. Insect vector disease hazards	No					
6.1. Community health hazard	No					
7. Reservoir bank stability	-					
7.1. Impairment of reservoir uses and water quality	-					
8. Operation monitoring						
8.1. Without it, operators not likely to comply with constraints				x		8. Careful planning/design according to the law
<b>E. Potential Environmental Enhancement Measures</b>						
1. Reservoir fishery enhance- development	-					
1.1. Considerable extra reservoir fishery potential realized	-					
2. Drawdown agriculture development	-					
2.1. Considerable extra agricultural production realized	-					
3. Downstream community water supply				x	Positive effect	
3.1. Improvement in community living standards				x	Positive effect	
4. Downstream aquaculture	-					
4.1. Improvement in community living standards	-					
5. Forestry/wildlife reserves	No					
5.1. Conservation of forests/ wildlife	No					
6. Recreation	-					
6.1. Improvement in community quality of life including the poor	-					
<b>F. Critical Review Criteria</b>						
1. Loss of irreplaceable natural resources	No					
2. Accelerated use of resources for short-term gains	No					
3. Endangering of species	No					
4. Undesirable rural-to-urban migration	No					
5. Increase in affluent/poor people gap	No					



**Table D.4 Checklist of Environmental Parameters for Studencica Supplemental Water Supply Project**

6. Name of Project : Studencica Supplemental Water Supply Project

(Related Municipality : Kicevo, Krusevo, Prilep )

Actions Affecting Environmental Resources and Values	IEE (D)				Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	-					
1.1. Serious social inequities	-					
2. Encroachment into precious ecology	-					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	-					
3.1. Loss of these values	-					
4. Watershed erosion silt Runoff	x					4. Watershed management program
4.1. Shortened reservoir life	-					
5. Effects on groundwater Hydrology						
5.1. Economic loss	-					
6. Migrating valuable fish Species	No					
6.1. Decrease in fish species Catch	No					
7. Inundation of mineral Resources	-					
7.1. Loss of these values	-					
8. Other inundation losses or adverse effects	-					
8.1. Depends on type of Effect						
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	-					
1.1. Impairment of water quality and land values	-					
2. Reservoir site preparation	-					
2.1. Affects reservoir water quality including nutrients for fishery	-					
3. Water right conflicts	x					3. Careful management of water right allocation
3.1. Serious social conflicts	No					
4. Fish screens	No					
4.1. Loss of fish stock	No					
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	No					
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers		x				Strictly following the Tender Docum.
(a1) hazards to workers' health/safety		x				Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	x					Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities		x				Strictly following the Tender Docum.
(d) dust/odors/fires/noise/Vibrations		x				Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors		x				Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)		x				Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors		x				Strictly following the Tender Docum.
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3. Construction monitoring						
3.1. Without it construction contractor not likely to observe constraints			x			3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>						
1. Downstream flow variations	x					1. Minimum adverse effects
1.1. Disturbance to down- fisheries, and other uses	No fisheries					
2. Downstream erosion						
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	No					
3. Lack of reservoir management	-					
3.1. Social conflict in reservoir community	-					
4. Eutrophication (aquatic,weeds)	No					
4.1. Heavy evaporation plus impairment of fishing and power generation	-					
5. Downstream water quality	No					
5.1. Impairment of downstream water quality from flow restrictions	No					
6. Insect vector disease hazards	No					
6.1. Community health hazard	No					
7. Reservoir bank stability	-					
7.1. Impairment of reservoir uses and water quality	-					
8. Operation monitoring						
8.1. Without it, operators not likely to comply with constraints			x			8. Careful planning/design
<b>E. Potential Environmental Enhancement Measures</b>						
1. Reservoir fishery enhance- development	-					
1.1. Considerable extra reservoir fishery potential realized	-					
2. Drawdown agriculture development	-					
2.1. Considerable extra agricultural production realized	-					
3. Downstream community water supply				x	Positive effect	
3.1. Improvement in community living standards				x	Positive effect	
4. Downstream aquaculture	No					
4.1. Improvement in community living standards	-					
5. Forestry/wildlife reserves	No					
5.1. Conservation of forests/ wildlife	No					
6. Recreation	-					
6.1. Improvement in community quality of life including the poor	-					
<b>F. Critical Review Criteria</b>						
1. Loss of irreplaceable natural resources	No					
2. Accelerated use of resources for short-term gains	No					
3. Endangering of species	No					
4. Undesirable rural-to-urban migration	No					
5. Increase in affluent/poor people gap	No					

**Table D.5 Checklist of Environmental Parameters for Pelagonija Circle Water Supply Project**

7. Name of Project : Pelagonia Circle Rural Water Supply Project

(Related Municipality : Medzitlija & other villages )

Actions Affecting Environmental Resources and Values	IEE (D)			Remarks/ Data Sources	Recommended Feasible Protection Measures	
	No Significant Effect	Significant Effect				
		Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	-					
1.1. Serious social inequities	-					
2. Encroachment into precious ecology	No					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	No					
3.1. Loss of these values	No					
4. Watershed erosion silt Runoff	No					
4.1. Shortened reservoir life	-					
5. Effects on groundwater Hydrology	No					
5.1. Economic loss	No					
6. Migrating valuable fish Species	No					
6.1. Decrease in fish species Catch	No					
7. Inundation of mineral Resources	No					
7.1. Loss of these values	No					
8. Other inundation losses or adverse effects	No					
8.1. Depends on type of Effect	No					
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	No					
1.1. Impairment of water quality and land values	No					
2. Reservoir site preparation						
2.1. Affects reservoir water quality including nutrients for fishery	-					
3. Water right conflicts	No					
3.1. Serious social conflicts	No					
4. Fish screens	No					
4.1. Loss of fish stock	No					
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	No					
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers		x				Strictly following the Tender Docum.
(a1) hazards to workers' health/safety		x				Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities		x				Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities	No					
(d) dust/odors/fires/noise/Vibrations		x				Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors		x				Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)	No					
(e1) hazards to workers and Neighbors	No					
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3.	Construction monitoring					
3.1.	Without it construction contractor not likely to observe constraints			x		3. Appropriate construction
<b>D. Environmental Problems Relating to Project Operation</b>						
1.	Downstream flow variations	-				
1.1.	Disturbance to down- fisheries, and other uses	No				
2.	Downstream erosion	-				
2.1.	Erosion of banks and river bottom damaging down- stream riverside facilities	-				
3.	Lack of reservoir management	-				
3.1.	Social conflict in reservoir community	-				
4.	Eutrophication (aquatic,weeds)	No				
4.1.	Heavy evaporation plus impairment of fishing and power generation	-				
5.	Downstream water quality	No				
5.1.	Impairment of downstream water quality from flow restrictions	-				
6.	Insect vector disease hazards	No				
6.1.	Community health hazard	No				
7.	Reservoir bank stability	-				
7.1.	Impairment of reservoir uses and water quality	-				
8.	Operation monitoring					
8.1.	Without it, operators not likely to comply with constraints			x		8. Careful planning/design and Operation according to the law
<b>E. Potential Environmental Enhancement Measures</b>						
1.	Reservoir fishery enhance- development	-				
1.1.	Considerable extra reservoir fishery potential realized	-				
2.	Drawdown agriculture development	-				
2.1.	Considerable extra agricultural production realized	-				
3.	Downstream community water supply				x	
3.1.	Improvement in community living standards				x	3. Planning for optimal use of stored water
4.	Downstream aquaculture					
4.1.	Improvement in community living standards	-				
5.	Forestry/wildlife reserves	No				
5.1.	Conservation of forests/ wildlife	No				
6.	Recreation	-				
6.1.	Improvement in community quality of life including the poor	-				
<b>F. Critical Review Criteria</b>						
1.	Loss of irreplaceable natural resources	No				
2.	Accelerated use of resources for short-term gains	No				
3.	Endangering of species	No				
4.	Undesirable rural-to-urban migration	No				
5.	Increase in affluent/poor people gap	No				

**Table D.6 Checklist of Environmental Parameters for Southwest Mountainous Area Rural Water Supply Project**

(1/2)

8. *Name of Project : Southwest Mountainous Area Rural Water Supply Project* (Related Municipality : Belchista and Villages )

Actions Affecting Environmental Resources and Values	IEB (D)			Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Small	Significant Effect Moderate   Major		
<b>A. Environmental Problems due to Project Locations</b>					
1. Resettlement	-				
1.1. Serious social inequities	-				
2. Encroachment into precious ecology	No				
2.1. Loss of ecological values	No				
3. Encroachment on historical/cultural values	No				
3.1. Loss of these values	No				
4. Watershed erosion silt Runoff	-				
4.1. Shortened reservoir life	-				
5. Effects on groundwater Hydrology	No				
5.1. Economic loss	No				
6. Migrating valuable fish Species	No				
6.1. Decrease in fish species Catch	No				
7. Inundation of mineral Resources	No				
7.1 Loss of these values	No				
8. Other inundation losses or adverse effects	No				
8.1. Depends on type of Effect	No				
<b>B. Environmental Problems Related to Design</b>					
1. Road erosion	x				1. Erosion protection measures
1.1. Impairment of water quality and land values	No				
2. Reservoir site preparation	-				
2.1. Affects reservoir water quality including nutrients for fishery	-				
3. Water right conflicts	No				
3.1. Serious social conflicts	No				
4. Fish screens	-				
4.1. Loss of fish stock	-				
<b>C. Environmental Problems Associated with Construction Stage</b>					
1. Soil erosion/silt runoff	No				
1.1. Impairment of water quality and land values	No				
2. Other construction hazards					
(a) safety of workers		x			Strictly following the Tender Docum.
(a1) hazards to workers' health/safety		x			Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x		Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	No				
(c) water-oriented diseases	No				
(c1) hazards to health of workers and nearby Communities	No				
(d) dust/odors/fires/noise/ Vibrations		x			Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors		x			Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)	No				
(e1) hazards to workers and Neighbors	No				
(f) environmental aesthetics	No				
(f1) loss of scenic values	No				

3. Construction monitoring						
3.1. Without it construction contractor not likely to observe constraints			x			3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>						
1. Downstream flow variations	x					
1.1. Disturbance to down- fisheries, and other uses	No					
2. Downstream erosion	No					
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	-					
3. Lack of reservoir management	-					
3.1. Social conflict in reservoir community	-					
4. Eutrophication (aquatic,weeds)	No					
4.1. Heavy evaporation plus impairment of fishing and power generation	-					
5. Downstream water quality	No					
5.1. Impairment of downstream water quality from flow restrictions	No					
6. Insect vector disease hazards	No					
6.1. Community health hazard	No					
7. Reservoir bank stability	-					
7.1. Impairment of reservoir uses and water quality	-					
8. Operation monitoring						
8.1. Without it, operators not likely to comply with constraints			x			8. Careful planning/design and operation according the law
<b>E. Potential Environmental Enhancement Measures</b>						
1. Reservoir fishery enhance- development	-					
1.1. Considerable extra reservoir fishery potential realized	-					
2. Drawdown agriculture development	-					
2.1. Considerable extra agricultural production realized	-					
3. Downstream community water supply				x		
3.1. Improvement in community living standards				x		3. Planning for optimal use of stored water
4. Downstream aquaculture	-					
4.1. Improvement in community living standards	-					
5. Forestry/wildlife reserves	No					
5.1. Conservation of forests/ wildlife	No					
6. Recreation	No					
6.1. Improvement in community quality of life including the poor	No					
<b>F. Critical Review Criteria</b>						
1. Loss of irreplaceable natural resources	No					
2. Accelerated use of resources for short-term gains	No					
3. Endangering of species	No					
4. Undesirable rural-to-urban migration	No					
5. Increase in affluent/poor people gap	No					

**Table D.7 Checklist of Environmental Parameters for Paligrad Multipurpose Dam Project**

(1/2)

12. Name of Project : Paligrad Multipurpose Dam Project

(Related Municipality : Skopje )

Actions Affecting Environmental Resources and Values	IEE (D)				Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Significant Effect				
		Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	No					
1.1. Serious social inequities	No					
2. Encroachment into precious ecology	No					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	No					
3.1. Loss of these values	No					
4. Watershed erosion silt Runoff	x					4. Watershed management program and erosion protection measures
4.1. Shortened reservoir life		x				
5. Effects on groundwater Hydrology	No					
5.1. Economic loss	No					
6. Migrating valuable fish Species				x		
6.1. Decrease in fish species Catch			x			
7. Inundation of mineral Resources	No					
7.1 Loss of these values	No					
8. Other inundation losses or adverse effects	No					
8.1. Depends on type of Effect	No					
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	x					
1.1. Impairment of water quality and land values	No					
2. Reservoir site preparation						
2.1. Affects reservoir water quality including nutrients for fishery						
3. Water right conflicts	No					
3.1. Serious social conflicts	No					
4. Fish screens				x		4. Study on fish migration
4.1. Loss of fish stock			x			
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	x					1. Proper construction planning plus monitoring
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers			x			Strictly following the Tender Docum.
(a1) hazards to workers' health/safety			x			Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	x					Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities	No					
(d) dust/odors/fires/noise/ Vibrations			x			Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors		x	x			Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)			x			Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors	No		x			Strictly following the Tender Docum.
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3. Construction monitoring						
3.1. Without it construction contractor not likely to observe constraints				x		3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>						
1. Downstream flow variations	x					1. Minimum adverse effects
1.1. Disturbance to down- fisheries, and other uses		x				
2. Downstream erosion	No					
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	No					
3. Lack of reservoir management			x			3. Appropriate reservoir management
3.1. Social conflict in reservoir community	No					
4. Eutrophication (aquatic, weeds)			x			
4.1. Heavy evaporation plus impairment of fishing and power generation						
5. Downstream water quality			x			
5.1. Impairment of downstream water quality from flow restrictions	No					
6. Insect vector disease hazards	No					
6.1. Community health hazard	No					
7. Reservoir bank stability	No					
7.1. Impairment of reservoir uses and water quality	No					
8. Operation monitoring						
8.1. Without it, operators not likely to comply with constraints			x			8. Careful planning/design and Operation according to the law
<b>E. Potential Environmental Enhancement Measures</b>						
1. Reservoir fishery enhance- development		x				1. Appropriate reservoir fishery management
1.1. Considerable extra reservoir fishery potential realized		x				
2. Drawdown agriculture development				x		
2.1. Considerable extra agricultural production realized				x		2. Appropriate management of drawdown agriculture
3. Downstream community water supply				x		
3.1. Improvement in community living standards				x		3. Planning for optimal use of stored water
4. Downstream aquaculture	x					
4.1. Improvement in community living standards	x					
5. Forestry/wildlife reserves			x			
5.1. Conservation of forests/ wildlife			x			5. Use of project for establishment of reserves to offset losses
6. Recreation		x				
6.1. Improvement in community quality of life including the poor		x				6. Planning for optimal multipurpose reservoir use
<b>F. Critical Review Criteria</b>						
1. Loss of irreplaceable natural resources		x				
2. Accelerated use of resources for short-term gains	No					
3. Endangering of species			x			
4. Undesirable rural-to-urban migration	No					
5. Increase in affluent/poor people gap	No					



**Table D.8 Checklist of Environmental Parameters for Rechani Multipurpose Dam Project**

13. Name of Project : Rechani Multipurpose Dam Project

(Related Municipality : Kocani & Vinica )

Actions Affecting Environmental Resources and Values	IEE (D)				Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Significant Effect				
		Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	No					
1.1. Serious social inequities	No					
2. Encroachment into precious ecology	No					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	No					
3.1. Loss of these values	No					
4. Watershed erosion silt Runoff	x					4. Watershed management program and erosion protection measures
4.1. Shortened reservoir life		x				4.1 Erosion protection measures
5. Effects on groundwater Hydrology	x					
5.1. Economic loss	No					
6. Migrating valuable fish Species	No					
6.1. Decrease in fish species Catch	No					
7. Inundation of mineral Resources	No					
7.1. Loss of these values	No					
8. Other inundation losses or adverse effects	No					
8.1. Depends on type of Effect	No					
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	x					1. Erosion protection measures
1.1. Impairment of water quality and land values	x					1.1 Careful planning / design / O&M /monitoring
2. Reservoir site preparation	No					
2.1. Affects reservoir water quality including nutrients for fishery	No					
3. Water right conflicts	No					
3.1. Serious social conflicts	No					
4. Fish screens	x					4. Study on fish migration
4.1. Loss of fish stock	No					
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	x					1. Proper construction planning plus monitoring
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers			x			Strictly following the Tender Docum.
(a1) hazards to workers' health/safety			x			Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	x					Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities	No					
(d) dust/odors/fires/noise/ Vibrations			x			Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors			x			Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)			x			Strictly following the Tender Docum.
(e1) hazards to workers and Neighbors			x			Strictly following the Tender Docum.
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3.	Construction monitoring						
3.1.	Without it construction contractor not likely to observe constraints				x		3. Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>							
1.	Downstream flow variations	x					1. Minimum adverse effects
1.1.	Disturbance to down- fisheries, and other uses	x					
2.	Downstream erosion	x					2. Erosion protection emasures
2.1.	Erosion of banks and river bottom damaging down- stream riverside facilities	No					
3.	Lack of reservoir management				x		3. Appropriate reservoir management
3.1.	Social conflict in reservoir community	No					
4.	Eutrophication (aquatic,weeds)	No					
4.1.	Heavy evaporation plus impairment of fishing and power generation						
5.	Downstream water quality	No					
5.1.	Impairment of downstream water quality from flow restrictions	No					
6.	Insect vector disease hazards	No					
6.1.	Community health hazard	No					
7.	Reservoir bank stability	No					
7.1.	Impairment of reservoir uses and water quality	No					
8.	Operation monitoring						
8.1.	Without it, operators not likely to comply with constraints				x		8. Careful planning/design and operation according the law
<b>E. Potential Environmental Enhancement Measures</b>							
1.	Reservoir fishery enhance- development	x					1. Appropriate reservoir management
1.1.	Considerable extra reservoir fishery potential realized			x			
2.	Drawdown agriculture development				x		
2.1.	Considerable extra agricultural production realized				x		2. Appropriate management of drawdown agriculture
3.	Downstream community water supply					x	
3.1.	Improvement in community living standards					x	3. Planning for optimal use of stored water
4.	Downstream aquaculture	x					
4.1.	Improvement in community living standards	x					
5.	Forestry/wildlife reserves	No					
5.1.	Conservation of forests/ wildlife	No					
6.	Recreation			x			
6.1.	Improvement in community quality of life including the poor			x			6. Planning for optimal multipurpose reservoir use
<b>F. Critical Review Criteria</b>							
1.	Loss of irreplaceable natural resources	No					
2.	Accelerated use of resources for short-term gains	No					
3.	Endangering of species	No					
4.	Undesirable rural-to-urban migration	No					
5.	Increase in affluent/poor people gap	No					

**Table D.9 Checklist of Environmental Parameters for Strumica Area Irrigation Rehabilitation Project**

(1/2)

17. Name of Project : Strumica Area Irr. Rehabilitation Project

(Related Municipality : Strumica )

Actions Affecting Environmental Resources and Values	IEE (D)				Remarks/ Data Sources	Recommended Feasible Protection Measures
	No Significant Effect	Significant Effect				
		Small	Moderate	Major		
<b>A. Environmental Problems due to Project Locations</b>						
1. Resettlement	-					
1.1. Serious social inequities	-					
2. Encroachment into precious ecology	No					
2.1. Loss of ecological values	No					
3. Encroachment on historical/cultural values	No					
3.1. Loss of these values	No					
4. Watershed erosion silt Runoff		x				4. Watershed management program and erosion protection measures
4.1. Shortened reservoir life	-					
5. Effects on groundwater Hydrology		x			Positive effect	5. Careful planning plus mitigation measures
5.1. Economic loss	No					
6. Migrating valuable fish Species	No					
6.1. Decrease in fish species Catch	No					
7. Inundation of mineral Resources	-					
7.1 Loss of these values	-					
8. Other inundation losses or adverse effects	-					
8.1. Depends on type of Effect	-					
<b>B. Environmental Problems Related to Design</b>						
1. Road erosion	x					1. Erosion protection measures
1.1. Impairment of water quality and land values	-					
2. Reservoir site preparation						
2.1. Affects reservoir water quality including nutrients for fishery	-					
3. Water right conflicts	-					
3.1. Serious social conflicts	-					
4. Fish screens	No					
4.1. Loss of fish stock	No					
<b>C. Environmental Problems Associated with Construction Stage</b>						
1. Soil erosion/silt runoff	x					1. Proper construction planning plus monitoring
1.1. Impairment of water quality and land values	No					
2. Other construction hazards						
(a) safety of workers		x				Strictly following the Tender Docum.
(a1) hazards to workers' health/safety		x				Strictly following the Tender Docum.
(b) sanitation at workers' Camp			x			Strictly following the Tender Docum.
(b1) hazards to health of workers and nearby Communities	x					Strictly following the Tender Docum.
(c) water-oriented diseases	No					
(c1) hazards to health of workers and nearby Communities	No					
(d) dust/odors/fires/noise/ Vibrations			x			Strictly following the Tender Docum.
(d1) hazards to workers and Neighbors			x			Strictly following the Tender Docum.
(e) quarrying hazards (blast- ing and hauling)	No					
(e1) hazards to workers and Neighbors	No					
(f) environmental aesthetics	No					
(f1) loss of scenic values	No					

3. Construction monitoring					
3.1. Without it construction contractor not likely to observe constraints			x		3.1 Appropriate construction monitoring according to Tender Documents (very strictly)
<b>D. Environmental Problems Relating to Project Operation</b>					
1. Downstream flow variations	-				
1.1. Disturbance to down- fisheries, and other uses	-				
2. Downstream erosion	No				
2.1. Erosion of banks and river bottom damaging down- stream riverside facilities	No				
3. Lack of reservoir management			x		3. Appropriate reservoir management
3.1. Social conflict in reservoir community			x		
4. Eutrophication (aquatic,weeds)	No				
4.1. Heavy evaporation plus impairment of fishing and power generation	-				
5. Downstream water quality	No				
5.1. Impairment of downstream water quality from flow restrictions	No				
6. Insect vector disease hazards	No				
6.1. Community health hazard	No				
7. Reservoir bank stability	-				
7.1. Impairment of reservoir uses and water quality	-				
8. Operation monitoring					
8.1. Without it, operators not likely to comply with constraints			x		8. Careful planning/design and operation according to the law
<b>E. Potential Environmental Enhancement Measures</b>					
1. Reservoir fishery enhance- development	-				
1.1. Considerable extra reservoir fishery potential realized	-				
2. Drawdown agriculture development			x		
2.1. Considerable extra agricultural production realized			x		2. Appropriate management of drawdown agriculture
3. Downstream community water supply	-				
3.1. Improvement in community living standards	-				
4. Downstream aquaculture	No				
4.1. Improvement in community living standards	No				
5. Forestry/wildlife reserves	No				
5.1. Conservation of forests/ wildlife	No				
6. Recreation	-				
6.1. Improvement in community quality of life including the poor	-				
<b>F. Critical Review Criteria</b>					
1. Loss of irreplaceable natural resources	No				
2. Accelerated use of resources for short-term gains	No				
3. Endangering of species	No				
4. Undesirable rural-to-urban migration	No				
5. Increase in affluent/poor people gap	No				

