

(Table F9). Also the TKI mine is much larger than this mine. Therefore, the effects on the regional economy of reduced operation of this mine would be marginal.

(4) Other aspects

Land tenure problems may arise associated with the inundation by the reservoir and the relocation/resettlement of the Çavusköyü village. Water-borne diseases may increase to a small extent along the reservoir shores, while drinking water supply should continue to rely primarily on springs and groundwater.

4.2 Impact on Natural/physical Aspects

(1) Topography

The planned reservoir will submerge part of the canyon created by the Ermenek river over hundreds of million years. The Project, however, will expand the opportunities for more people to appreciate the unique landscape by creating the large water body and improving access.

(2) Geology

There are conditions of old landslide on slopes of proposed reservoir area, but it is judged that impounding of reservoir will not cause any landslide because the existing slope of ground surface is already gentle and the expected movement of reservoir water surface is very slow.

(3) Vegetation

Vegetation in the Project area will not be affected, except possible minor effects by construction activities for access roads, power plant, and transmission

lines as well as submersion of small forests in the planned reservoir area.

(4) Meteoro-hydrology

The creation of the reservoir will raise the ground-water table around the reservoir. This may increase the yield of some springs located at lower elevation, but such effects cannot be assessed at this time. Possible effects of the large water body on local climate will be minimal.

(5) Water quality

With the creation of the reservoir, water quality of the Ermenek river system will change. First, organic contents of reservoir water will increase as organic wastes are released from existing settlements and plants and other materials decompose. Such effect will be smaller for the Project than many other dam projects, as vegetation is relatively thin in the planned reservoir area. Second, such changes will increase the population of phyto- and zoo - planktons and other micro-organisms. This in turn will affect the water quality in the downstream. These effects will be small as judged from the observation of another dam project (Oymapinar) located in the similar environment.

In many reservoirs particularly in tropical and sub-tropical environment, large amount of sediments transported during rainy season is once trapped by the reservoirs and thus turbid flow in the downstream tends to be prolonged by release from the reservoirs. This sometimes affects fish culture in the downstream. This problem, however, does not seem to occur in the Project, as the sediment transport is small even during rainy season. The Oymapinar dam project located in the

similar natural environment having comparable runoff coefficient has not faced such a problem since its completion in 1984.

The discharge of organic materials into the Ermenek river system will increase as the Project area develops. Main factors are population increase and urbanization, increase in per capita water use which in turn will increase sewage loads, development of industries and increased fertilizer utilization. This process, however, will be slow to develop and its possible negative effects cannot be determined yet.

4.3 Impact on Fauna and Flora

(1) Terrestrial fauna and flora

No significant change is expected in the natural environment of the Project area as described above, and thus no adverse effect is foreseen in terrestrial fauna and flora. However, habitats of some species will be affected by the planned reservoir, including breeding areas of some birds. Precise effects of this nature cannot be determined at this time.

(2) Aquatic fauna and flora

As the water quality of the Ermenek river system changes as described above, aquatic ecosystem will certainly change. Dominant species of fish may change, and more aquatic flora will flourish. However, such ecological evolution will be relatively slow, as the upstream reaches of the Ermenek river are almost intact at present and organic loads do not seem to increase so fast.

4.4 Risk Resultant Matrix

The risk resultant matrix is constructed for this PEIA by taking such aspects of the environment that seem to be more important as judged from the analyses above. Possible/probable impact of the Project activities on different aspects of the environment is expressed by the following indicators.

o = No effect expected

+ = Positive effect expected

- = Negative effect expected

+ = Neutral/mixed effect expected; i.e. there may a change in the conditions of this aspect of the environment, but from an overall ecosystem perspective, such change cannot be judged neither totally beneficial nor totally harmful.

x = Undetermined; i.e. there is the possibility of some effect occurring, but with the present data available, it is impossible to predict the direction of the effect.

The complete risk resultant matrix is given in Table F18.

CHAPTER 5. LAWS

Environment-related articles are entered in the Constitution and other laws.

Article 3 of the Environment Law No.18132 promulgated in 1983 provides the general principles regarding environment protection and prevention of environmental pollution. Sub article c) among others states that "Institutions authorized to make decisions and evaluate projects concerning the use of land and resources shall pursue the objective of protecting and not polluting the environment, at the same time taking care not to affect development efforts adversely.

In and after 1983 some relevant laws and decree-laws were promulgated. They are; the Law on Protection of Cultural and National Assets No.18113, the National Part Law No.18132, the Bosphorus Law, the Decree-Law Concerning the Establishment and Functions of the Environmental General Directorate duplicate No.18435, and the Building Code (Official Gazette No.18749).

The Aquatic Products Law No.13799 promulgated in 1971 contains provisions directly related to the dam;-

Measures to be taken in dams and artificial lakes

Article 8: Before any water is introduced into dam reservoirs or other artificial lakes, an application must be made by the concerned parties to the Ministry of Agriculture to determine the measures that need to be taken regarding aquatic products, and any such measures indicated as necessary by the Ministry must be taken.

Measures to protect aquatic products from damage

Article 9: When inland waters are used for purposes such as irrigation or the production of energy, it is a condition that the measures necessary for protecting the life, propagation, conservation and production of the aquatic products existing in such waters be taken by the parties concerned. The Ministry of Agriculture shall determine what these measures should consist of.

CHAPTER 6. COUNTER-MEASURES AND FOLLOW-UP WORKS

As described in the previous section, the planned Project works do not seem to cause any serious environmental problems, although materials and time used at this time are limited and the Study is of a preliminary nature. The Study, however, has identified such aspects of the environment that should be more closely looked into in the future and some of the Project works that need to be more carefully planned and implemented. On the basis of such findings, follow-up activities are recommended in this section.

6.1 Countermeasures

6.1.1 Decision-making process

These many arise augments among personnel of interest about land expropriation, arrangement of structures, transportation and other environmental issues.

A sustainable development is the principle applicable to the environmental program in any country, but the environmental quality involves such a lot of aspects that it cannot be simplified into a single parameter like monetary value in economic analysis and, further more, the environmental issues in a country or region are usually argued in close relation with the social, economic and cultural conditions particular to the country or the region. The decision-making process should involve sufficient exchange of views to build up consensus among the people of interest.

6.1.2 Resettlement program

The land expropriation for the Project is expected to be successfully completed by means of reasonable amount of

compensation to the affected people, but some land tenure problem may emerge. In this connection, a resettlement program should be worked out with a principle that the previous quality of life amenity can be maintained.

6.1.3 Environmental consideration in design of project facilities

The Project as planned has been judged technically feasible on the basis of geological, hydrological, topographic and other investigations at a F/S level. As such, no serious problem on natural/physical aspects of the environment is foreseen. However, some of the Project works would need more careful treatment during construction and thus counter-measures should be incorporated in the detailed planning.

During the preparatory works of the Project, some minor effects on the vegetation are foreseen by construction of access roads, clearing of trees for transmission line routes, and frequent transport of construction equipment and materials. These effects can be minimized by proper road and transmission line alignment and other standard precautionary measures such as road subgrade stabilization and grading of road sides and steep slopes combined with tree planting, if appropriate.

Main construction works may cause some water quality problem by allowing soil and other dust and wastes to escape into streams. This problem can be easily controlled by careful construction activities and provision of sediment ponds and other simple facilities, if found necessary.

In order to minimize the disturbance of terrestrial fauna and flora as well as topography, adoption of a tunnel type headrace and an underground power house is recommended as presently planned. Thus the plan for these works should

be further elaborated on in the next stage. This would also contribute to the protection of the tourism potentials foreseen in the Project area.

Possible effects of water impoundment in the reservoir and the headrace tunnel on the groundwater regime may be more clarified by further geological investigations. Some undesirable consequences are inevitable such as groundwater gushing and water leakage from the reservoir. They do not seem to pose any serious problem at this stage, and counter-measures can be formulated as minor problems occur.

Although it is not a case of the environment to be affected by the Project but rather the other way round, the landslide problem along the middle reach of the Erik stream would call for continuing attention. The site for the intake weir to divert the stream water to the headrace has already been shifted upstream to avoid the landslide prone area according to the present plan.

6.1.4 Legal and institutional measures

The creation of still water body involves a thrust to water pollution and further problems of entrophication. These problems will be caused due to nitrogen, phosphorus and heavy metals resulting from increased human activities upstream.

There is no crucial measures to cope with these problems, if these problem occur. It is only the countermeasure to possible future problem that the disposal of unfavorable material is not permitted. Such countermeasure should include a legal restriction of disposal with heavy penalty and regional plans to maintain human activities within a limit.

6.2 Further Studies

The Study carried out at this time is not only the first one of this kind related to the Project but in fact one of the first environmental impact studies carried out for major infrastructure projects in Turkey. Although no serious environmental problem is foreseen on the basis of limited studies of available materials and field investigation, efforts initiated by the Study should not be wasted and should be properly followed up. For this purpose, a complete environmental impact assessment (EIA) should be carried out in the next stage, probably at the time of detailed design. This would serve as a model for such a study for any large-scale project where serious environmental problems may be involved.

It is recommended that a biological inventory study be carried out for the entire Göksu river system. This would cover also the Silifke delta, which provides important habitats for many bird species. Especially in the catchment area of the Ermenek river, unique topographic and geological features and almost intact aquatic environment would justify such a study.

Of the possible positive impact of the Project, potentials for fishery and tourism development would deserve more attention. There exist unexploited tourism resources in and around the Ermenek city as well as the unique topographic and geological features, and also a variety of fish species. These resources may be enhanced by the planned reservoir. A fishery and tourism potentials study would identify all the potential resources, assess each of them, and draw up the best strategy for stage-wise development of these resources together with planning for necessary infrastructure facilities.

A team of a small number of experts, including an archaeologist and a biologist, can carry out this potential study. A more pragmatic approach may be to carry out both the biological inventory study and the fishery and tourism potential study as part of the complete EIA study.

The Project will trigger socio-economic development in the Project area and bring about ecological changes, as described in the previous section. These changes will be slow to take place. Monitoring would be essential to guide such changes into a most desirable direction without causing adverse effects to the fauna and flora as well as inhabitants in the Project area. By monitoring the progress of socio-economic and ecological changes, remedial measures can be formulated and taken at an early time, if and when any adverse effect is observed. A proper monitoring system for the Project area may be designed at the time of the EIA study.

CHAPTER 7. CONCLUSION

The level of the Study conducted at this time corresponds to what is generally called a "preliminary environmental impact analysis (PEIA)." The Study has been carried out based on readily available data, study reports and limited field observations as well as hearing from other experts, given the short time allowed for the Study.

Existing environmental conditions have been clarified in the aspects of socio-economy, natural/physical conditions, and fauna and flora. Fairly reasonable and specific data are available for population and agricultural production in the Project area, but data on other economic activities such as manufacturing industries and detailed data on employment and social infrastructure are not readily available. Natural and physical conditions have been investigated at this time for a feasibility study. Reasonable water quality data are also available at a few points in the Göksu river basin including upper catchment of the Ermenek river. General data and information on terrestrial and aquatic fauna and flora are available for a broader area, usually defined as the Mediterranean region, of which the Project area is a part. Detailed data specific to the Project area and the Ermenek river basin are not available.

Based on these data and information, a tentative conclusion may be drawn that the planned Project works do not seem to cause any serious environmental problem. However, since the materials and time used for the Study were limited, some aspects of the environment could not be much investigated and possible impact on them undetermined. Therefore, follow-up works would be indispensable. They would consist of further studies for the Project works incorporating counter-measures.

The further studies to be carried out include:

- (1) Complete environment impact analysis (EIA),
- (2) Biological inventory study, and
- (3) Fishery and tourism potentials study.

The latter two studies may be undertaken as part of the complete EIA study. Also a proper system may be designed to monitor the socio-economic and ecological changes which will take place slowly after the Project is implemented. Such a monitoring system will allow to formulate and implement remedial measures at an early time, if and when any adverse effect is observed.

Since the Study is one of the first environmental impact studies related to major infrastructure projects in Turkey, it should be properly followed up. The Project with this and the follow-up studies should become a model case of major infrastructure projects in Turkey for which different aspects of the environment and possible impact on them are studied in a serious and comprehensive manner.

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Legal Provisions.

TABLES

**Table F1 POPULATION, DENSITY AND GROWTH RATES
OF THE PROJECT PROVINCES**

	Konya	Içel	Antalya	Turkey
Population in 1985	1,769,050	1,034,085	891,149	50,664,458
Population density (/km ²)				
1985	36	64	43	63
Growth rates (% p.a.)				
1980-85	2.5	4.1	3.5	2.5
1975-85	2.2	3.8	2.9	2.3
1970-85	2.2	3.2	3.2	2.4

Source : SIS, Statistical Yearbook of Turkey, 1987

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (1/6)**

(A) Göksu river basin

District/City/Village Population		District/City/Village Population	
Ermenek district			
Ermenek city (B)	14,113	Kazançi subdistrict	
Ermenek subdistrict		Kazançi (B.M.) (B)	2,789
Agaccati	174	Ardickaya	1,446
Asagicaglar	1,019	Catalbadem	1,048
Bagbelen	378	Gokcekent	1,559
Camlica	656	Ikizcinar	728
Cavusköyü	200	Ozluce	712
Eskice	208	Yaylapazari	317
Evsin	388	Yesilkoy	360
Gökceseki	552		
Guneyyurt (B)	5,139		
Kayaonu	475		
Olukpınar	442		
Pamuklu	539		
Pınaronu	292		
Ucboluk	1,053		
Yalındal	598		
Yukarıcaglar	1,053		
Göktepe subdistrict		Tepebasi subdistrict	
Göktepe (B.M.) (B)	3,539	Tepebasi (B.M.)	1,078
Adiller	1,398	Basyayla (B)	3,005
Civandere	511	Boyalik	472
Civler	1,508	Bozyaka	299
Cukurbag	1,033	Buyukkarapinar	862
Daran	398	Elmayurdu	835
Dumlugoze	1,584	Katranli	1,171
Esentepe	630	Kislakoy	764
Gunder	225	Uzumlu	1,012
Isikli	127	Yerbagi	533
Kocasli	394		
Ortakoy	400	TOTAL	62,375
Sariveliler (B)	3,884		=====
Ugurlu	475		

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (2/6)**

(A) Göksu river basin (continued)

District/City/Village Population District/City/Village Population

Hadim district			
Hadim city (B)	11,574		
Hadim subdistrict		Taşkent subdistrict	
Asagikizilkaya	204	Taşkent (B.M.) (B)	10,531
Bagbasi (B)	3,189	Afsar (B)	4,462
Beyreli	337	Balcilar (B)	5,501
Dedemli (B)	6,226	Bolay	1,030
Dolhanlar	681	Buyukkilicapinar	369
Fakilar	166	Cetmi (B)	2,422
Igdeoren	121	Ilicapinar	413
Kalinagil	530	Kecimen	185
Kaplanli	309	Kongul	207
Korualan (B)	4,873	Sazak	169
Oduncu	1,290		
Polat	276	TOTAL	66,292
Sarnic	349		=====
Yalincevre	852		
Yukarikizilkaya	597		
Aladag subdistrict			
Aladag (B.M.)	1,835		
Agacci	122		
Asagiesenler	1,042		
Asagikizilca	218		
Ciftepinar	154		
Dulgerler	365		
Gaziler	508		
Goynukkisla	1,097		
Kuzoren	380		
Kupluce	249		
Sarihaci	585		
Selahattin	308		
Umurlar	209		
Yagci	429		
Yelmez	355		
Yenikonak	368		
Yukariesenler	522		
Yukarikizilca	683		

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (3/6)**

(A) Göksu river basin (continued)

District/City/Village Population		District/City/Village Population	
Mut district			
Mut city	15,145	Kirkkavak	545
Mut subdistrict		Kizilalan	277
Alacam	775	Koprubasi	613
Asagikoselerli	978	Koselerli	587
Aydinoglu	368	Kumacukuru	102
Bagcagiz	230	Kurtulus	244
Balli	627	Malhoca	536
Barabanli	784	Mirahor	432
Bayirkoy	649	Mucuk	170
Bozdogan	306	Ortakoy	287
Burunkoy	411	Ozkoy	190
Caltili	148	Ozlu	336
Camlica	694	Palantepe	686
Camphinar	405	Sakiz	902
Catalharman	475	Sariveliler	403
Civi	528	Selamli	418
Comelek	797	Sucalti	632
Cukurbag	379	Tekeli	264
Dagpazari	598	Topkaya	219
Demirkapi	157	Topluca	473
Derincay	372	Yalnizcabag	760
Distas	851	Yapinti	1,025
Elbeyli	401	Yesilkoy	445
Elmapinar	294	Yildizkoy	155
Esen	476	Yukarikoselerli	677
Esencay	179		
Evren	945	Sarikavak subdistrict	
Fakirca	405	Kurkcü (B.M.)	696
Gecimli	843	Caglayangedik	155
Gencali	385	Cakalli	183
Gokcetas	620	Cortak	333
Gume	491	Derekoy	485
Haciahmetli	1,046	Gocekler	167
Haciilyasli	365	Haydarkoy	301
Hacinuhlu	455	Hisarkoy	219
Hacasait	133	Hocali	255
Hamamkoy	916	Karacaoglan	519
Ilica	621	Kayabasi	109
Ibrahimli	158	Kislakoy	365
Kadikoy	339	Narli	245
Karadiken	137	Pamukli	147
Kavakli	265	Tugrul	518
Kavakozu	405		
Kelcekoy	634		
Kemenli	430		
Kiravga	4,058	TOTAL	53,745
			=====

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (4/6)**

(A) Göksu river basin (continued)

District/City/Village Population		District/City/Village Population	
Bozkir district		Kizilyaka subdistrict	
Bozkir subdistrict		Kizilyaka (B.M.)	
Hisarlik	1,936	Agacoba	627
Tepearasi	291	Alanozu	887
Beloren subdistrict		Baskisla	893
Armutlu	887	Bozkondak	932
Hamzalar	2,155	Gocer	683
Karaguney	501	Murat dede	444
Karaagzi	518		517
Kizilcakir	420	TOTAL	9,420
Kiziloz	850		=====
Ucpinar subdistrict		Alanya district	
Ucpinar (B)	2,375	Demirtas subdistrict	
Sogucak	807	Seyhler	530
TOTAL	10,740		
	=====		
Karaman district		Gülnar district	
Karaman subdistrict		Gülnar subdistrict	
Avlagi	451	Cukurko	245
Bucakkisla subdistrict		Dayicik	913
Bucakkisla (B.M.)	437	Demiroz	437
Bayirkoy	1,029	Gezende	1,005
Catak	309	Ilisu	243
Ckurkoy	228	Kayrak	816
Ihsaniye	829	Kurbaga	246
Kurucabel	56	Kuskan	2462
Ozdemir	665	TOTAL	6,897
Yukariakin	265		=====

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (5/6)**

(A) Göksu river basin (continued)

District/City/Village Population

Silifke district	
silifke city	28,111
silifke subdistrict	
Bayindir	204
Bukdegirmeni	412
Caltibozkir	1,451
Cilbayir	238
Evkafciiftligi	354
Gokbelen	243
Gunduzler	369
Kurtulus	1,139
Nurikoy	927
Pelitpinari	374
Sabak	492
Yenibahce	390
Yenisu	211
TOTAL	35,333
	=====
Göksu river basin total	245,332

**Table F2 SETTLEMENTS AND POPULATION
IN ERMENEK DISTRICT (6/6)**

(B) Ermenek river basin

District	Village	Population
Ermenek		62,375
Hadim	Beyreli	337
Mut	Camlica	694
	Valnizcabag	760
	Alacam	775
Alanya	Seyhler	530
Gulnar	Gezende	1,005
	Ilisu	243

Ermenek river basin total 66,719

Note : A few villages may be left out.

Source : SIS, Census of Population 20.10.1985

Province : 07 - Antalya

33 - Icel

42 - Konya

**Table F3 GROSS REGIONAL/DOMESTIC PRODUCT
OF THE PROJECT PROVINCES AND TURKEY, 1986**

(Unit : Million TL in 1986 price)

	Konya	Içel	Antalya	Turkey
1. Agriculture	322,188	188,041	208,678	6,732,944
Farming & Animal Husbandry	319,688	179,811	192,297	6,355,309
Forestry	2,306	7,200	15,530	235,300
Fishery	194	1,031	851	142,335
2. Industry	186,044	474,322	103,386	12,288,969
Mining & Quarrying	17,992	1,664	2,258	792,260
Manufacturing	136,951	496,402	57,319	10,235,527
Electricity, Gas & Water	31,101	16,256	43,809	1,761,182
3. Construction	33,354	23,400	21,984	1,572,555
4. Trade	195,829	97,915	107,974	6,716,000
5. Transportation	99,463	68,182	67,112	3,827,038
6. Financial Institution	30,021	30,917	18,652	1,181,163
7. Housing	41,775	25,924	18,824	1,651,194
8. Professional Services	29,508	48,016	44,529	2,175,629
9. Imputed Service Expenditure	(14,974)	(15,421)	(9,303)	(589,135)
10. Subtotal (1-9)	923,208	941,295	581,836	36,056,357
11. Public Services	60,748	27,782	25,916	2,073,309
12. Subtotal (10+11)	983,956	969,077	607,752	38,129,666
13. Import Duties	16,276	51,154	7,025	1,158,177
14. GRP (12+13) (Purchaser's price)	1,000,232	1,020,232	614,777	39,287,843

Source : Istanbul Sanayi Odasi Arastirma Dairesi, Yay No : 1988/8,
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**Table F4 AREA HARVESTED WITH DIFFERENT CROPS
IN THE PROJECT PROVINCES, 1987**

	(Unit : 10 ³ ha)		
	Konya	Içel	Antalya
Field crops	1,878.9	262.1	287.2
Wheat	935.8	147.8	141.0
Barley	607.5	26.5	49.5
Other cereals	60.4	4.1	10.8
Subtotal	1,603.7	178.4	201.3
Chick pea	68.9	31.7	20.4
Lentil	47.0	0.3	-
Other pulses	23.1	0.7	2.1
Subtotal	139.0	32.7	22.5
Sugarbeet	61.1	-	3.0
Cotton	-	30.5	38.5
Other industrial crops	40.8	-	6.9
Subtotal	101.9	30.5	45.4
Sunflower	21.9	3.0	1.7
Soybean	-	10.3	3.1
Other oil crops	0.7	6.1	10.2
Subtotal	22.6	19.4	15.0
Tuber crops	11.6	1.1	2.9
Fodder crops	7.6	0.1	1.1
Vegetables	14.2	28.2	23.2
Total harvested area	1,900.7	290.4	311.5
(% of total provincial area)	(37.7 %)	(17.9 %)	(14.0 %)
Total provincial area	5,085.7	1,618.7	2,226.0

Source : SIS, Agricultural Structure and Production 1987.

**Table F5 FRUITS PRODUCTION
IN THE PROJECT PROVINCES, 1987**

(Unit : TONS)

Fruits	Konya	Içel	Antalya
Pear	28.4	2.1	25.8
Apple	150.0	46.4	188.1
Apricot	1.3	19.4	1.9
Cherry	10.0	1.3	2.2
Peach	2.5	46.2	6.7
Olive	2.2	52.8	14.7
Grapefruit	-	14.6	1.2
Lemon	-	288.8	21.4
Mandarin	-	47.4	15.9
Orange	-	161.6	223.0
Strawberry	0.5	15.3	0.1
Banana	-	8.4	26.6
Grape	299.6	130.0	15.2
Others	24.2	35.7	24.8
Total	518.7	870.0	567.6

Source : Same as Table F4.

**Table F6 CULTIVATED AREA AND PRODUCTION BY CROP
IN ERMENEK DISTRICT, 1988**

Crop	Area (ha)	Production (tons)	Crop	Area (ha)	Production (tons)
Cereals			Vegetables		
Wheat	6,500	11,500	Squash	10	100
Barley	2,700	5,000	Okra	10	10
Rye	1,600	2,500	Green pepper	50	95
Maize	60	350	Tomato	200	3,500
Mixed grains	1,500	2,300	String bean	250	450
Pulses			Carrot	30	300
Chick pea	800	1,100	Cucumber	50	450
Dry bean	350	380	Spinach	5	10
			Black cabbage	45	500
Vineyards	4,925	24,625	Lettuce	4	50
			Eggplant	15	200
Fruits			Green garlic	2	10
Apple	510	9,030	Green onion	3	50
Pear	262	2,025	Parsley	1	1
Quince	112	250	Radish	2	20
Plum	135	1,025	Industrial crops		
Cherry	75	1,103	Dry onion	300	5,600
Peach	155	920	Dry garlic	4	20
Sourcherry	2	6	Potatoes	350	4,700
Olive	32	150			
Mulberry	3	50	Fodder crops		
Fig	25	310	Alfalfa	70	1,600
Pomegranate	20	620	Sainfoin	3	60
Almond	85	630	Fallow	10,556	
Walnut	264	1,980			
TOTAL			32,075		

Source : Ermenek District Agricultural Office

**Table F7 ANIMAL POPULATION
IN ERMENEK DISTRICT, 1983-88**

Year	Sheep				Goat		
	0-1 year old lamb	Grownup sheep	Ram and castrated	TOTAL	0-1 year old	Grownup	He-goat and astrated
1983	9,580	13,330	1,270	24,180	42,750	53,590	2,110
1984	6,529	9,210	580	16,319	25,950	40,592	1,366
1985	5,240	13,090	1,280	22,860	48,500	60,345	2,500
1986	8,380	13,090	1,280	23,000	48,500	59,000	2,500
1987	5,000	10,700	1,000	16,700	24,000	40,000	1,415
1988				13,654			

Year	Horse	Mule	Donkey
1983	855	2,950	4,800
1984	823	2,754	4,713
1985	829	1,921	4,715
1986	842	2,745	4,771
1987	842	2,790	4,751
1988	727	3,158	4,580

Source : Ermenek District Agricultural Office

**Table F8 PRODUCTION OF ANIMAL PRODUCTS
IN ERMENEK DISTRICT, 1988**

Product	Production (ton)	Price (TL/kg)
Milk	1,850	300
Meat	300	3,000
Fresh butter	55	7,500
Cheese	100	4,000
Sheep cheese	68	4,500
Wool	14	5,000
Goat bristle	16	3,000
Hides	14,700 pieces	2,000 TL/piece
Eggs	1,700,000 eggs	1,000 TL/egg
Honey	80	7,500
Wax	3	5,000

Source : Ermenek District Agricultural Office

Table F9 GROSS AGRICULTURAL INCOME BY ACTIVITY, 1987-88

(Unit: 10⁶ TL)

Year	Forestry	Cereals and other crops	Fruits	Vegetables	Animal products	TOTAL
1987	1,233	2,960	8,947	1,038	1,616	15,794
1988	3,096	3,192	12,379	1,149	1,861	21,677

Source : Ermenek District Agricultural Office

Table F10 LAND USE IN ERMENEK DISTRICT, 1988

Land use	Area (ha)	Share (%)
Cultivated land	32,075	13.8
Cereals	12,360	5.4
Fallow	10,556	4.5
Pulses	1,150	0.5
Industrial crops	654	0.3
Fodder crops	73	0.0
Vegetables	677	0.3
Vineyards	4,925	2.1
Fruits	1,680	0.7
Pasture / meadow	31,300	13.5
Forests	161,000	69.4
Settlements	700	0.3
Ponds and marshland	500	0.2
Land unsuited to production activities	6,350	2.8
TOTAL	231,925	100.0

Source : Ermenek District Agricultural Office

**Table F11 MEAN MONTHLY PRECIPITATION AT SELECTED STATIONS
... IN AND AROUND THE PROJECT AREA**

Elevation		Month									
Station	(m)	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
Aydincik (Gilindire)	10	181.9	110.1	71.3	34.0	12.3	1.4	0.3	0.1	5.4	58.3
Anamur	5	227.0	163.7	106.2	41.4	22.7	5.1	0.4	0.7	7.5	79.5
Gazipasa	20	172.7	131.5	86.9	46.6	28.8	3.9	1.3	0.8	12.8	63.5
Demirtas	50	210.1	137.1	97.4	67.1	24.8	5.7	1.7	1.8	14.2	69.4
Alanya	7	249.9	165.5	93.6	51.8	32.4	5.8	3.4	0.9	18.6	78.4
Koprulu	800	400.9	220.2	170.3	97.4	41.8	18.6	3.5	8.9	16.0	109.4
Gundogmus	930	306.7	193.2	149.8	87.6	59.1	34.8	7.7	7.2	24.5	84.9
Mut	275	84.7	56.1	40.4	23.8	21.5	13.0	4.7	1.8	4.6	30.0

Source : DMI

**Table F12 METEOROLOGICAL DATA FOR THE ERMENEK STATION,
1983-88**

Index	Unit	Year				
		1983	1984	1985	1986	1987
No. of frost days	days	10.0	8.0	7.0	10.0	11.0
No. of sub-zero days	days	30.0	28.0	25.0	23.0	42.0
High temperature	°C	36.2	37.2	35.8	35.9	35.8
Low temperature	°C	-7.2	-5.3	-13.0	-6.3	-9.4
High relative humidity	%	30.1	37.5	61.3	60.6	87.0
Low relative humidity	%	25.2	26.0	32.7	30.1	10.0
No. of rainy days	days	30.0	32.0	43.0	45.0	55.0
Annual precipitation	mm	447.0	487.0	554.0	434.0	371.0

Source : Ermenek District Agricultural Office

Table F13 SEDIMENT TRANSPORT BY THE ERMENEK RIVER

Sampling station (code) and date	Discharge (m ³ /sec)	Suspended Sediment Concentration (PPM)	Total Sediment Transported (ton/day)	Sand Content (%)	Water Tempe- rature °C
Bucakkisla (1712)					
21.8.1987	8.3	29	20.8	0	12
14.2.1984	51.9	161	722.0	0	11
18.8.1983	9.0	86	66.9	0	21
16.2.1983	24.9	138	296.9	60	11
Cavuskoy (1723)					
7.2.1989	25.9	120	269.0	0	8
10.8.1988	10.3	164	146.0	55	18
26.2.1988	29.2	36	91.0	0	8
25.8.1987	8.5	8	6.0	0	16
Kirkkayak (1719)					
22.8.1984	11.1	50	48.0	0	21
15.2.1984	68.2	84	495.0	0	10
19.8.1983	15.3	20	26.5	0	20
17.2.1983	44.1	73	248.2	0	9
Karahacili (1714)					
20.8.1984	41.9	22	79.7	0	19
13.2.1984	271.4	314	7,363.0	64	10
17.8.1983	46.1	60	239.0	0	19
17.2.1983	103.8	129	1,157.0	28	12

Source : EİE, Sediment Data and Sediment Transport Amount for
Surface Waters in Turkey, 1987 (for 1712, 1723, 1714) EİE,
Raw data compiled by EİE staff (for 1723)

Table F14 WATER QUALITY DATA OF THE ERMENEK RIVER

Sampling point and date	Water Tempe- rature °C	pH	Na	K	Ca/Mg	CO ₃	HCO ₃	Cl	SO ₄	Total	BOD
Görmel											
18.2.1987	10	8.0	0.11	0.03	3.20	0.10	2.90	0.18	0.16	195	1.60
25.8.1987	16	8.2	0.10	0.03	3.30	0.40	2.20	0.20	0.63	187	0.00
Cavus											
10.8.1988	18	8.2	0.08	0.00	3.10	0.40	1.90	0.22	0.68	183	0.70
7.2.1989	8	8.1	0.15	0.00	3.70	0.30	2.90	0.20	0.48	227	0.90

Note : No or trace ammonia/nitrate/nitrite has been detected.

Source : DSI

Table F15 MAMMALS IN TURKEY AND IN THE PROJECT AREA (1/2)

Scientific name	Common name	Existence in the Project Area
Insectivora	Order of insectivores	
Erienceidae	Porcupines	o (E. europaeus)
Talpidae	Moles	o (Talpa caeca)
Soricidae	Shrews	
Chiroptera	Order of bats	
Carnivara	Order of carnivores	
Ursidae	Bears	x
Canidae	Dogs	
Canis lupus	Wolf	o
Canis aureus	Jackal	
Vulpes vulpes	Fox	
Mustelidae	Martens	o (Meles meles, Lutra lutro)
Herpestidae	Mongoose	
Hyaenidae	Hyenes	
Felidae	Cat	x
	(Wild cat, steppe cat, felis chaus, lynx, leopard, tiger)	
Artiodactyla	Order of even-toed mammals	
Suicae	Wild boars	o
Cervidae	Deer	
Cervus elaphus maral	Red deer	x
Capreolus capreolus	Roe deer	x
Dama dama	Fallow deer	o
Bovidae	Bovine	
Copra aegagrus aegagrus	Wild goat	o
Rupicapra rupicapra	Chamois	x
Ovis amon anatolica/gmelinii	Wild sheep	x
Gazella subgutturosa	Antelope	x
Lagomorpha	Hares	
Leporidae	Rabbits	o (Lepus europeus)

Table F15 MAMMALS IN TURKEY AND IN THE PROJECT AREA (2/2)

Scientific name	Common name	Existence in the Project Area
Rodentia	Rodants	
Sciuridae	Squirrels	o (S.anomalous syriacus)
Citellus citellus	Ground squirrels	
Castoridae	Beavers	
Capdomyidae	Water rats	
Hystricidae	Quilled porcupines	o (Hystrix indiacus)
Dipodidae	Jarboas	o (Allactage euphratica)
Gliridae	Dormice	o (Dryomys laniger)
Spalacidae	Mole rats	o (Spalax leucodon)
Muridae	Rats	o (Mus mucus etc.)
Cricetidae	Hamsters	o (Cricetulus miprotoriu Arvicola terrestris)
Gerbillidae	Gerbils	x
Microtidae (Arvicolidae)	Voles	o (Microtus socialis)

Note : o Existence confirmed (Name of species existing
in the Project area)

o Existence in small number reported

x Non-existent

Source: Compilation by the JICA Study Team in consultation with
scholars.

**Table F16 TREE SPECIES IN THE MEDITERRANEAN REGION
AND THE PROJECT AREA (1/2)**

Botanical name	Common name	Existence in the Project Area
<u>Shrubs</u>		
Quercus coccifera/illex	Holly oak	+
Arbutus andrachne	Strawberry tree	+
Myrtus communis	Myrtle	
Laurus nobilis	Laurel	-
Olea europea var.	Wild olive	+
Sylvestris		
Phillyrea latifolia	Broadleaf filaria	
Pistacea terebinthus/ lentiscus	Terebinth	+
Pistacea lantiscus	Mastic tree	
Erica verticillata	Heath	
Ceratonia silique	Carob	
Cercis siliquastrum	Judas tree	
Cistus villosus/ salviifolius	Rockroses	-
Spartium junceum	Broom	
Paliurus spina-christi	Blackthorn	
Styrax officinalis	Bead tree	
Fontanesia phillyreoides	Hog wood	
Vitex agnus-castus	Chate bush	
Nerium oleander	Oleander	
<u>Forest trees</u>		
Acacia cyanophylla	Cypress acacia	-
Casuarian equisetifolia	Ironwood	
Eucalyptus spp.	Eucalyptus	
Pinus brutia	Turkish red pine	+
Cedrus libani	Cedar	+
Abies cilicica	Cilician fir	
Q. libani	Lebanese oak	
Juniperus feoditissima/ excelsa/axycedrus/ phoenicea	Junipers	+
Cupressus sempervirens	Cypress	
Fagus arientalis	Beech	x
Pinus nigra	Black pine	+

Notes :

- + Existence in the Project area confirmed by the Ermenek Regional Office, G.D. of Forestry
- Less dominant in the Project area
- x May not be found in the Project area

**Table F16 TREE SPECIES IN THE MEDITERRANEAN REGION
AND THE PROJECT AREA (2/2)**

Other plants whose existence has been confirmed by the Ermenek Regional Office, G.D. of Forestry are the following.

Botanical name	Common name
Staphyles pinnata	Bead tree
Crataegrus manegya	Fig
Euphorbia tinctoris	Euphorbia
Creminea	
Durphacca	Elecampane
Verbascum olympicum	
Mentha	Pepper
Astragalus	Gum-tragacanth
Thymus serpyllum	Thyme
Acer	
Platanus orientalis	Plane tree
Salix alba	Willow
Ostrya carpinifolia	
Corylus	Hazelnut
Polypodium yulgare	
Rosa canina	
Selvia	
Rubus ideus	Blackberry
Phas coriaia	Sumac

Source: Compilation by the JICA Study Team in consultation with scholars.

**Table F17 FISH SPECIES IN THE MEDITERRANEAN REGION
AND THE PROJECT AREA (1/2)**

Scientific name	English name	Turkish name
Superordo ELOPOMORPHA		
Ordo : Anguilliformes		
Familia : Anguillidae		
Anguilla anguilla*	Eel fish	Yılan balığı
Superordo PROTACANTHOPTERYGII		
Ordo : Salmoni formes		
Familia : Salmonidae		
Salmo trutta macrostigma*	Trout	Dere alas
Superordo OSTARIOPHYSI		
Ordo : Cyprinidae		
Familia : Cyprinidae		
Cyprinus carpio *	Carp	Sazan balığı
Vimba vimba tenella *		Tahta bal karagz
Cyprinion macrostomum		
Garra rufa obtusa		Vantuzlu balık
Acanthobrama marmid		Tahta balığı
Acanthorutilus anatolicus *		Yag balığı
Alburnus akili		Gekce balığı
Gobio gobio microlepidotus	Gudgeon	Derekayas balığı
Pararhodeus kervillei *		
Leucaspis irideus		
Chondrostoma nasus *		Karaburun
Ch. regium		Karaburun
Leuciscus cephalus *	Chub	Tatlısu kefalı
L. borysthenticus *		Tatlısu kefalı
L. lepidus *		
Barbus capito pectoralis *	Barbel fish	Biyikli balık
B.plebejus escherichi *	Barbel fish	Biyikli balık
Capoeta barroisi		In balığı (Karabalık)
C. pestai		Siraz balığı
C. capoeta bergamae		Karabalık
C. capoeta angorae		Karabalık

**Table F17 FISH SPECIES IN THE MEDITERRANEAN REGION
AND THE PROJECT AREA (2/2)**

Scientific name	English name	Turkish name
Familia : Cobitidae		
Cobitis taenia *	Spined loach	Tasyiyen baligi
C.elongata bilseli	Loach	Kocatasyiyen baligi
Nemacheilus angorae *	Ankara stone loach	Ankara tasyiyen baligi
N. lendli	Stone loach	Cepce baligi
N.tigris	Stone loach	Cepce baligi
Ordo : Siluriformes		
Familia : Siluridae		
Silurus glanis *	Wels	Yayin baligi
Familia : Bagridae		
Mystus halepensis *		
Familia : Clariidae		
Clarias lazera *		
Superordo : ACANTHOPTERYGII		
Ordo : Gasterostei formes		
Familia : Gasterosteidae		
Gasterosteus aculeatus	Stickleback	Dikence baligi
Ordo : Cyprinodonti formes		
Familia : Cyprinodontidae		
Anatolichthys burdurensis		
A.transgrediens		
Aphanius chantrei fontinalis *		
A. sophiae mentoides *		
A. burduricus		
Familia : Poeciliidae		
Gambusia affinis	Mosquito fish	Sivrisinel baligi
Ordo : Mugiliformes		
Familia : Mugilidae		
Mugil cephalus *	Mullet	Deniz kefali
M. ramada *	Mullet	Deniz kefali
Ordo : Perciformes		
Familia : Percidae		
Stizostedion lucioperca *	Pike perch	Aklevrek (Sudak)
Familia : Belontiidae		
Blennius fluviatilis *		Horoz bina baligi

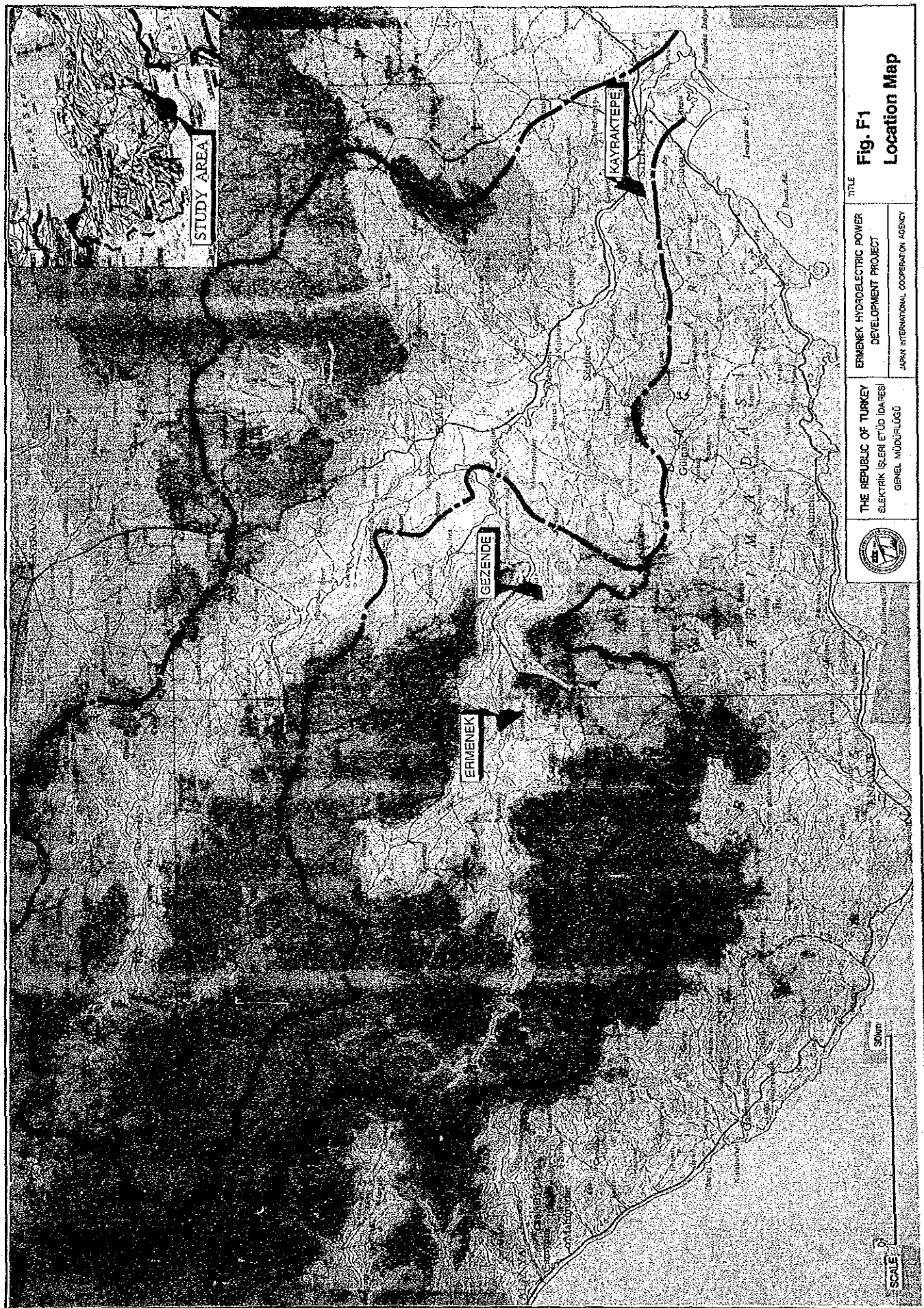
* : Fish species which may be found in the Project Area

Source: Compilation by the JICA Study Team in consultation with scholars.

**Table F18 RISK RESULTANT MATRIX FOR PEIA
OF THE PROJECT**

Aspect of Environment	Possible Impact			Note
	Precon- struc- tion	Con- struc- tion	Opera- tion	
1 Socio-economy				
(1) Demography	0	±	+	- Relocation of people + Employment opportunities
(2) Agriculture	0	0	-	- Inundation of agricultura land
(3) Fishery	0	0	+	+ Aquaculture in the long ru
(4) Industry	0	0	±	+ Promotion of agro-industri - Negative effect on coal mi
(5) Trade	0	0	+	+ Use of reservoir
(6) Tourism	0	0	+	+ Better access, increased opportunities
(7) Land tenure	-	0	0	- Problem associated with resettlement
(8) Health	0	0	x	
2 Natural/Physical Aspects				
(1) Topography	0	-	±	- Submersion of canyon, mino disruption + Better landscape by reserv
(2) Geology	0	0	x	
(3) Vegetation	-	-	0	- Tree cutting, Erosion
(4) Meteorology	0	0	x	
(5) Water quality	0	-	-	- Discharge of sediment, wastes etc.
3 Fauna and Flora				
(1) Terrestrial fauna	0	0	x	
(2) Terrestrial flora	0	0	x	
(3) Aquatic fauna	0	-	±	- Effect by lower water quality + Increased productivity
(4) Aquatic flora	0	-	±	- Effect by lower water quality + Diversification

FIGURES

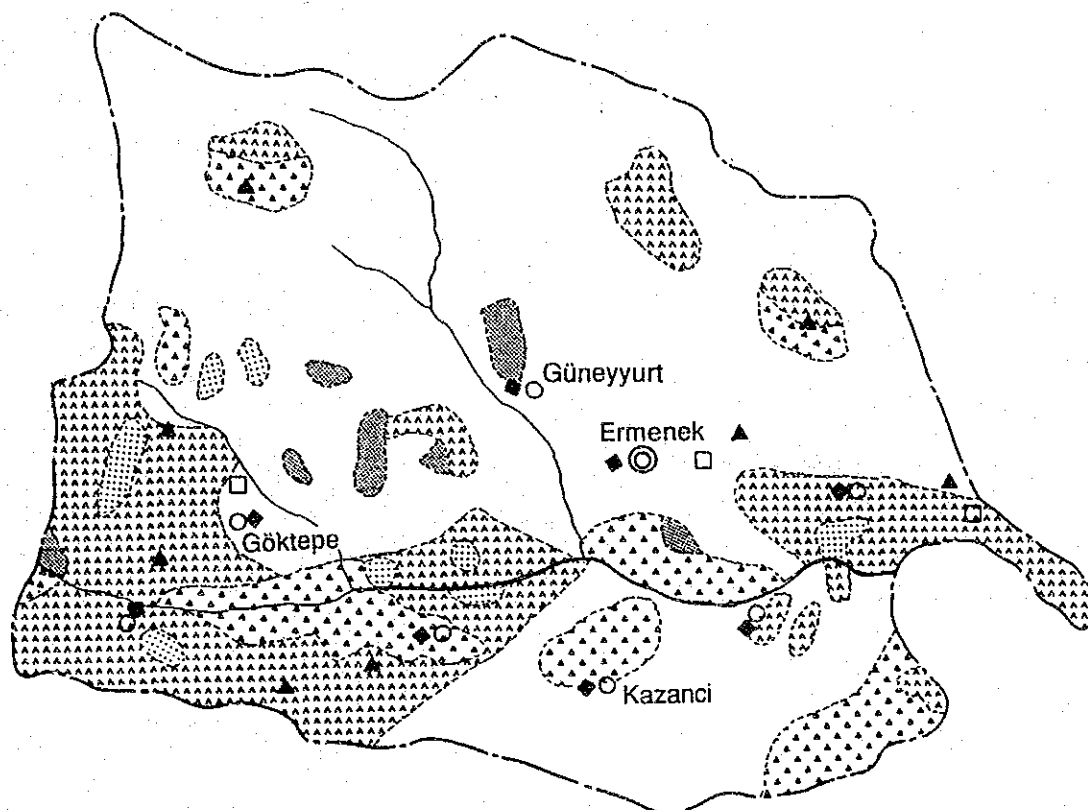











ERMENEK HYDROELECTRIC POWER
DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

F - 66



-  Grove forest
-  Degraded grove forest
-  Village where tree cutting is allowed
-  Village where tree cutting is not allowed
-  Off-forest depot
-  Fire tower
-  Protection center

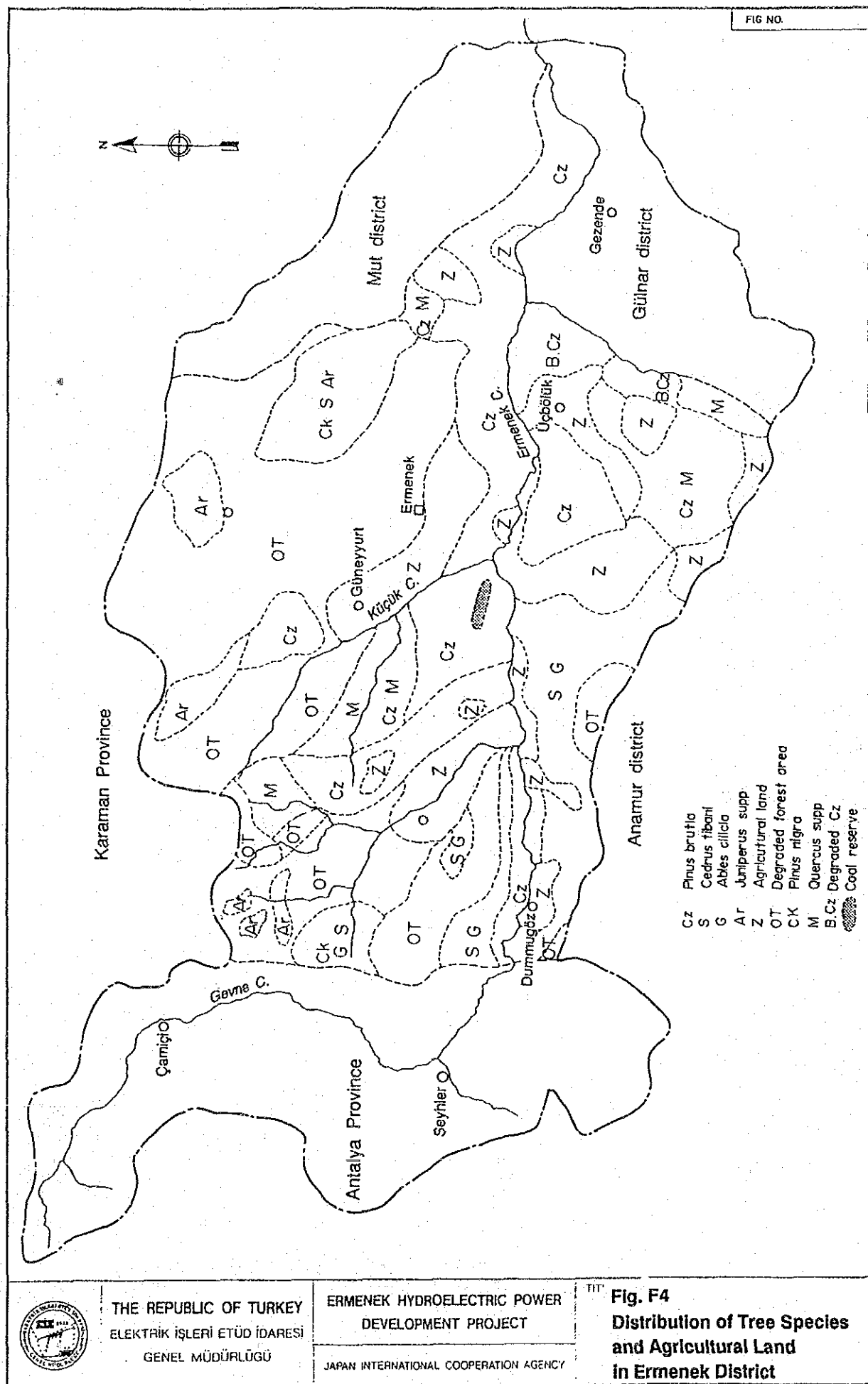


THE REPUBLIC OF TURKEY
ELEKTRİK İŞLERİ ETÜD İDARESİ
GENEL MÜDÜRLÜĞÜ

ERMENEK HYDROELECTRIC POWER
DEVELOPMENT PROJECT

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. F3
Forest Areas
and Related Facilities
in Ermenek District



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Fig. F4
Distribution of Tree Species
and Agricultural Land
in Ermenek District

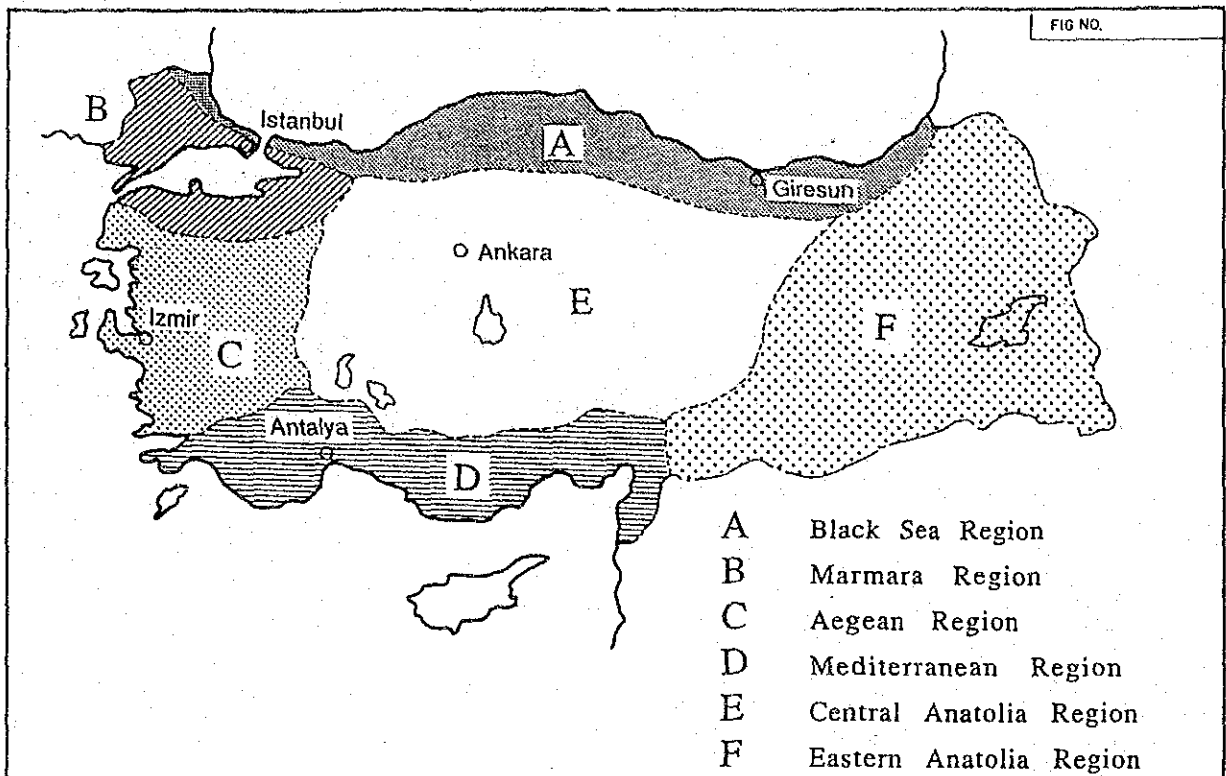


Fig. F5 Regional Division of Turkey by Vegetation

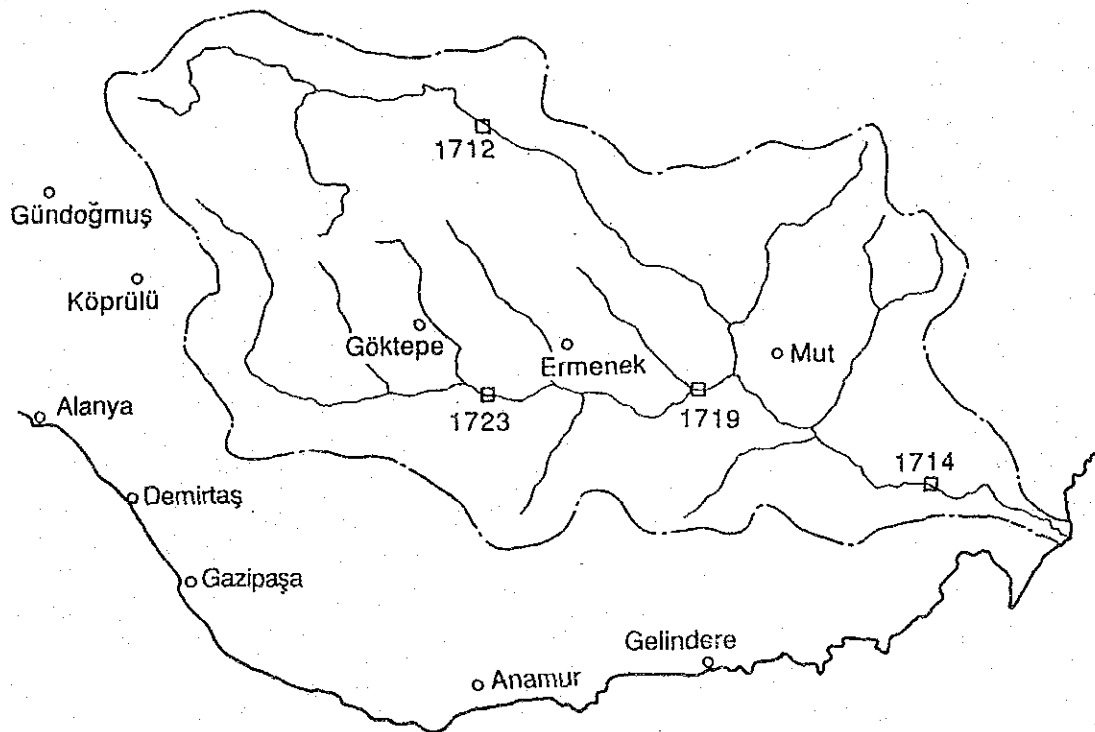


Fig. F6 Location of Meteorological Stations
and Water Quality Sampling Points



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TITLE

Figs. F5 & F6

