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CUMULATIVE IMPACT ASSESSMENT OF HYDROELECTRIC POWER PLANT PROJECTS IN SEYHAN RIVER BASIN



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FOREWORD

This report is an update of the Cumulative Impact Assessment (CIA) of Hydroelectric Power Plant (HEPP) Projects in Seyhan River Basin, carried out in September 2008. Since the last study, ENERJISA Energy Generation Inc. Co. (ENERJISA) have planned two new projects, namely Kusakli Weir and HEPP and Dogancay Weir and HEPP, in the basin. In addition to these, there are five new projects planned by other developers and currently in construction. Moreover, construction of some of the projects planned by ENERJISA and other investors has been started within this period. Therefore, information about these additional projects has been included in this report while current status of other projects was updated.

The identification and analysis of cumulative impacts associated with non-ENERJISA projects has been limited to information available in the public domain. ENERJISA has no control over the activities of other private sector and government hydropower developers active in the Seyhan River Basin, thus any recommendations made in this report has no regulatory standing. The CIA was commissioned at a stage when many of the projects under consideration were already constructed, under construction or licensed.

All the additional projects are run-of-river type HEPPs with small installed capacities. The new projects of ENERJISA are planned in Seyhan River and one of the main tributaries, namely Goksu River whereas projects of other investors are mostly planned in small tributaries of Goksu River. Since all these projects have small installed capacities and of run-of-river type, it is considered that they will not make a significant contribution to cumulative impacts caused by the previous set of projects assessed.

This report also includes information about ongoing monitoring studies including water quality and fish fauna monitoring, carried out for ENERJISA projects regarding their cumulative impacts in the basin.

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ABBREVIATIONS

AZE	Alliance for Zero Extinction
BOD	Biochemical Oxygen Demand
BOT	Built-Operate-Transfer
BTC	Baku-Tbilisi-Ceyhan
CIA	Cumulative Impact Assessment
COD	Chemical Oxygen Demand
dBA	A-Weighted deciBel
DOKAY	DOKAY Engineering and Consultancy Ltd. Co.
DOLSAR	DOLSAR Engineering Ltd. Co.
DSI	State Hydraulic Works
E	East
EBA	Endemic Bird Area
EC	European Commission
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIEI	Electrical Power Resources Survey and Development Administration
EMMP	Environmental Management and Monitoring Plan
EMRA	Energy Market Regulatory Authority
ENERJISA	ENERJISA Energy Generation Inc. Co.
EPFI	Equator Principles Financial Institution
EU	European Union
EUAS	Turkish Electricity Generation Corporation
FEOW	Freshwater Ecoregions of the World
GSI	Gonadosomatic Index
GWh	Giga Watt Hour
h	Hour
ha	Hectare
HEPP	Hydroelectric Power Plant
HSE	Health Safety and Environment
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
km	Kilometer
kV	Kilo volt
L	Liter
m	Meter
MoEF	Ministry of Environment and Forestry
MW	Mega Watt
N	North
NPAA	National Programme for the Adoption of the Acquis

s	Second
S	South
SEA	Strategic Impact Assessment
SMS	State Meteorological Service
TEIAS	Turkish Electricity Transmission Corporation
TEMELSU	TEMELSU International Engineering Services Inc.
TKN	Total Kjeldahl Nitrogen
TUIK	Turkish Statistical Institution
VOC	Volatile Organic Carbon
W	West
WCD	World Commission on Dams
WFD	Water Framework Directive
WPCR	Water Pollution Control Regulation
WWF	World Wildlife Fund
%	Percent
°	Degree

1. BACKGROUND AND PURPOSE

ENERJISA is planning to construct and operate six HEPP Projects listed below;

- Yamanli II Hydroelectric Power Plant (HEPP) and Quarries Project
- Menge Dam, HEPP and Quarries Project
- Kusakli Weir and HEPP Project
- Kopru Dam, HEPP and Quarries Project
- Kavşakbendi Dam, HEPP and Quarries Project
- Dogancay Weir and HEPP Project

on Seyhan River Basin in East Mediterranean Region of Turkey. The location of Seyhan River Basin in Turkey is presented in Figure 1-1.

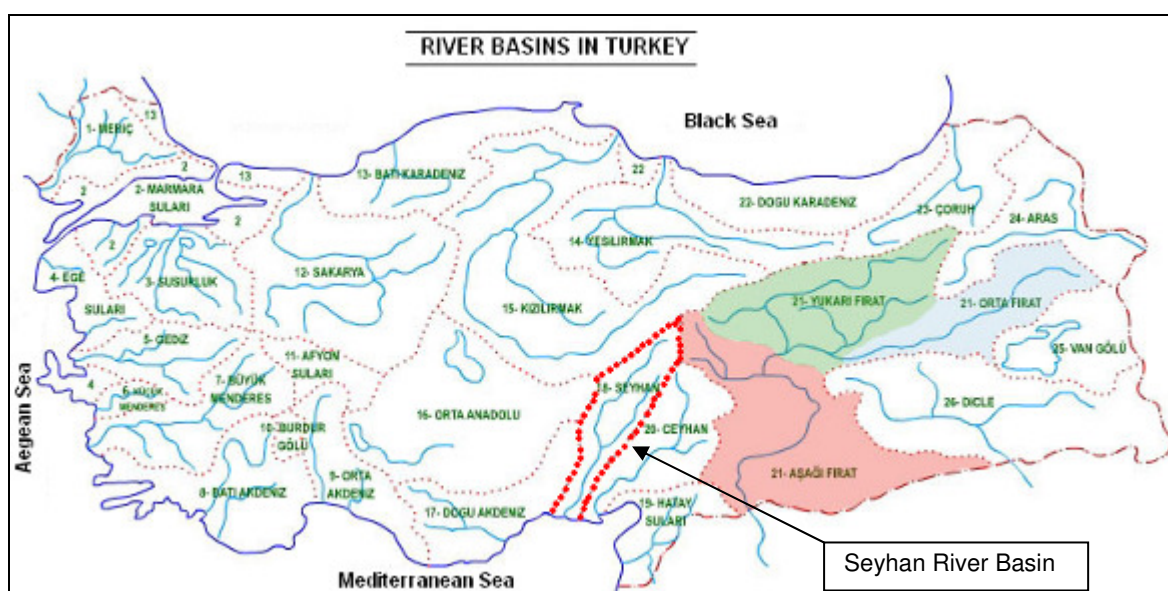


Figure 1-1. Location of Seyhan River Basin in Turkey

Source: URL 1, Official Website of EIEI, 2008

The HEPP projects of ENERJISA will be financed by a consortium of banks (the Lenders) including the International Finance Corporation (IFC), the private-sector unit of the World Bank Group; WestLB, a European commercial bank in Germany; Akbank a Turkish commercial bank; and European Investment Bank (EIB), the long-term lending bank of the European Union (EU).

As part of the due diligence process for these projects, the Lenders have some requirements in addition to the Turkish legislation related to the environmental and socio-economic issues of the construction and operation of the HEPPs. Several studies have been carried out for compliance with environmental and social requirements of the Lenders. For this purpose, Environmental Management and Monitoring Plans (EMMP) for HEPPs under construction (i.e. Menge, Kopru and Kavsak Bendi HEPPs) have been

prepared according to the IFC Performance Standards. EMMPs for Kusakli and Dogancay HEPPs are being prepared. Besides, a “Need Assessment for Cumulative Impact Assessment (CIA) (Project Evaluation)” study was conducted for the EIB in accordance with the EU Directives on Strategic Environmental Assessment (SEA) and Water Framework Directives (WFD). As an outcome of these studies the Lenders have requested a “CIA Study”.

CIA is defined in the “*Final Report on the Study on the Assessment of Indirect and Cumulative Impacts, as well as Impact Interactions within the Environmental Impact Assessment (EIA) Process, Volume 2: Research Study and Findings*” that is published by the European Commission Directorate such that:

“The assessment of impacts on the environment that result from incremental changes to environmental parameters when added to changes brought about by other past, present or reasonably foreseeable actions. Cumulative impacts are additive in nature - the sum of all impacts aggregate together to affect a receptor in a holistic manner.”

The same report also refers to impacts that may interact to produce a cumulative effect. These synergistic or interactive impacts combine to produce a total impact which is greater than the sum of the individual impacts affecting a receptor.

1.1 Overview of the Projects

This report will mainly discuss the cumulative impacts of the HEPPs of ENERJISA listed above. Background information on these projects is given below and the locations of the HEPPs are presented in Figure 1-2:

- Yamanli II is a run-of-river type HEPP project on Goksu River, consisting of two weirs and two powerhouses. Total installed capacity and the annual energy generation of the project are 80 MW and 294 GWh, respectively. Detailed information on the project will be presented in Section 2.1.1.
- Menge Dam, HEPP and Quarries is a project at the downstream of Yamanli II HEPP on Goksu River, with a powerhouse at the toe of the dam. The installed capacity of the power plant is 85 MW and average annual energy generation is estimated to be 202.56 GWh. The surface area of the dam reservoir will be 2.67 km². Detailed information on the project will be presented in Section 2.1.2.
- Kusakli is a run-of-river type HEPP project at the downstream of Menge HEPP on Goksu River, consisting of a weir and a powerhouse. The installed capacity and the annual energy generation of the project are 20.3 MWm/19.5 MWe and 46.657

GWh, respectively. Detailed information on the project will be presented in Section 2.1.3.

- Kopru Dam, HEPP and Quarries is a project at the downstream of Menge HEPP on Goksu River, with a powerhouse at the toe of the dam. The installed capacity of the power plant is 145 MW and average annual energy generation is estimated to be 381.36 GWh. The surface area of the dam reservoir will be 2.93 km². Detailed information on the project will be presented in Section 2.1.4.
- Kavsak Bendi Dam, HEPP and Quarries is a project at the downstream of Kopru HEPP on Goksu River. The water to be stored in the reservoir of the dam will be transmitted to a powerhouse with a 1.950 m long transmission tunnel. The installed capacity of the power plant is 145.40 MW and average annual energy generation is estimated to be 650.78 GWh. The surface area of the dam reservoir will be 2.00 km². Detailed information on the project will be presented in Section 2.1.5.
- Dogancay is run-of-river type HEPP project at the downstream of Kavsak Bendi HEPP on Seyhan River, consisting of a weir and a powerhouse. The installed capacity and the annual energy generation of the project are 60.252 MW and 153.812 GWh, respectively. Detailed information on the project will be presented in Section 2.1.6.

1.2 Purpose and Requirements for Cumulative Impact Assessment

The purpose of this study is the assessment of the six HEPPs proposed by ENERJISA in the Seyhan Basin for potential cumulative impacts that are not addressed in the individual EIAs prepared for the projects.

The HEPP projects of ENERJISA will be funded by a consortium of banks whose requirements are stated below.

- IFC applies Performance Standards on environmental and socio-economic issues.
- WestLB is an Equator Principles Financial Institution (EPFI), and thus also follows IFC Performance Standards.
- Akbank follows Turkish legislation.
- EIB follows EU Directives on environmental and socio-economic issues, including the Directives on Strategic Environmental Assessments (SEA) and Water Framework Directives (WFD).

IFC applies eight Performance Standards to manage social and environmental impacts and to enhance development opportunities in private sector. These standards establish requirements to avoid, reduce, mitigate or compensate for impacts on people

and the environment. Among these standards, “Performance Standard 1 - Social and Environmental Assessment and Management System” establishes the importance of integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects. According to paragraph 5 of this Performance Standard, the client will follow the requirements stated below related to the cumulative impacts:

“Risks and impacts will be analyzed in the context of the project’s area of influence. This area of influence encompasses, as appropriate:

(i) the primary project site(s) and related facilities that the client (including its contractors) develops or controls, such as power transmission corridors, pipelines, canals, tunnels, relocation and access roads, borrow and disposal areas, construction camps;

(ii) associated facilities that are not funded as part of the project; and whose viability and existence depend exclusively on the project and whose goods or services are essential for the successful operation of the project;

(iii) areas potentially impacted by cumulative impacts from further planned development of the project, any existing project or condition, and other project-related developments that are realistically defined at the time the Social and Environmental Assessment is undertaken; and

(iv) areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The area of influence does not include potential impacts that would occur without the project or independently of the project.”

As highlighted above in item (iii), IFC emphasises the need for a CIA in order to focus the analysis on the project’s area of influence and future project-related developments in that area.

In addition, more detailed information is provided by IFC in a series of Guidance Notes to assist in interpreting and applying the Performance Standards. In Guidance Note 1, updated on July 31, 2007, IFC describes its cumulative impacts requirements in Paragraph G22 as follows:

“The combination of multiple impacts from existing projects, the proposed project, and/or anticipated future projects may result in significant adverse and/or beneficial impacts that would not be expected in case of a stand-alone project. The Assessment should evaluate these cumulative impacts commensurate with the source, extent, and severity of cumulative impacts anticipated. As a result, the geographic and temporal boundaries of the cumulative impact assessment would depend on the potential cumulative impacts that are attributable to the project and those that affect the project as a result of reasonably foreseeable activities by third parties, and will influence the final definition of the project area of influence.”

In addition to IFC requirements, EIB follows EU directives related to the assessment of the environmental and socio-economic impacts of projects. EU Directives on EIA, and SEA will be discussed in Chapter 3, Legal Framework Overview.

1.3 Scope of the Cumulative Impact Assessment

The scope of this study comprises of the following items:

- identification of geographic and temporal scope of the CIA based on an understanding of the project development plans;
- description of the affected environment including the physical, biological and socioeconomic conditions with an emphasis of ecosystem components and human dependence on natural resources for settlement and livelihoods;
- assessment of potential cumulative environmental and social impacts associated with project development; and
- identification of the mitigation measures based upon a review of the existing individual EIA and EMPs.

1.3.1 Geographic Scope

Given the river-related nature of all the HEPPs proposed by ENERJISA, the most appropriate geographic boundary for the CIA study covering the area which will possibly be affected environmentally and socially by the proposals has been taken to be the watershed boundary of the Seyhan basin. The lower point of this can be defined as the Yedigoze Reservoir, since this currently acts as a barrier to potential impacts on the river below the proposed developments. Therefore, the location on the Yedigoze Reservoir which forms the maximum draw down elevation at the furthest point from the Yedigoze Dam axis has been determined and the catchment area boundaries of that location has been selected as the CIA study area. Such a boundary includes the locations of the material borrow sites, the service roads which will be improved during the project, and the possible corridors for the electricity transmission lines. The geographic boundary of the CIA Study Area is presented in Figure 1-2.

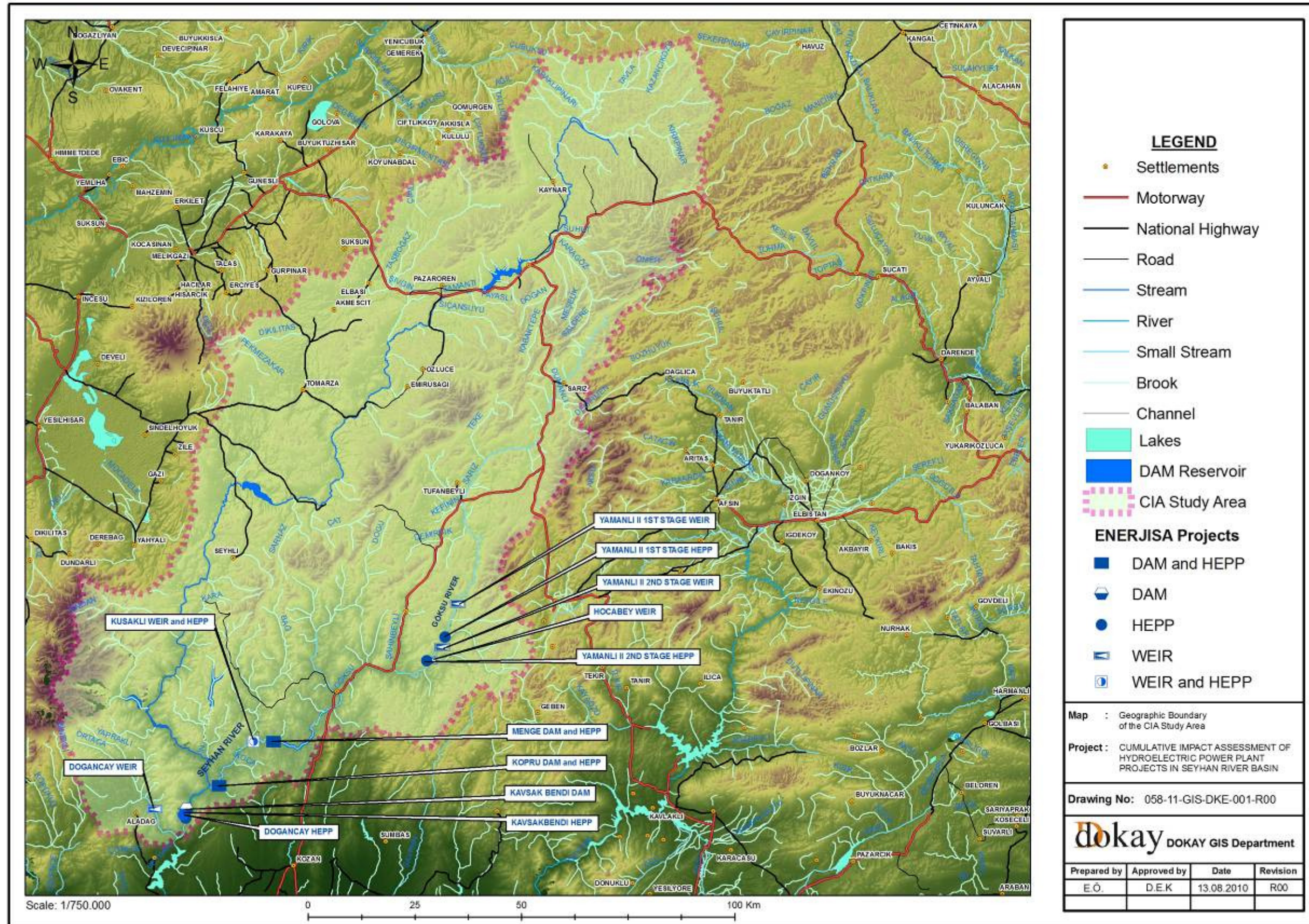


Figure 1-2. Geographic Boundary of the CIA Study Area

1.3.2 Temporal Scope

The temporal scope of the CIA study can be considered separately as the construction and operation phases. Although there is no definite information on the construction phase schedule of the projects, it is not expected that construction of all four projects will start at the same time. Regarding the operation phase, all HEPP projects of ENERJISA have obtained the Energy Generation Licenses from the Energy Market Regulatory Authority (EMRA) for 49 years. Cumulative impacts have been assessed accordingly.

1.3.3 Other Projects (Planned and Projected)

Beside the HEPPs that ENERJISA has proposed in the Seyhan Basin, there are some other projects or existing plants in the CIA study area defined above. The most recent information on these projects is presented in Table 1-1 below.

Table 1-1. General Information on the HEPPs in Seyhan Basin

Name of the Project	Installed Capacity (MW)	Average Annual Energy Production (GWh)	Current Status of the Project
PROJECTS IN UPPER SEYHAN BASIN			
Zamanti River			
Bahcelik Dam and HEPP	4.71	27.84	Operation (Private Company)
Gumusoren Dam and HEPP	5	12	Final Design (DSI)
Gicik Weir and HEPP	6.7	25	Construction (DSI)
Camlica I Weir and HEPP	84	429	Operation (Private Company)
Camlica II Weir and HEPP	15.9	90.7	Construction (Private Company)
Camlica III Weir and HEPP	28.5	42.6	Construction (Private Company)
Tatlar Weir and HEPP	58	214	Feasibility (Private Company)
Indere Dam and HEPP	32.6	100.5	Construction (Private Company)
Topaktas Dam and HEPP	7	34	Feasibility (Private Company)
Goksu River			
Yamanli I Weir and HEPP	22	100	Feasibility (Private Company)
Yamanli II Weir and HEPP	80	294	Final Design (ENERJISA)
Yamanli III Weir and HEPP	58.8	238	Construction (Private Company)
Feke-I Weir and HEPP	29.4	117	Construction (Private Company)
Feke-II Dam and HEPP	71	223.4	Construction (Private Company)
Asmaca Creek (Goksu River)			
Saritepe Weir and HEPP	5	20	Construction (Private Company)
Taslik Creek (Goksu River)			
Kilicli-I Weir and HEPP	2.7	9.85	Construction (Private Company)
Kilicli-II Weir and HEPP	2.4	9.49	Construction (Private Company)

Name of the Project	Installed Capacity (MW)	Average Annual Energy Production (GWh)	Current Status of the Project
Salam Creek (Goksu River)			
Maran HEPP	12.58	35.85	Construction (Private Company)
Kiy HEPP	16.98	67.48	Construction (Private Company)
PROJECTS IN LOWER SEYHAN BASIN			
Zamanti River			
Goktas Energy Project (Goktas Dam and I-II HEPP)	290	1,160	Construction (Private Company)
Goksu River			
Menge Dam and HEPP	85	120	Construction (ENERJISA)
Kusakli Weir and HEPP	19.5	46.66	Final Design (ENERJISA)
Kopru Dam and HEPP	145	377	Construction (ENERJISA)
Seyhan River			
Kavsak Bendi Dam and HEPP	181.81	715	Construction (ENERJISA)
Dogancay Weir and HEPP	60.252	153.812	Final Design (ENERJISA)
Yedigoze Dam and HEPP	300	949	Construction (Private Company)

Source: *Revised Kavsak Bendi HEPP Project Feasibility Report, 2008*; official website of EMRA; and announcements appeared in local news portals related to the projects

1.4 Identification of Main Cumulative Impact Issues

In order to determine the cumulative impacts of the projects during construction, individual impacts stated in the EIA Reports will be assessed whether they interact each other and overlap. The main issues to review for the assessment are:

- Dust and gas emissions
- Wastewater and solid waste generation
- Excavation and demolition wastes
- Noise and vibration
- Hazardous wastes
- Vegetation communities and flora
- Faunal elements
- Landscape
- Historic and cultural features
- Socio-economic factors

During the operation phase of the HEPPs, the most significant potential cumulative impacts will be observed in aquatic environment. These potential impacts include:

- Change of water flow regime from a river system to a series of lakes
- Change of water quality

-
- Sediment reduction in the downstream flow of the reservoir

The impacts expected during the operation phase in the aquatic environment and hydrology in the river will be different for run-of-river HEPPs and HEPPs with a dam. Detailed assessment of cumulative impacts is presented in Chapter 5.

2. SUMMARY DESCRIPTION OF THE PROJECTS

2.1 Description and History of the ENERJISA Projects

The State Hydraulic Works (DSI), the main investing institution responsible for the utilization of water resources in Turkey, conducts planning studies in order to determine the most appropriate project formulations by using long-term data records. This CIA study focuses mainly on the HEPPs to be constructed and operated by ENERJISA. These four projects and most of the other projects listed in Section 1.3.3 were first proposed by DSI in “*Lower Seyhan Basin Master Plan Report (1980)*” and “*Upper Seyhan Basin Master Plan Report (1984)*” which were prepared by the Engineering Services Firm Group consisting of Verbund-Plan (Vienna-Austria), Romconsult (Bucharest-Romania) and Temelsu (Ankara-Turkey).

During the preparation of these master plans, Electrical Power Resources Survey and Development Administration (EIEI), a public organization carrying out engineering services related to the production of electrical energy, also contributed to the engineering studies conducted for the above master plans. These master plans give information on the utilization of water resources, flood control, irrigation and energy generation issues related to Seyhan Basin.

As a result of some legal arrangements related to the energy sector, the Built-Operate-Transfer (BOT) Model was introduced in 1984 with the enactment of Expropriation Law numbered 3096 and dated December 4, 1984. This model introduced the establishment and operation of a power plant by the private sector for a certain period of time. It is stipulated that the facility will be transferred to the State at the end of the period. Later, for the harmonization of energy legislation with the corresponding European Communities’ legislation, the ‘Electricity Market Law’ numbered 4628 was enacted in 2001 to enable progress into a liberalized electricity market and to provide for fair and transparent market regulation.

Consequently, the projects determined by the DSI and EIEI were reassessed by the private sector in Turkey and new design alternatives were proposed for the HEPPs. Table 1-1 presents the most up-to-date status of the HEPPs within the CIA study area.

Since the installed capacities of the ENERJISA projects are greater than threshold values given in respective EIA regulations effective at the time the EIA applications were made to the MoEF, EIA reports were prepared for the projects except for Kusakli Weir and HEPP. The EIA process for this project is ongoing (see Section 2.1.3).

General layout of ENERJISA projects in Seyhan Basin are shown in Figure 2-1. Detailed information on these projects is presented in the following sections.

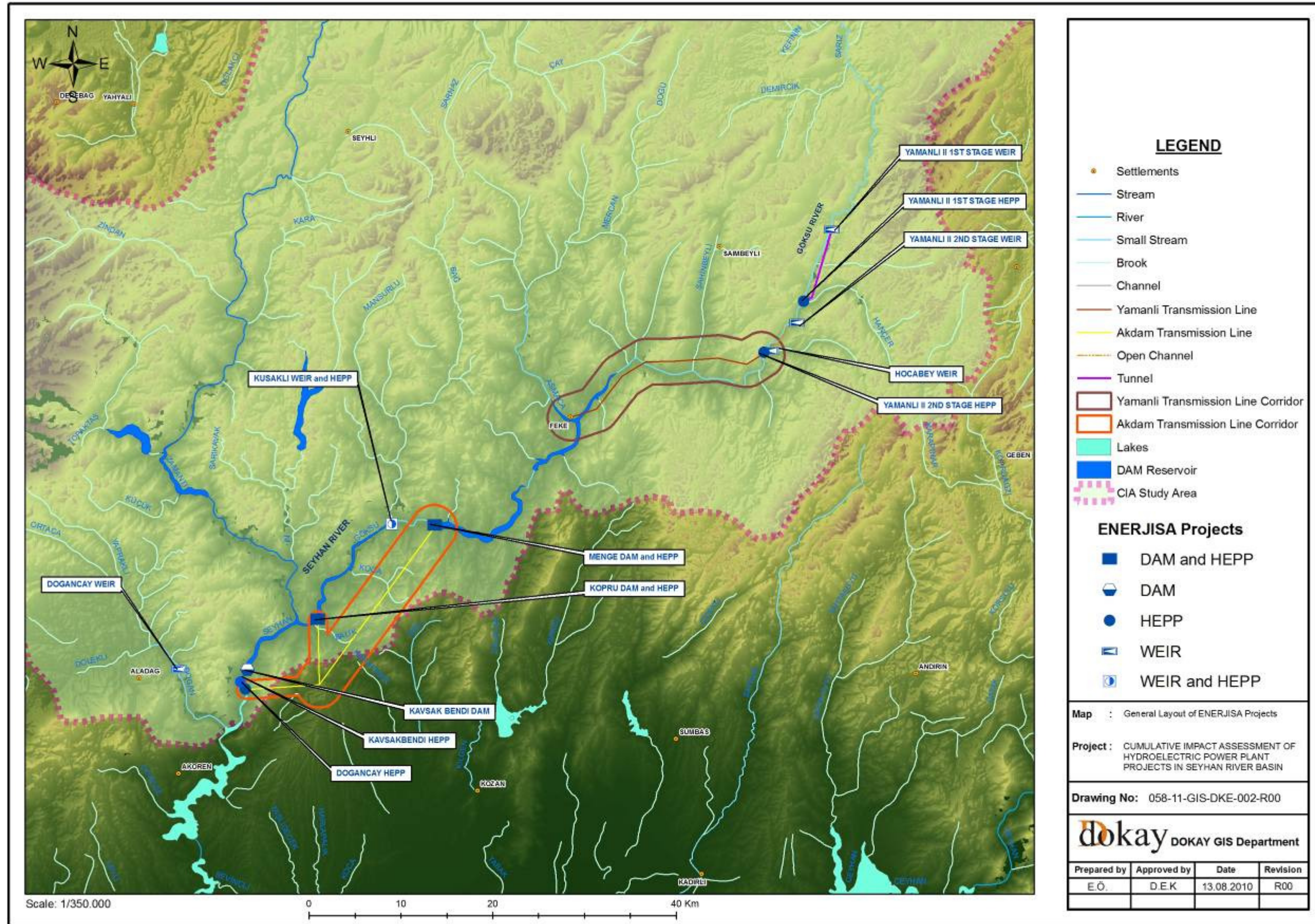


Figure 2-1. General Layout of ENERJISA Projects

2.1.1 Yamanli II HEPP and Quarries Project

Yamanli II is a “run-of-river” type HEPP project and will be located on Goksu River, main tributary of Seyhan River, in the Upper Seyhan Basin. The project is in its final design phase. The Energy Generation License of the project was obtained from the Energy Market Regulatory Authority (EMRA) in 2006 and will be valid for 49 years.

Yamanli II HEPP and Quarries Project consists of Yamanli II Weir with a thalweg elevation of 1,153 m, a 16 km long energy tunnel, surge tank, penstock and Yamanli II HEPP with a tailwater elevation of 760 m which is on the right shore of Goksu River. Due to the difficulty of construction of such a long energy tunnel, long investment period, energy production capacity and cost of the project, it is planned to construct the Project in two stages. The stages of the Project are as follows:

Stage I: Yamanli II Stage I Weir with a thalweg elevation of 1,153 m, 9200 m long energy tunnel, surge tank, penstock and Yamanli II Stage I HEPP on Goksu River.

Stage II: Yamanli II Stage II Weir, 5,500 m long energy tunnel, Hocabey Weir on Hocabey Creek (tributary of Goksu River), penstock and Yamanli II Stage II HEPP on the left shore (Yamanli II HEPP and Quarries Project, EIA Report, 2008). Within the Project, the construction material will be primarily supplied from tunnel excavations, but in case of a need there will be two quarries (M1 and M2) with a total area of 5.5 ha.

The connection routes of the transmission lines of the project were determined by the General Directorate of Turkish Electricity Transmission Corporation (TEIAS). Accordingly, two alternatives have been proposed. The first alternative is to connect the transmission line to Feke Transformer Station with a line of 7 km long, 2 x 1C 954 MCM Cardinal conductors. The second one is to connect the line with a special direct transmission line to the switchyard of Tufanbeyli Power Plant (Yamanli II HEPP and Quarries Project, EIA Report, 2008).

Full technical details of the Yamanli II HEPP and Quarries project are presented in Table 2-1.

A major part of the Project lies in the borders of Saimbeyli District of Adana Province and the remaining part lies in Goksun District of Kahramanmaraş Province. The project consists of Yamanli II Stage I Weir and HEPP (installed capacity of 59 MW) at the upstream, Yamanli II Stage II Weir, Hocabey Weir and Yamanli II Stage II HEPP (installed capacity of 22.30 MW) at the downstream. The total installed capacity of the project is 81.3 MW and the annual energy generation will be 294 GWh. The design studies for the project have been carried out by DOLSAR (DOLSAR Engineering Ltd. Co.)

The EIA procedure of the project is being carried out by DOKAY. The public participation meeting for the project was made on February 21-22, 2007 in Saimbeyli and

Goksun districts with the coordination of the related Provincial Directorates of Environment and Forest. The general attitude of the local people towards the project was positive. The EIA Report was prepared in compliance with the EIA Regulation and was submitted to the Ministry of Environment and Forestry (MoEF) on March 6, 2008. Currently, the EIA Report has been accepted as the final EIA Report. However, a few procedural steps are yet to be completed prior to the issuance of the EIA Positive Certificate.

Table 2-1. General Characteristics of the Yamanli HEPP and Quarries Project

Characteristics	Unit	Amount
Yamanli II 1st Stage Weir		
Drainage Area	km ²	1,696
Annual Average Flow (Full upstream development)	m ³	318.27x10 ⁶
Thalweg Elevation	m	1153.50
Crest Elevation	m	1170.00
Height from Base	m	21.30
Height from Thalweg	m	16.50
Energy Tunnel		
Diameter	m	3.50
Length	m	9200
Yamanli II 1st Stage HEPP		
Installed Capacity	MW	59
Firm Energy	GWh	
Secondary Energy	GWh	
Total Energy	GWh	192.30
Project Flow	m ³ /s	22.5
Yamanli II 2nd Stage Weir		
Annual Average Flow (Full upstream development)	m ³	568.51x10 ⁶
Thalweg Elevation	m	841.50
Crest Elevation	m	858.00
Height from Base	m	16.50
Height from Thalweg	m	21.30
Energy Tunnel		
Diameter	m	3.50
Length	m	5,500
Hocabey Weir		
Drainage Area	km ²	70.1
Annual Average Flow (Full upstream development)	m ³	38.99x10 ⁶
Thalweg Elevation	m	844.00
Crest Elevation	m	850.00
Height from Base	m	10.00
Height from Thalweg	m	6.00
Transmission		

Characteristics	Unit	Amount
Dimensions	m	Under design phase
Length	m	1,900
Yamanli II 2nd Stage HEPP		
Installed Capacity	MW	22,3
Firm Energy	GWh	
Secondary Energy	GWh	
Total Energy	GWh	94,71
Project Flow	m ³ /s	30

Source: Yamanli II Weir and HEPP Feasibility Report, April 2005

The project is at the final design stage and the above figures are subject to change.

2.1.2 Menge Dam, HEPP and Quarries Project

Menge Dam, HEPP and Quarries Project is located in Adana Province, Kozan and Feke Districts on Goksu River. The project which is in the final design phase will be used only for energy generation purpose and has an Energy Generation License for 49 years obtained from EMRA in 2006.

Within the project, a dam body, derivation tunnel, water intake structure, penstock, powerhouse, service roads and a transmission line will be constructed. A quarry will be used to supply the material for the construction. The powerhouse will be constructed at the toe of the Menge Dam with an installed capacity of 85 MW and the average annual energy generation is estimated to be 202.56 GWh. Minimum and maximum water elevations will be 470.0 and 480.0 m, respectively. The thalweg elevation will be 422.5 m and crest elevation will be 483.0 m. The surface area and volume of the dam reservoir will be 2.67 km² and 50.8 hm³, respectively.

Menge Dam and HEPP Project was proposed in the “Upper Seyhan Basin Master Plan” in 1984 by the DSI. According to the proposed formulation the maximum water elevation was 480 m, gross head was 35 m, installed capacity was 33 MW, and total annual energy generation was 113.4 GWh. For the present formulation which was proposed by TEMELSU International Engineering Services Inc. (TEMELSU), a gross head of 57.5 m between 480 m and 422.5 m is planned to be utilized.

The electricity to be generated in the Menge HEPP which is proposed at the toe of the dam will be transmitted to “Kopru Dam and HEPP” with a 20 km long transmission line in the downstream and then is planned to be transmitted to Akdam Transformer Station with a 10 km long transmission line (Menge Dam and HEPP Project Introduction File, 2008).

General characteristics of the Menge Dam, HEPP and Quarries Project are presented in Table 2-2.

The EIA Report of the project is currently being prepared by DOKAY in accordance with the EIA Regulation issued in the Official Gazette dated July 17, 2008 and numbered 26939. The public participation meeting for the project was made on April 8, 2008 in Kozan District with the coordination of Adana Provincial Directorate of Environment and Forest. The general attitude of the local people towards the project was positive.

Table 2-2. General Characteristics of Menge Dam and HEPP Project

Characteristics	Unit	Amount
Drainage Area	km ²	3,750
Annual Average Flow	hm ³	1,606
Derivation Tunnel		
Inner Diameter	m	9.0
Length	m	330
Dam		
Type	-	Roller Compacted Concrete (RCC)
Thalweg Elevation	m	410.0
Crest Elevation	m	483.0
Minimum Water Elevation	m	470.0
Maximum Water Elevation	m	480.0
Reservoir Area	km ²	2.67
Total Reservoir Volume	hm ³	50.8
Powerhouse		
Installed capacity	MW	85
Tailwater Elevation	m	422,5
Gross Head	m	57,5
Project Flow Rate	m ³ /s	180
Firm Energy	GWh	58,73 – 57,86*
Secondary Energy	GWh	143,83 – 144,08*
Total Energy	GWh	202,56 – 201,93*

* The values determined for the existing and full development cases with respect to upstream projects

Source: Menge Dam and HEPP Project Introduction File, 2008

2.1.3 Kusakli Weir and HEPP Project

Kusakli is a “run-of-river” type HEPP project and will be located on Goksu River, main tributary of Seyhan River. Project is located within the boundaries of Kozan District of Adana Province. EIA process for the project is ongoing, and the project is in its final design phase. The Energy Generation License of the project was obtained from the Energy Market Regulatory Authority (EMRA) in 2008 and will be valid for 49 years.

Kusakli Weir and HEPP Project consists of Kusakli Weir with a thalweg elevation of 408.50 m and Kusakli HEPP with a tailwater elevation of 410.00 m which is on the right

shore of Goksu River. As a result of feasibility studies carried out for the project, no transmission structure (i.e. transmission channel or tunnel) was proposed between the weir and powerhouse. The installed capacity and the annual energy generation of the project are 20.3 MWm/19.5 MWe and 46.657 GWh, respectively. The EIA procedure of the project started on June 22, 2010, and still in progress.

General characteristics of the Kusakli Weir and HEPP project are presented in Table 2-3.

Table 2-3. General Characteristics of the Kusakli Weir and HEPP Project

Characteristics	Unit	Amount
Kusakli Weir		
Drainage Area	km ²	3,750
Annual Average Flow (Full upstream development)	m ³	1569.44x10 ⁶
Annual Average Flow Rate (Full upstream development)	m ³ /s	49.83
Design Flow Rate	m ³ /s	180.0
Flow Diverted (Full upstream development)	m ³ /s	1552.16 x10 ⁶
Thalweg Elevation	m	408.50
Base Elevation	m	404.50
Height from Base	m	19.25
Height from Thalweg	m	15.25
Maximum Water Elevation	m	422.50
Normal Water Elevation	m	422.50
Water Intake Structure and Sedimentation Tank		
Threshold Elevation of Water Intake Structure	m	412.50
Number of Cofferdam Gates	-	2
Spillway		
Threshold Elevation	m	410.50
Elevation of Approach Channel	m	408.50
Design Flow Rate (Q ₅₀₀)	m ³ /s	2036,00
Derivation Channel		
Length of Derivation	m	173.50
Design Capacity (Q ₁₀)	m ³ /s	928.00
Water Depth in Channel	m	7.50
Inlet Elevation	m	409.00
Outlet Elevation	m	408.85
Upstream Cofferdam (1st Stage)		
Crest Elevation	m	417.00
Thalweg Elevation	m	408.50
Base Elevation	m	406.50
Height from Thalweg	m	8.50
Crest Length	m	40.00
Crest Width	m	4.00
Downstream Cofferdam (1st Stage)		
Crest Elevation	m	414.00
Thalweg Elevation	m	408.50
Base Elevation	m	406.50

Characteristics	Unit	Amount
Height from Thalweg	m	5.50
Crest Length	m	44.00
Crest Width	m	4.00
Upstream Cofferdam (2nd Stage)		
Crest Elevation	m	419.00
Crest Length	m	65.00
Crest Width	m	4.00
Downstream Cofferdam (2nd Stage)		
Crest Elevation	m	417.00
Crest Length	m	37.00
Crest Width	m	4.00
Kusakli HEPP		
Installed Capacity	MWm/MWe	20.30/19.50
Firm Energy (Full upstream development)	GWh	12.52
Secondary Energy	GWh	34.14
Total Energy	GWh	46.66
Project Flow	m ³ /s	180.00

Source: EIA Application Report for Kusakli Weir and HEPP Project, June 2010.

2.1.4 Kopru Dam, HEPP and Quarries Project

Kopru Dam, HEPP and Quarries Project is located on Goksu River, Kozan District of Adana Province. The project which is in the final design phase will be used only for energy generation purpose and has an Energy Generation License for 49 years obtained from EMRA in 2006.

Within the project, a dam body, derivation tunnel, water intake structure, penstock, powerhouse, service roads and a transmission line will be constructed. Construction material will be supplied from two quarries. The powerhouse will be constructed at the toe of the Kopru Dam with an installed capacity of 145 MW and the average annual energy generation is estimated to be 381.36 GWh. Minimum and maximum water elevations will be 390.0 and 410.0 m, respectively. The thalweg elevation will be 318.0 m and crest elevation will be 415.0 m. The surface area and volume of the dam reservoir will be 2.93 km² and 93.2 hm³, respectively.

Kopru Dam and HEPP Project was proposed in the "Lower Seyhan Basin Master Plan" in 1980 by the DSI. According to the proposed formulation the maximum water elevation was 445 m, gross head was 127 m, installed capacity was 189 MW, and total annual energy generation was 480.9 GWh. For the present formulation which was proposed by TEMELSU, a gross head of 92 m between 410 m and 318 m is planned to be utilized.

The electricity to be generated in the Kopru HEPP which is proposed at the toe of the dam will be transmitted to Akdam Transformer Station with a 10 km long transmission line (Kopru Dam and HEPP Project Introduction File, 2008).

General characteristics of the Kopru Dam, HEPP and Quarries Project are presented in Table 2-4.

The EIA Report is currently being prepared by DOKAY in accordance with the EIA Regulation issued in the Official Gazette dated July 17, 2008 and numbered 26939. The public participation meeting for the project was made on April 8, 2008 in Kozan District with the coordination of Adana Provincial Directorate of Environment and Forest. The general attitude of the local people towards the project was positive.

Table 2-4. General Characteristics of Kopru Dam and HEPP Project

Characteristics	Unit	Amount
Drainage Area	km ²	4,300
Annual Average Flow	hm ³	1,851
Derivation Tunnel		
Inner Diameter	m	9.50
Length	m	560
Dam		
Type	-	Roller Compacted Concrete (RCC)
Thalweg Elevation	m	318.0
Crest Elevation	m	415.0
Minimum Water Elevation	m	390.0
Maximum Water Elevation	m	410.0
Reservoir Area	km ²	2.93
Total Reservoir Volume	hm ³	93.20
Powerhouse		
Installed capacity	MW	145
Tailwater Elevation	m	318.0
Gross Head	m	92.0
Project Flow Rate	m ³ /s	190.0
Firm Energy	GWh	114.84
Secondary Energy	GWh	266.53
Total Energy	GWh	381.36

Source: Kopru Dam and HEPP Project Introduction File, 2008

2.1.5 Kavsak Bendi Dam, HEPP and Quarries Project

Kavsak Bendi Dam, HEPP and Quarries Project is located on Lower Seyhan Basin, approximately 8 km downstream from the junction of Zamanti and Goksu rivers which are two main tributaries of Seyhan River. The project which is in the construction

phase will be used only for energy generation purpose and has an Energy Generation License for 49 years obtained from EMRA in 2007.

The EIA procedure of the project was carried out by DOKAY in accordance with the EIA Regulation (issued in the Official Gazette dated July 17, 2008 and numbered 26939), and the Final EIA Report was approved by the MoEF on October 5, 2007.

After the EIA process, ENERJISA has made a revision in the project. In this context, detailed geological surveys carried out in locations of project units. Considering geological characteristics of the area, dam axle was located approximately 300 m to the upstream whereas powerhouse was located approximately 400 m to the downstream with respect to their original locations. As a result of this, length of the transmission tunnel increased from 1950 to 2593 m. It was also decided that excavation material to be obtained from dam axle and transmission tunnel would be adequate for construction, and hence, quarries have been excluded from the scope of the project.

Besides these, optimization studies for energy generation were repeated, and corrections have been made in the installed capacity and electricity generation amount of the project. According to optimization studies, an installed capacity of 178.89 MW was computed for Kavsak Bendi HEPP. In the Final EIA Report, ENERJISA committed that 5 m³/sec of environmental flow would be released from the dam location in order to sustain the aquatic life in the river section between dam and powerhouse. This environmental flow was also taken into consideration in optimization studies, and an additional powerhouse at the toe of the dam was proposed. As a result of this, total installed capacity of the project increased from 145.40 MW to 181.81 MW. Since the installed capacity of the project was increased, ENERJISA needed to implement a new EIA process.

In this new EIA process, the MoEF required that the environmental flow should be increased to 9.42 m³/s in accordance with the Regulation amending the Regulation on Procedures and Principles for Agreements on Water Utilization Rights Signed for Electricity Generation Investments (issued in the Official Gazette dated August 18, 2009 and numbered 27323). The new EIA report regarding the capacity increase in the project was prepared by DOKAY, and approved by the MoEF on February 23, 2010.

According to results of revised optimization studies, it was concluded that redesigning the powerhouse at the toe of the dam according to the flow of 9.42 m³/s would not increase the total installed capacity of the project more than 0.5 MW, which is the threshold value given in the EIA Regulation to determine whether or not an EIA is necessary for an hydroelectric project. Therefore, there is no need to make any revision in the EIA Report.

In this regard, characteristics of the project given in the CIA Report, prepared in September 2008, have been updated in this report. Within the project, Kavsak Bendi Dam,

derivation tunnel, water intake structure, transmission tunnel, surge tank, powerhouse, service roads and a transmission line will be constructed. As mentioned above, the construction material will be supplied from excavations to be carried out at dam axle and transmission tunnel. The water to be stored in the reservoir will be transmitted to a powerhouse with a 2593 m long transmission tunnel. The installed capacity of the power plant is 178.89 MW and total annual energy generation is estimated to be 715.43 GWh whereas the installed capacity of the power plant at the toe of the dam is 2.9 MW and its total annual energy generation is estimated to be 25.60 GWh. As given above, total installed capacity of the project is 181.81 MW, and total energy generation is 741.03 GWh. However, since these figures were computed according to the environmental flow of 5 m³/s, there may be slight change in total amount of annual electricity generation. Minimum and maximum water elevations will be 312.0 and 318.0 m, respectively. The thalweg elevation will be 250.0 m and crest elevation will be 323.0 m. The surface area and volume of the dam reservoir at maximum water elevation will be 1.42 km² and 30.0 hm³, respectively. The design studies for the project have been carried out by DOLSAR.

General characteristics of the Kavsak Bendi Dam, HEPP and Quarries Project are presented in Table 2-5.

Table 2-5. General Characteristics of Kavsak Bendi Dam and HEPP Project

Characteristics	Unit	Amount
Drainage Area	km ²	13,200
Annual Average Flow at the Dam Axis (full upstream development)	hm ³	3,503.10
Derivation Tunnel		
Number	-	2 (DR1 and DR2)
Diameter	m	7.90
Length (DR1/DR2)	m	505.80/551.70
Kavsak Bendi Dam		
Type	-	Concrete
Thalweg Elevation	m	249.00
Crest Elevation	m	323.00
Minimum Water Elevation	m	312.00
Maximum Water Elevation	m	318.00
Reservoir Area	km ²	1.42
Total Reservoir Volume at Maximum Water Elevation	hm ³	30
Transmission Tunnel		
Inner Diameter		9.00
Length		2.593
Kavsak Bendi HEPP		
Installed capacity	MW	178.89
Gross Head	m	85.50
Project Flow Rate	m ³ /s	260.67
Firm Energy	GWh	271.71
Secondary Energy	GWh	443.72

Characteristics	Unit	Amount
Total Energy	GWh	715.43
Power Plant at the Toe of the Dam		
Project Flow Rate	m ³ /s	5.00
Installed capacity	MW	2.92
Firm Energy	GWh	25.60
Secondary Energy	GWh	-
Total Energy	GWh	25.60

Source: Kavsak Bendi HEPP Revised Feasibility Report, 2008

2.1.6 Dogancay Weir and HEPP Project

Dogancay is a “run-of-river” type HEPP project. Dogancay Weir will be located on Dogan Creek, a tributary of Seyhan River, while Dogancay HEPP will be located on Seyhan River. A transmission tunnel will be opened in the mountain between valleys of Dogan Creek and Seyhan River to connect weir and HEPP. Entire project is located within the boundaries of Aladag District of Adana Province. EIA process for the project was completed, and the project is in construction phase. The Energy Generation License of the project was obtained from the Energy Market Regulatory Authority (EMRA) in 2008 and will be valid for 49 years.

Dogancay Weir and HEPP Project consists of Dogancay Weir with a normal water elevation of 558.50 m. Length of the conveyance tunnel is 6810 m. The installed capacity and the annual energy generation of the project are 60.252 MW and 153.812 GWh, respectively. The EIA Positive Certificate for the project was issued by the MoEF on August 25, 2009. The project is in final design phase.

General characteristics of the Dogancay Weir and HEPP project are presented in Table 2-6.

Table 2-6. General Characteristics of the Dogancay Weir and HEPP Project

Characteristics	Unit	Amount
Dogancay Weir		
Annual Average Flow Rate (Full upstream development)	m ³ /s	8.87
Base Elevation	m	553.00
Height from Base	m	8.80
Normal Water Elevation	m	558.50
Crest Length	m	80
Crest Elevation	m	561.80
Spillway		
Capacity	m ³ /s	444.17
Threshold Elevation	m	558.50
Length	m	50
Net Width	m	48

Characteristics	Unit	Amount
Sedimentation Tank		
Normal Water Elevation	m	558.50
Design Flow Rate	m ³ /s	23
Conveyance Channel		
Section (Excavation/Tunnel)	-	Rectangular Box Section
Length	m	210.00
Water Height	m	2.73
Base width	m	3.55
Capacity	m ³ /s	23.00
Conveyance Tunnel		
Section	-	Straight Leg Horseshoe
Length	m	6810.00
Excavation Diameter	m	4.20
Inner Diameter	m	3.55
Thickness of the Tunnel Lining	m	0.35
A-B line (Payment Line)	m	0.15
Tunnel Inlet Base Elevation	m	55.15
Slope	-	0.001
Flow Type	-	Free Surfaced
Project Discharge	m ³ /s	23.00
Headpond		
Width x Length	m	30 x 48
Active Water Depth	m	3.00
Depth and Width	m	6.90/8.95
Maximum Water Level	m	551.79
Minimum Water Level	m	548.26
Normal Water Level	m	551.26
Spillway Length	m	30
Penstock Entrance Base Elevation	m	540.59
Penstock		
Diameter	m	2.3
Length	m	800
Wall Thickness	mm	8 - 25
Velocity in Penstock	m/s	5.54
Turbine		
Type		Vertical Shaft Pelton
Number of units		3 equal
Project Discharge	m ³ /s	23.00
Unit Discharge	m ³ /s	7.667
Turbine Axis Elevation	m	240.72
Tailwater Elevation	m	238.50
Gross Head	m	312.76
Net Head	m	304.27
Dogancay HEPP		
Installed Capacity	MW	60.252
Firm Energy	GWh	0
Secondary Energy	GWh	153.812

Characteristics	Unit	Amount
Total Energy	GWh	153.812
Design Flow Rate	m ³ /s	23

Source: ENSU Due Diligence Report for Dogancay Weir and HEPP Project, July 2009.

2.2 Existing and Other Proposed HEPPs in the Seyhan Basin

Beside HEPP projects proposed by ENERJISA, there are other projects proposed by other private companies and existing HEPPs in the CIA Study Area in Seyhan Basin. The general layout of all HEPPs in the CIA Study Area is presented in Figure 2-2.



For some existing HEPPs and projects under construction, the EIA procedure is not initiated. These projects are exempted from the EIA Regulation requirements according to the provisional Article 3 of EIA Regulation. Article 3 states that “*Provisions of this regulation do not apply to those projects; (i) whose final design was approved, or (ii) for which permission, license or approval was obtained pursuant to environment and other related legislation, or (iii) expropriation decision was taken, or (iv) site selection was made based on relevant legislation, or were (v) taken into investment programme, before February 7, 1993*”.

Existing HEPPs

Bahcelik Dam and HEPP

Bahcelik Dam and HEPP is located on Zamanti River in Pinarbasi District of Kayseri Province. It began to operate in 2005. The HEPP which is being operated by a private company is used for irrigation and energy generation purposes. Since its permission procedures were finalized before February 7, 1993, the project is exempted from the EIA Regulation requirements. The installed capacity of the power plant is 4.71 MW and average annual energy generation is 27.84 GWh. The surface area and volume of the reservoir is 12.13 km² and 216.14 hm³, respectively (URL 2, Official Website of DSI 12th Regional Directorate, 2008).

Camlica I HEPP

Camlica I HEPP which is a run-of-river type project is located on Zamanti River in Yahyali District of Kayseri Province. The construction of the HEPP started in 1995 and began to operate in 1998. The EIA procedure was finalized on May 26, 1997 with an EIA Positive Certificate. The installed capacity of the power plant is 84 MW and average annual energy generation is 429 GWh (URL 3, Website of Ayen Energy Co. Inc., 2008)

HEPPs under Construction

Gicik (Zamanti) Weir and HEPP

Gicik (Zamanti) Weir is a part of Develi Phase II Irrigation Project which was initiated 30 years ago. The construction of the project is expected to finish in 2008. An area of 52,000 ha in the Develi Lowland will be irrigated with an 11 km long tunnel. At the exit part of the tunnel a power plant will be constructed with an installed capacity of 6.7 MW. Since the permission procedures for the project were finalized before February 7, 1993, the project is exempted from the EIA Regulation requirements.

Feke-II Dam and HEPP

Feke Dam and HEPP is located on Goksu River in Feke District of Adana Province. The HEPP which is a private company project will be used only for energy generation purpose. The installed capacity of the power plant is 71 MW and average annual energy generation is estimated to be 223.4 GWh. The volume of the reservoir will be 63.07 hm³. The EIA procedure of the project was finalized and EIA Report was approved on January 31, 2008 (URL 4: Official Website of Feke District Governorship, 2008)

Saritepe Weir and HEPP

Saritepe Weir and HEPP which is a run-of-river type project is located on Asmaca Creek, a tributary of Goksu River, in Feke District of Adana Province. The HEPP which is a private company project will be used only for energy generation purpose. The construction of the HEPP is expected to finish at the end of 2008. Within the project, a weir with a height of 10 m and a 2 km long transmission channel will be constructed. The installed capacity of the power plant is 5 MW and average annual energy generation is estimated to be 20 GWh. The project is exempted from the EIA Regulation requirements. (URL 4: Official Website of Feke District Governorship, 2008).

Yedigoze Dam and HEPP

Yedigoze Dam and HEPP is located on Seyhan River within the boundaries of Imamoglu, Kozan and Aladag Districts of Adana Province. The HEPP is a project of a private company and will be used for irrigation and energy generation purposes. The construction of the HEPP is expected to be completed in 2011. The installed capacity of the power plant is 300 MW and average annual energy generation is estimated to be 969 GWh. The surface area and volume of the reservoir will be 14.9 km² and 642.8 hm³, respectively. The EIA procedure of the project was carried out by DOKAY and EIA Report was approved on June 6, 2007 (Yedigoze Dam, HEPP and Quarries Project Final EIA Report, 2007)

Proposed HEPPs

In addition to HEPPs under construction and existing HEPPs, there are projects in feasibility and final design phases proposed by other private companies than ENERJISA. General information related to these projects is presented in Table 2-5 below.

The most recent information about these projects have been obtained mainly from official websites of EMRA, DSI and General Directorate of EIA and Planning, announcements appeared in local news portals related to the projects and EIA reports if available.

Table 2-7. General Information on the HEPP Projects Proposed in the CIA Study Area

Name of the Project	Location (Province - District)	Installed Capacity (MW)	Average Annual Energy Production (GWh)	Information	EIA Procedure
UPPER SEYHAN BASIN					
Zamanti River					
Bahcelik Dam and HEPP	Kayseri - Pinarbasi	4.71	27.84	- Operation (Private Company) - Irrigation and energy generation purposes - Reservoir area and volume: 12.13 km ² and 216.140 hm ³	The project is exempted from the EIA Regulation requirements
Gumusoren Dam and HEPP	Kayseri - Develi	5	12	- Final Design (DSI) - Irrigation and energy generation purposes - Reservoir volume: 216.9 hm ³	EIA Report was approved on November 14, 1997
Gicik (Zamanti) Weir and HEPP	Kayseri - Develi	6.7	25	- Construction (DSI) - Irrigation and energy generation purposes - 52,000 ha area will be irrigated	The project is exempted from the EIA Regulation requirements
Camlica I Weir and HEPP	Kayseri - Yahyalı	84	429	- Operation (Private Company) - Run-of-river type HEPP - Energy generation purpose	EIA Report was approved on May 26, 1997
Camlica II Weir and HEPP	Kayseri - Yahyalı	15.9	90.7	- Construction (Private Company) - Run-of-river type HEPP	-
Camlica III Weir and HEPP	Kayseri - Yahyalı	28.5	42.6	- Construction (Private Company) - Run-of-river type HEPP	EIA process has been completed
Tatlar Weir and HEPP	Kayseri - Yahyalı	58	214	- Feasibility (Private Company) - Run-of-river type HEPP	-
Indere Dam and HEPP	Adana - Feke / Kayseri - Yahyalı	32.6	100.5	- Construction (Private Company) - Energy generation purpose - Reservoir volume: 60.34 hm ³	EIA process has been completed
Topaktas Dam and HEPP	Kayseri - Yahyalı	7	34	- Feasibility (Private Company) - Reservoir volume: 1.47 hm ³	-
Goksu River					
Yamanli I Weir and HEPP	Adana - Saimbeyli	22	100	- Feasibility (Private Company) - Run-of-river type HEPP	-

Name of the Project	Location (Province - District)	Installed Capacity (MW)	Average Annual Energy Production (GWh)	Information	EIA Procedure
Yamanli II Weir and HEPP	Adana - Saimbeyli	81	287	- Final Design (ENERJISA) - Run-of-river type HEPP	EIA process is ongoing
Yamanli III Weir and HEPP	Adana - Saimbeyli	58.8	238	- Construction (Private Company) - Run-of-river type HEPP	-
Feke-I Weir and HEPP	Adana - Feke	29.4	117	- Construction - Energy generation purpose	EIA process has been completed
Feke-II Dam and HEPP	Adana - Feke	71	223.4	- Construction (Private Company) - Energy generation purpose - Reservoir volume: 63.07 hm ³	EIA Report was approved on January 31, 2008
Asmaca Creek (Goksu River)					
Saritepe Weir and HEPP	Adana - Feke	5	20	- Construction (Private Company) - Run-of-river type HEPP - Energy generation purpose	The project is exempted from the EIA Regulation requirements
Taslik Creek (Goksu River)					
Kilicli-I Weir and HEPP	Adana - Saimbeyli	2.7	9.85	- Construction (Private Company) - Energy generation purpose	EIA process has been completed
Kilicli-II Weir and HEPP	Adana - Saimbeyli	2.4	9.49	- Construction (Private Company) - Energy generation purpose	EIA process has been completed
Salam Creek (Goksu River)					
Maran HEPP	Adana - Feke	12.58	35.85	- Construction (Private Company) - Energy generation purpose	EIA process has been completed
Kiy HEPP	Adana - Feke	16.98	67.48	- Construction (Private Company) - Energy generation purpose	EIA process has been completed
LOWER SEYHAN BASIN					
Zamanti River					
Goktas Energy Project (Goktas Dam and I-II HEPP)	Adana - Kozan and Aladag	290	1,160	- Construction (Private Company) - Reservoir volume: 133.34 hm ³	EIA process has been completed
Goksu River					

Name of the Project	Location (Province - District)	Installed Capacity (MW)	Average Annual Energy Production (GWh)	Information	EIA Procedure
Menge Dam and HEPP	Adana - Kozan and Feke	85	120	- Final Design (ENERJISA) - Energy generation purpose - Reservoir area and volume: 2,67 km ² and 50.8 hm ³	EIA Report was approved on February 18, 2009
Kusakli Weir and HEPP	Adana-Kozan	19.5	46.66	- Final Design (ENERJISA) - Energy generation purpose	EIA process is ongoing
Kopru Dam and HEPP	Adana - Kozan	145	377	- Final Design (ENERJISA) - Energy generation purpose - Reservoir area and volume: 2,93 km ² and 93.2 hm ³	EIA Report was approved on February 18, 2009
Seyhan River					
Kavsak Bendi Dam and HEPP	Adana - Kozan and Aladag	181.81	741.03	- Construction (ENERJISA) - Energy generation purpose - Reservoir area and volume: 1.42 km ² and 51.05 hm ³	EIA Report for the capacity increase in the project was approved on February 23, 2010
Dogancay Weir and HEPP	Adana-Aladag	60.252	153.812	- Final Design (ENERJISA) - Energy generation purpose	EIA Report was approved on August 25, 2009
Yedigoze Dam and HEPP	Adana - Imamoglu, Kozan and Aladag	300	949	- Construction (Private Company) - Irrigation and energy generation purposes - Reservoir area and volume: 14.9 km ² and 642.8 hm ³	EIA Report was approved on June 6, 2007

3. LEGAL FRAMEWORK OVERVIEW

In this chapter, Turkish and European legislation related to the environmental impacts of construction and operation of the HEPPs has been reviewed and summarized.

3.1 National Legal and Institutional Situation

The Turkish EIA Regulation was introduced in 1993 and then revised four times until present. Although the latest revision was published on July 17, 2008, the projects of ENERJISA are subject to the requirements of the revision published in the Official Gazette dated December 16, 2003 and numbered 25318 according to the provisional Article 2 of the latest revision.

Turkish EIA process includes the steps of screening, public participation, scoping, EIA study, examination and evaluation of the EIA report. According to this regulation, projects are classified into two categories: projects listed in Annex I with significant potential impacts requiring an EIA report and projects listed in Annex II which may have significant potential impacts and require further environmental analysis. For these projects, a Project Introduction File is prepared in order to decide on whether an EIA report is required or not. These procedures are mostly in conformity with the EU EIA Directive.

Since the installed capacities of Kopru, Menge and Yamanli II HEPP projects of ENERJISA are greater than 50 MW, the projects are in the scope of Annex I which covers the projects requiring EIA Report according to the EIA Regulation, which was published on December 16, 2003. An EIA Report was also prepared for the capacity increase in Kavsak Bendi HEPP Project in accordance with the EIA Regulation, which was published on July 17, 2008. EIA reports of these four projects have been prepared by DOKAY. Since the threshold for installed capacity in Annex I was decreased to 25 MW in the EIA Regulation dated July 17, 2008, an EIA Report was prepared for Dogancay Weir and HEPP Project. An EIA Report for Kusakli Weir and HEPP is being prepared.

Water Pollution Control Regulation (Official Gazette dated December 31, 2004 and numbered 25687) (amended by the regulation issued in the Official Gazette dated February 13, 2008 and numbered 26786)

Water Pollution Control Regulation (WPCR) provides legal and technical foundations required for the determination of water pollution control in order to protect the surface and groundwater resources of the country and to ensure their optimum use within the best manner. Article 5 of this regulation particularly gives information on river basin plans and basin protection plans.

“Article 5 – Basin plans are prepared by DSI with related institutions in order to determine whether the existing water quality of inland waters are appropriate for intended water utilization. A basin protection plan is required to be prepared for protection, pollution prevention and remediation of inland waters quality considering the characteristics of the basin as well. As a result of the basin protection plan, a long term protection program and protective measures will be determined. It is obligatory to follow the resultant protection plan. The MoEF will prepare the basin protection plan or/and ensure its preparation with the involvement of related institutions”.

Draft Strategic Environmental Assessment Regulation (by MoEF)

This regulation is in the list of legislation envisaged to be enacted in the year 2007 of Turkish National Programme for the Adoption of the Acquis (NAAP), Chapter 27. However, according to the interview conducted with Havva Ozkir (Office Manager in Planning and Strategic EIA Department, General Directorate of EIA and Planning) the draft SEA Regulation will be enacted in 2010 and will cover the environmental assessment of plans and programs subject to the approval of a public authority and enabling public participation in this process. Public institutions, which draw up master plans, physical plans, sectoral plans and programs within the scope of this regulation, will be included. The basin master plans which are related to the development of HEPPs in these basins will be in the scope of this regulation.

National Laws and Regulations Related to the Environmental Impacts of the Projects

The laws and regulations mentioned below, include the national legal requirements to reduce environmental impacts that may occur during construction and operation activities of the hydropower projects.

- Environmental Law numbered 2872,
- Turkish EIA Regulation (Official Gazette dated July 17, 2008 and numbered 26939),
- Air Quality Control Regulation (Official Gazette dated November 02, 1986 and numbered 19269),
- Regulation on Control of Industrial Air Pollution (Official Gazette dated July 03, 2009 and numbered 27277),
- Water Pollution Control Regulation (Official Gazette dated December 31, 2004 and numbered 25687) (amended by the regulation issued in the Official Gazette dated February 13, 2008 and numbered 26786),
- Regulation on Assessment and Management of Environmental Noise (Official Gazette dated June 04, 2010 and numbered 27601),
- Regulation on Control of Excavation Material, Construction and Demolition Wastes (Official Gazette dated March 18, 2004 and numbered 25406),

- Solid Waste Control Regulation (Official Gazette dated March 14, 1991 and numbered 20814),
- Regulation on Control of Waste Oils (Official Gazette dated January 21, 2004 and numbered 25353),
- Regulation on Control of Used Batteries and Accumulators (Official Gazette dated August 31, 2004 and numbered 25569),
- Regulation on Control of Packaging Material Wastes (Official Gazette dated June 24, 2007 and numbered 26562),
- Hazardous Wastes Control Regulation (Official Gazette dated March 14, 2005 and numbered 25755),
- Soil Pollution Control Regulation (Official Gazette dated May 31, 2005 and numbered 25831),
- Guideline on Production, Import, Transportation, Preservation, Storage, Sale, Use, Disposal and Control of the Explosive Materials (Official Gazette dated September 29, 1987 and numbered 19589),
- Forest Law numbered 6831, amended by the law numbered 5192,
- Regulation Related to Protection and Utilization of Farmlands (Official Gazette dated March 25, 2005 and numbered 25766),
- Law on Protection of Cultural and Natural Assets (Law Numbered 2863 with Amendment by Law Numbered 5226),
- Regulation on Occupational Health and Safety (Official Gazette dated February 11, 1974 and numbered 14765),
- Regulation on Health and Safety in Constructive Works (Official Gazette dated December 23, 2003 and numbered 25325).

3.2 EU Environmental Legislation and International Commitments

Environmental Impact Assessment (EIA) Directive (97/11/EC) (amending Directive 85/337/EEC)

The EIA Directive on the assessment of the effects of certain public and private projects on the environment was introduced in 1985 (85/337/EEC) and was amended in 1997 (97/11/EC). The EIA procedure ensures that environmental consequences of projects are identified and assessed before authorisation is given. The public can give its opinion and all results are taken into account in the authorisation procedure of the project. The public is informed of the decision afterwards (URL 5, Website of European Commission (EC), 2008).

The EIA Directive outlines which project categories shall be made subject to an EIA, which procedure shall be followed and the content of the assessment. The projects of ENERJISA proposed in Seyhan Basin are HEPPs listed in Annex II of this directive and therefore requires an EIA according to this directive.

Strategic Environmental Assessment (SEA) Directive (2001/42/EC)

The purpose of the SEA Directive is to ensure that environmental consequences of certain plans and programmes are identified and assessed during their preparation and before their adoption. The public and environmental authorities can give their opinion and all results are integrated and taken into account in the course of the planning procedure. After the adoption of the plan or programme the public is informed about the decision and the way in which it was made. In the case of likely transboundary significant effects the affected Member State and its public are informed and have the possibility to make comments which are also integrated into the national decision making process. (URL 6, Website of EC, 2008)

Article 3(2) states that an environmental assessment shall be carried out for all plans and programmes which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning or land use and which set the framework for future development consent of projects listed in Annexes I and II of EIA Directive. The projects of ENERJISA in Seyhan Basin are HEPPs listed in Annex II of EIA Directive. These projects are among the components of Seyhan Basin master plan which is subject to an assessment in accordance with EU Directive on SEA.

Water Framework Directive (WFD) Directive (2000/60/EC)

The purpose of the Water Framework Directive (WFD) is to establish a legal framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater across Europe and ensure its long-term, sustainable use.

The directive establishes an innovative approach for water management based on river basins, the natural geographical and hydrological units and sets specific deadlines for Member States to protect aquatic ecosystems. The directive addresses inland surface waters, transitional waters, coastal waters and groundwater, and it establishes innovative principles for water management, including public participation in planning and economic approaches, including the recovery of the cost of water services.

One of the aims of the WFD is to ensure that by 2015 all of Europe's water bodies are of good ecological quality. In order to achieve this Article 4(3) of the directive allows Member States to designate some of their surface waters as heavily modified water bodies or artificial water bodies whereby they will need to meet the corresponding quality criteria required. They will need to meet the "good ecological potential" criterion for these ecosystems rather than "good ecological status". However, artificial and heavily modified bodies will still need to achieve the same low level of chemical contamination as other water bodies.

The final decisions will be included in the river basin management plans Member States must prepare for 2009. These plans will contain the measures Member States will implement in order to meet the directive's 2015 objectives, which include ensuring the good chemical status and good ecological potential of all artificial and heavily modified bodies of water.

Subsequent management plans must be prepared every six years. These will review whether the designations are still necessary in light of the steps some Member States are taking to restore the natural state of heavily modified water bodies such as reopening some of rivers' flood plains.

4. ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE

4.1 Introduction

This chapter is a brief summary of basin-wide existing environmental and socio-economic features of the affected environment such as topographical features, meteorological conditions, geological and hydrological characteristics, ecology, demographic characteristics, educational background, public infrastructure and means of livelihoods. Much of the information has come from the individual EIAs from the ENERJISA projects, supplemented by literature searches, DSI master plans and internet sources.

Seyhan Basin lies between latitudes 36° 30' - 39° 15' N and longitudes 34° 45' - 37° 00' E in the east of Mediterranean and Middle Anatolia. It covers an area of 20,731 km². The main part of the basin lies within Adana and Kayseri provinces.

Seyhan Basin can be examined separately as Upper and Lower Seyhan Basins. Upper Seyhan Basin lies in the northern part of the imaginary borderline passing through the elevations of 490 m on Zamanti River and 525 m on Goksu River. The southern part of this imaginary borderline up to Mediterranean Sea is called Lower Seyhan Basin.

4.2 Geology and Soil

4.2.1 Geology

Upper Seyhan Basin has a complicated geological structure. Early Cambrian aged deposit of sandstone-siltstone-quartzite-limestone is widely observed near proposed Feke Dam and its vicinity. There are deposits of Middle Cambrian aged limestones, Late Cambrian-Ordovician aged shale-siltstone, Early Devonian aged sandstone-shale-limestone near Feke District. Besides, Middle Devonian aged limestone- Dolomitic limestone deposits cover a wide range of area between Feke, Saimbeyli and Tufanbeyli Districts.

Late Devonian aged deposit of shale-sandstone-quartzite outcrops widely near Feke District and Ademi Settlement. Early Carboniferous aged deposit of clayed limestone-sandstone-graphitic shale-limestone is observed in the valley of Asmaca Creek, Belen Village and near vicinity. Permian aged limestone outcrops near Feke District and Kazikli Village. Early Triassic aged deposit of claystone-marn-sandstone-limestone is observed in the Zamanti Valley at the south of Tatlar Settlement, in the Goksu Valley at the south of Kazikli Village and at the east of Saimbeyli District. The Late Triassic-Early Cretaceous aged limestone outcrops widely throughout the Zamanti and Goksu valleys. This formation which is commonly observed in Divrik Mountain and Aladag, is a typical

component of the karstic topography. Late Cretaceous aged limestone extends from Kup Settlement through the east direction.

Miocene-aged deposit of conglomerate-limestone-sandstone-marn-siltstone is observed widely at the north of Kazikli Village and extends along the Goksu River to the south.

Volcanites and Pliocene aged formations cover a large area in the Zamanti Valley extending from Gumusoren Village through the upstream parts of the river. Quaternary aged volcanites generally cover the Pliocene aged clasts in the Zamanti valley.

In the CIA Study Area, permeability is an important concern in the Zamanti and Goksu valleys. The heights of Gumusoren, Goktas, Feke and Indere dams have been determined in a way that the permeable formations will not be left under the water level. This problem leads to the run-of-river solutions for most of the HEPP projects instead of dams along Zamanti and Goksu rivers.

In the lower part of the basin which is called Lower Seyhan Basin, the geological formations from Cambrian to Devonian period are widely observed. Permian Carboniferous and Mesozoic aged formations lie through the southwest direction and more young deposits follow these formations in the south direction. This deposit has been interrupted by the tectonic movements along the south direction. Claystone, shale, quartzite, ophiolitic rocks and limestone are observed in the basin of Zamanti and Goksu rivers depending on the stratigraphic distribution. Slope stability and water runoff problems due to carstic characteristics are the main issues to take into consideration for the site selection of dams in Lower Seyhan Basin (Upper and Lower Seyhan Basin Master Plans, DSI).

A general Geological Map of the CIA Study Area in Seyhan Basin is presented in Appendix-A.

According to the Map of Earthquake Zones of Turkey prepared by the Ministry of Public Works and Settlement (General Directorate of Disaster Affairs, Earthquake Research Department), CIA Study Area is classified as 3rd and 4th degree earthquake zones. There is not any epicenter in the CIA Study Area. Map of Earthquake Zones of Turkey is presented in Appendix-B.

4.2.2 Soils

The general soil structure of the Seyhan Basin is mainly composed of rough and rocky red Mediterranean soils as well as red or brown Mediterranean and alluvial soils. Along Goksu Valley, alluvial deposits only exist in places where major tributaries join Goksu River. The alluvial soil formation from the point where Goksu River joins Zamanti

River to Gumusoren Dam and HEPP project site is similar to Goksu Valley. On the other hand, alluvial deposits with a width of 100 m and thickness of 6-7 m are observed in the upper sections of Zamanti Valley (Upper Seyhan Basin Master Plan, DSI)

4.3 Topography and Geomorphology

The Seyhan Basin is surrounded by the Middle Taurus Mountain system comprising the Tecer Mountains (elevation:1,600 m) in the north, the Tahtali Mountains (elevation: 3,075 m) in the east, and the Melendiz and Bolkar mountains (elevation: 3,524 m) in the west. There is no significant lake formation in the basin but there are reservoirs of Seyhan and Catalan dams as artificial lakes. The rivers generally flow through steep valleys and gorges.

Upper Seyhan Basin has a mountainous topography. Tahtali Mountains cross the basin in south-north east direction. Flat areas lie mostly in Uzunyayla in the north and those areas located at an elevation of 1,500 m. Besides, there are flat areas lying along valleys through which Zamanti and Goksu river flow.

4.4 Land Use and Areas of Interest

Although there is no specific information about the land use in the CIA Study Area, the data for the districts of Adana and Kayseri Provinces which lie within the borders of the CIA Study Area can be used in order to give an overall idea on this issue. Table 4-1 presents the distribution of lands in the districts within the CIA Study Area.

Table 4-1. Land Use in the Districts within the CIA Study Area

District	Total Area (ha)	Agricultural Land (ha)	Forests and Scrublands (ha)	Grassland and Pasture (ha)	Other Lands (ha)
ADANA PROVINCE					
Feke	133,500	14,200	92,773	5,000	21,527
Saimbeyli	113,200	11,700	69,547	11,700	20,253
Kozan	169,000	60,320	98,707	1,770	8,203
Aladağ	138,000	7,800	85,794	1,600	42,806
Imamoglu	42,400	34,750	6,897	250	503
TOTAL	596,100	128,770	353,718	20,320	93,292
Percentage	100	21.6	59.4	3.40	15,6
KAYSERİ PROVINCE					
Pinarbasi	283,326	116,768	17,850	121,463	27,245
Develi	202,931	113,083	12,010	48,798	29,040
Yahyali	156,716	51,964	21,870	45,182	37,700
TOTAL	642,973	281,815	51,730	215,443	93,985
Percentage	100	43.8	8.1	33.5	14.6

Source: Adana Provincial Environmental Performance Report, 2006

Kayseri Provincial Environmental Performance Report, 2006

Adana and Kayseri Provinces exhibit very different land-use characteristics with forests and scrublands dominating the districts of Adana Province occupying more than half the land area, while Kayseri is much more open with agricultural land and grasslands and pastures accounting for more three-quarters of the Province.

4.5 Meteorological Conditions

To provide an overview of the meteorological conditions of the CIA Study Area in the Seyhan Basin, the long term meteorological data recorded at Tufanbeyli and Kozan Meteorological Stations of Turkish State Meteorological Service (SMS) have been analyzed. General information on these meteorological stations is presented in Table 4-2.

Table 4-2. General Information on Meteorological Stations

Tufanbeyli Meteorological Station	
Record Period	1986 - 2004
Latitude	38.16
Longitude	36.13
Height	1350 m
Kozan Meteorological Station	
Record Period	1975-2005
Latitude	37.27
Longitude	35.49
Height	11 m

4.5.1 Climate

The climatic conditions in the CIA Study Area display transition characteristics between the Mediterranean climate and continental climate of the Central Anatolia Region. A Mediterranean climate dominates in the Lower Seyhan Basin whereas a continental climate is observed in the Upper Seyhan Basin where most of the projects are located. Characteristics of the Mediterranean climate are hot and dry summers, cool and rainy winters. Because the Taurus Mountains traverse the middle Seyhan Basin, the Lower Seyhan Basin is not affected by northern winds. Therefore, the summers are quite hot.

4.5.2 Temperature

According to the data recorded in Tufanbeyli Meteorological Station, annual average temperature is 9.9 °C, maximum and minimum temperatures are 37 °C and – 27.8°C, respectively. On the other hand, the highest temperature recorded in Kozan Meteorological Station is 44.8 °C while the lowest temperature is -5.0°C. Monthly Temperature Values Recorded in Tufanbeyli and Kozan Meteorological Stations are presented in Figure 4-1 and 4-2, respectively.

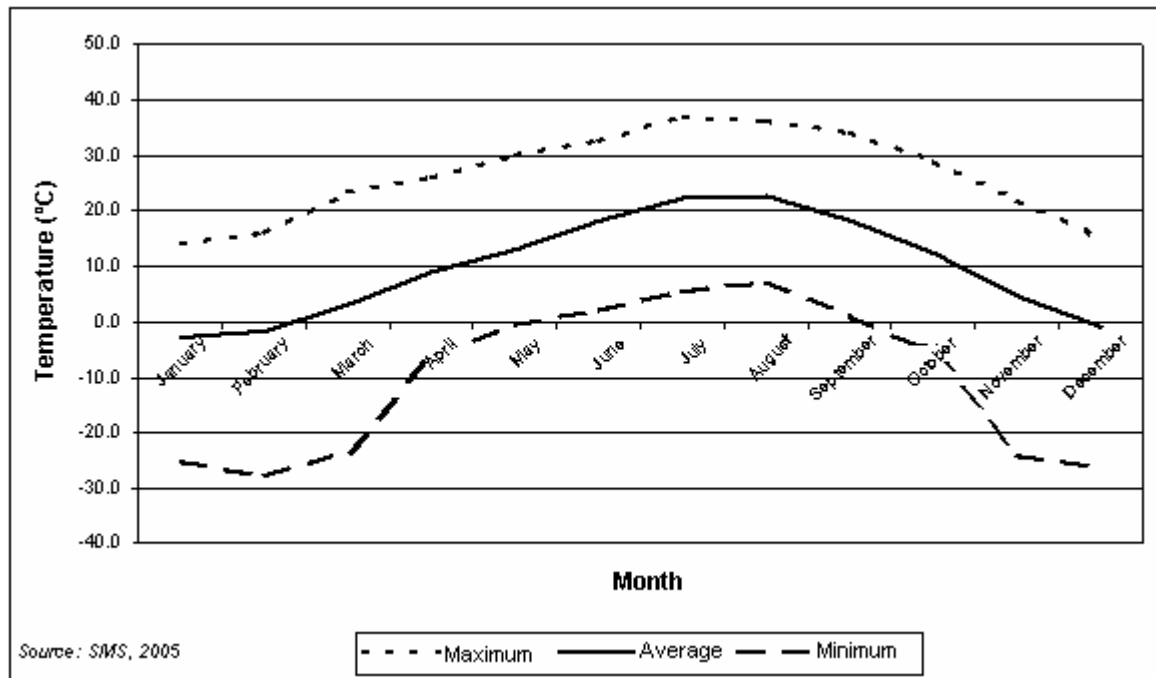


Figure 4-1. Monthly Temperature Values Recorded in Tufanbeyli Meteorological Station (1986-2004)

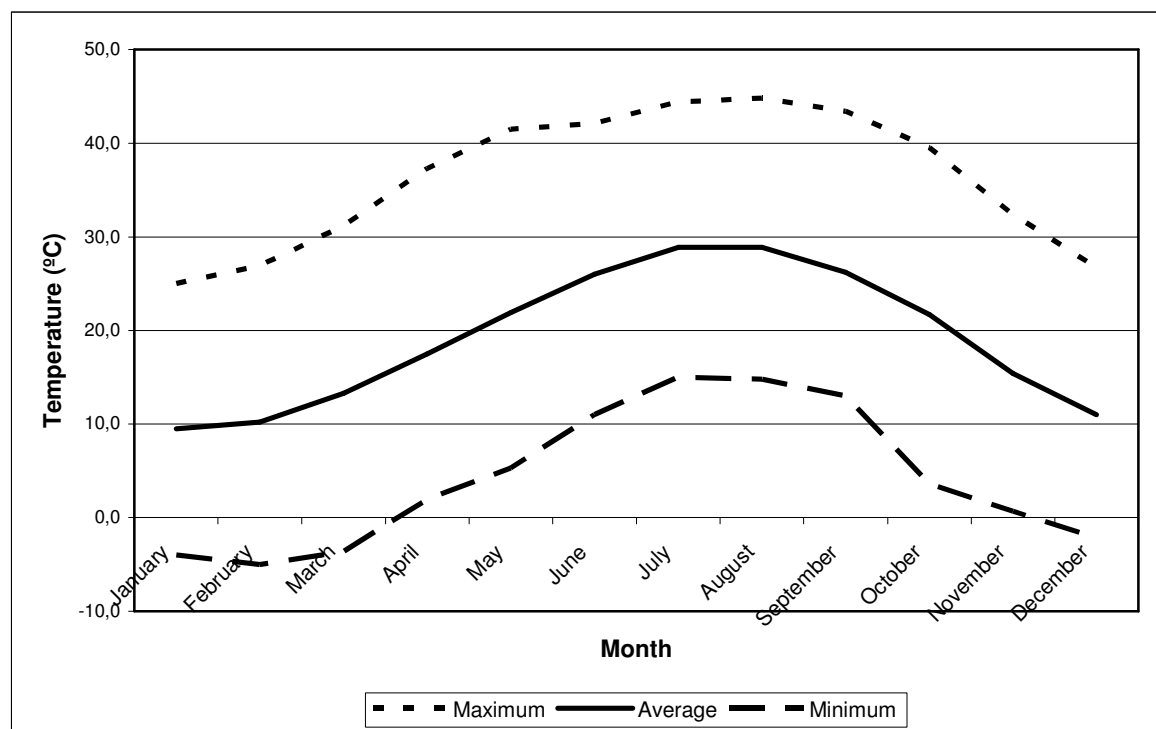


Figure 4-2. Monthly Temperature Values Recorded in Kozan Meteorological Station (1975-2005)

4.5.3 Precipitation

Precipitation is generally in the form of rain and hail, and observed in the autumn, winter and spring seasons. Precipitation data recorded in Tufanbeyli Meteorological Station reveals that the amount of average total annual precipitation is 562.1 mm.

Maximum precipitation is observed during winter times. The precipitation data recorded by Kozan Meteorological Station reveals that the amount of average total annual precipitation is 851.7 mm. The highest amount of precipitation is observed in fall season. Figure 4-3. and Figure 4-4 present the monthly precipitation amount recorded in Tufanbeyli and Kozan Meteorological Stations, respectively.

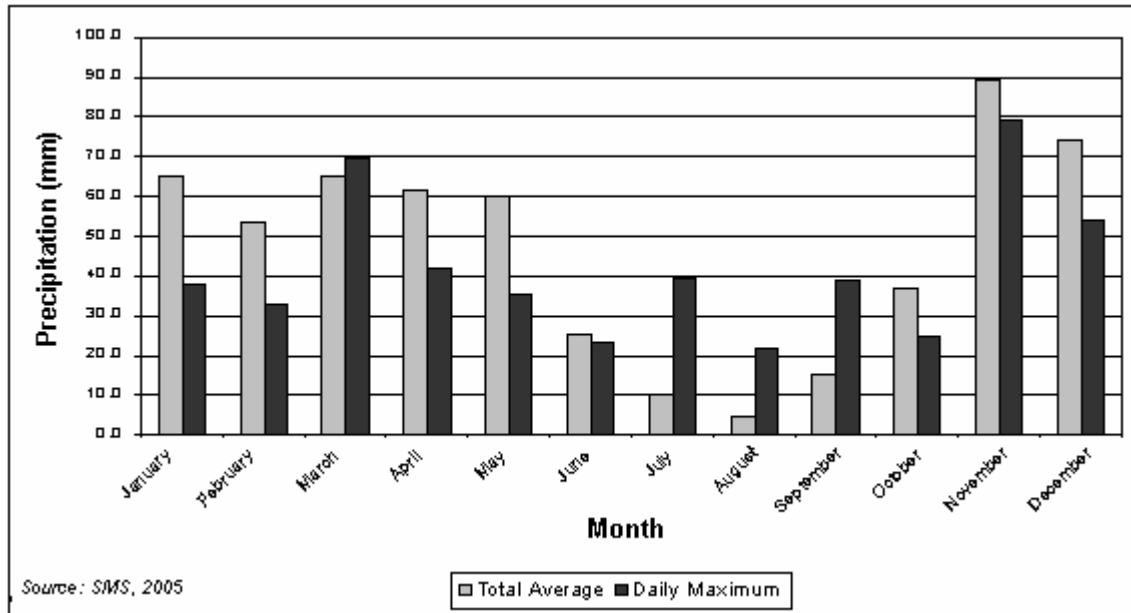


Figure 4-3. Monthly Precipitation Values Recorded in Tufanbeyli Meteorological Station (1986-2004)

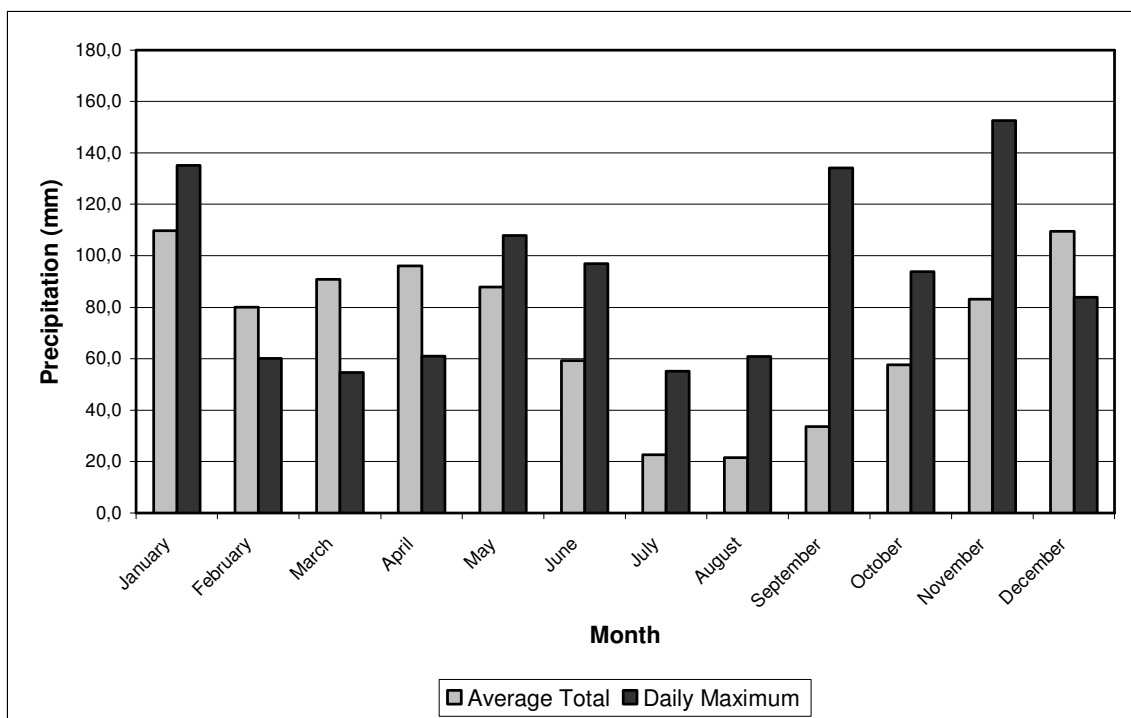


Figure 4-4. Monthly Precipitation Values Recorded in Kozan Meteorological Station (1975-2005)

4.5.4 Wind

According to the records of Tufanbeyli Meteorological Station, prevailing wind directions are north and northeast in winter times, south in March and September, and southwest in June, July and August. The winds in the direction of north and northeast are dry and do not cause rainfall. However these winds decrease the air temperature considerably in winter times. On the other hand, according to Kozan Meteorological Station, prevailing wind direction of the region is north-northwest with an average speed of 3.3 m/s. In addition, annual average wind speed of the region is 2.0 m/s and average number of stormy days is 4.1.

4.6 Hydrology, Hydrogeology and Water Resources

4.6.1 Hydrology

The Seyhan River is 495 km long and drains a basin 20,450 km². The Zamanti River which is one of its main tributaries is 306 km long from the source to the confluence with the Goksu River. The Zamanti drains an area of 8,748 km². The length of Goksu River, the other main tributary of the Seyhan River is 199 km in length and drains an area of 4,300 km².

The annual flow rates of the Zamanti and Goksu rivers are 1,347 million cubic metres and 310.41 million cubic metres, respectively. Maximum flow rates in the Goksu River occur in March-April at around 19.5 and 24.9 m³/sec.

4.6.2 Hydrogeology

The groundwater resources in the region where the Seyhan Lowland lies have a potential of 500 million m³/year. Around 140 million cubic metres of this amount is being used annually. Tufanbeyli District which is in the borders of the CIA Study Area has a safe potential of 14 hm³/year. The groundwater resources in the CIA Study Area and their total discharge potential are given in Table 4-3 below.

Table 4-3. Groundwater Discharges in the CIA Study Area

District	Discharge Potential
Feke	22 L/sec
Aladag	65 L/sec
Kozan	460 L/sec
Saimbeyli	1700 L/sec

There is a geothermal water resource near Haruniye, Adana. Its temperature is 33°C, and its flow rate is 10 L/sec.

4.6.3 Water Resources

Seyhan River and its two main tributaries, Goksu and Zamanti rivers, are the major surface water resources in the CIA Study Area. The reservoir of Bahcelik Dam located on Zamanti River is used for irrigation of the nearby agricultural lands of 49,033 ha. Besides, approximately 100 million cubic metres of water will be withdrawn from Zamanti River within the Gicik (Zamanti) Weir and HEPP Project which is expected to be in operation at the end of 2008. Around 52,000 ha area in the Develi Lowland will be irrigated within this project.

4.7 Ecology

4.7.1 Protected Areas and Sites of Recognised Conservation Value

Global 200: Priority Areas for Conservation

WWF has identified nearly 825 terrestrial ecoregions and 426 freshwater ecoregions across the Earth. According to the WWF, an ecoregion is defined as a "*relatively large unit of land or water containing a characteristic set of natural communities that share a large majority of their species, dynamics, and environmental conditions*" (URL 7, Official Website of World Wildlife Fund, 2008). Among the ecoregions identified by WWF, "the Global 200" is selected as those ecoregions most crucial to the conservation of global biodiversity. The Global 200 list actually contains 238 ecoregions, made up of 142 terrestrial, 53 freshwater, and 43 marine ecoregions. The Global 200 map of Turkey is presented in Appendix –C. According to the map, there are two features in the CIA Study Area in Seyhan Basin.

Terrestrial feature is the "*The Mediterranean Forests, Woodlands, and Scrub (123)*". This ecoregion covers parts of Southern Europe, Northern Africa, western Near East, and Asia Minor and its conservation status is identified as critical/endangered. This ecoregion is one of only five shrublands of its kind, which support 20 percent of the plant species on Earth. The species that live in this ecoregion are very different from each other, and many can not be found anywhere else. This Global 200 ecoregion is made up of terrestrial ecoregions such as Southern Anatolian montane conifer and deciduous forests (PA1220), Central Anatolian deciduous forests (PA0410) and Eastern Anatolian deciduous forests (PA0420) which will be discussed in the subsequent sections.

Freshwater feature in the CIA Study Area is the "*Anatolian Freshwater (195)*". This ecoregion covers the Eastern Mediterranean in Syria and Turkey and its conservation status is identified as critical/endangered. The aquatic habitats of this ecoregion support 20 species and 10 subspecies of endemic fish, a number of which are of conservation concern. Lakes in this ecoregion are an important habitat for migrating waterbirds. (URL 8, National Geographic, Wild World, 2008).

Endemic Bird Areas (EBAs)

BirdLife International which is a global partnership of conservation organisations that strives to conserve birds and their habitats, has identified nearly 218 regions as Endemic Bird Areas (EBAs) which are relatively rich in endemic bird species compared to other parts of the world. According to the search database for EBAs of Birdlife, there are no EBAs in Turkey except for the Caucasus EBA which extends from the southern Russian Federation, through Georgia and Armenia into north-west Iran including north-east Turkey and northern and western Azerbaijan (URL 9, Official Website of Birdlife International, 2008)

Important Bird Areas (IBAs)

The European Important Bird Area (IBA) Programme is implemented through national IBA Programmes in 29 countries with the support and co-ordination of the European Division of the BirdLife Secretariat. The IBAs in Turkey have identified by the Society for the Protection of Nature and BirdLife International. According to the search database of BirdLife for IBAs, there are nearly 130 IBAs in Turkey. Among them, Aladaglar IBA which is a part of Aladaglar Key Biodiversity Area (see Figure 4-5), lies within the borders of the CIA Study Area.

The selection criteria of the site is B2 which means the site supports species with an unfavourable conservation status. The site qualifies for its breeding population of Caspian Snowcock (*Tetraogallus caspius*), Lammergeir (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*) and Golden Eagle (*Aquila chrysaetos*) (Magnin, G. and Yazar, M., 1997). Although some of the projects under construction and/or planned lie within the IBA and KBA, they have been deemed not likely to cause adverse impacts since the projects are located in the valley bottoms and the key bird species listed all frequent the high mountain tops.

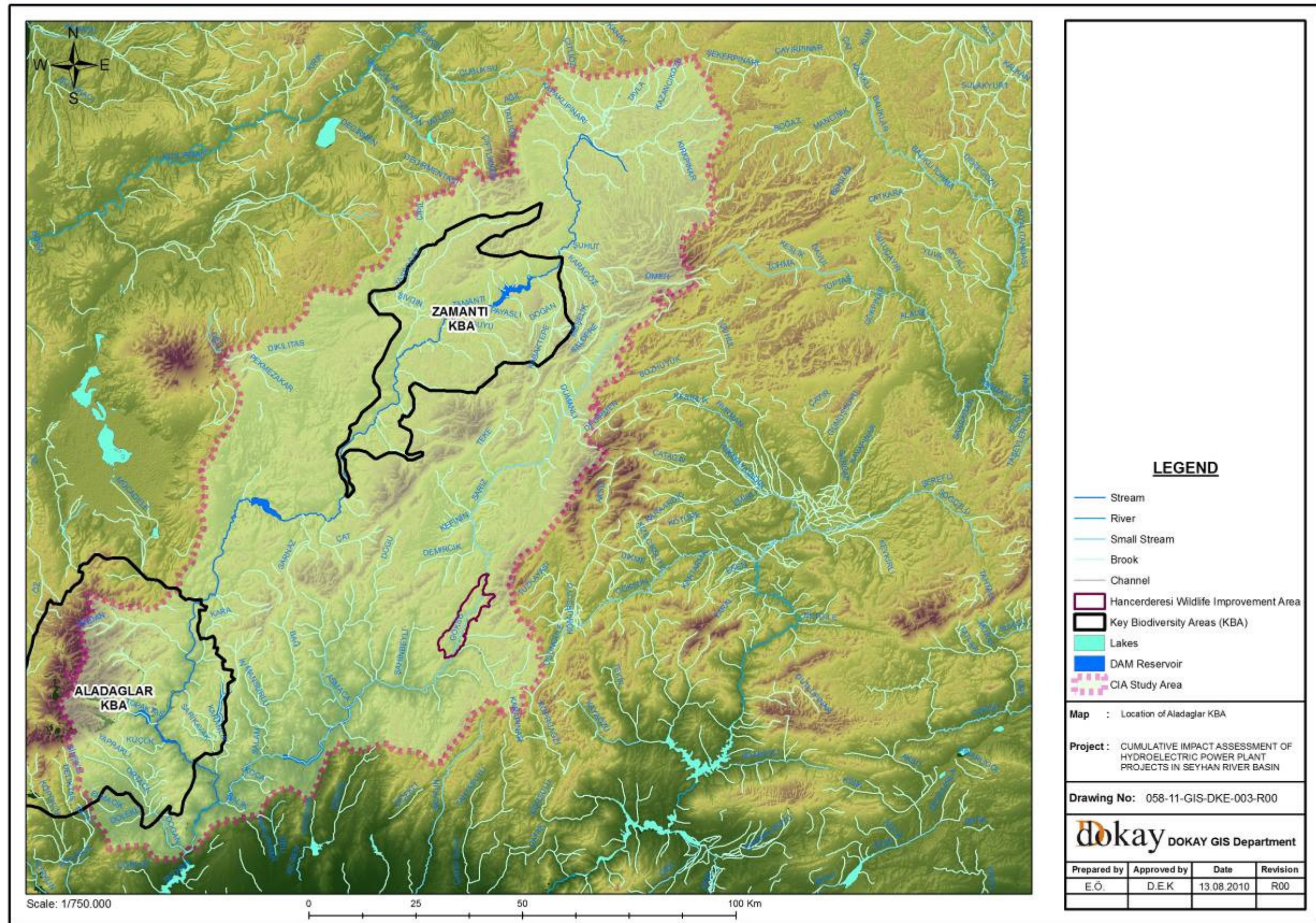


Figure 4-5. Location of Aladaglar KBA

Key Biodiversity Areas

Key Biodiversity Areas (KBAs) are places of international importance for the conservation of biodiversity at the global level. The concept of KBAs has been developed by a coalition of biodiversity conservation organisations including BirdLife International, Conservation International, and PlantLife International. Recently, a global initiative named "*The Alliance for Zero Extinction*" (AZE) (translated as "*Sıfır Yok Oluş*" in Turkish) has been launched to identify and protect the last remaining habitats which are KBAs for the world's most threatened species.

According to the book "*Key Biodiversity Areas of Turkey*" (Doga Dernegi, 2008), there are two Key Biodiversity Areas (KBAs) within the borders of CIA Study Area. These are Aladaglar and Zamanti KBAs – see Figure 4-5.

Aladaglar KBA which includes some part of the Zamanti River, is located in the south of the CIA Study Area. The KBA has a national park, a wildlife improvement area and an IBA within its borders. The other KBA, namely Zamanti, is located in the north of the CIA Study Area, and includes a part of the Zamanti River within its borders. Unlike Aladaglar KBA, there is no official protection for any part of the Zamanti KBA.

Wildlife Improvement Area

Wildlife Improvements Areas in Turkey are one of the protected areas determined by the Ministry of Environment and Forestry in accordance with the Terrestrial Hunting Law numbered 4915. The transmission tunnel to be constructed within the Yamanli II HEPP project lies within the borders of Hancerderesi Wildlife Improvement Area – see Figure 4-5. The site, which was determined by the Cabinet Decree (issued in the Official Gazette dated October 5, 2006 and numbered 26310), is a protected area for the wild goat (*Capra aegagrus*). However, the wildlife in this site will not be affected because the construction of transmission tunnel will be carried out underground.

4.7.2 Threatened, Protected and Endemic Species

Within the scope of the EIA process carried out for the ENERJISA HEPP project sites, inventories of the flora and fauna have been prepared. These inventories include plants, fish, amphibians, reptiles, birds and mammals. Not all of the species have been observed in the CIA Study Area, but these are included because of their high probability of existence within the CIA Study Area as a result of a literature search. Most of the species involved in these lists are either unclassified or classified as Lower Risk/Least Concern in accordance with the categories identified by the International Union for Conservation of Nature (IUCN) Red List (2007).

A survey of fish in the river basin commissioned by ENERJISA was undertaken in August 2008 by Prof. Dr. Füsün Erk'akan of Hacettepe University. According to this field study, *Alburnus orontis* inhabiting Seyhan and Ceyhan Basin (including Goksu River on which ENERJISA projects are proposed), is a fish species classified as Endangered (EN) in IUCN Red List (2007). Population density of this species is medium level in the Seyhan River Basin. This species prefers fast flowing water in order to breed and then they return to standing water. However, it was observed during the field study that, this species is well-adapted to standing water and prefers to spawn in the shallow, clean and vegetation habitats in the river. According to the study carried out by Dr. Erk'akan, when the HEPPs are constructed, this species will migrate to the tributaries discharging into reservoirs in order to breed. Then they will pass from one tributary to another through the littoral zones of the reservoirs, so gene flow will continue among the populations of this species which are living in these tributaries.

In addition to *Alburnus orontis*, there are three other fish species determined during the field study, namely *Oxyinoemacheilus (Schistura) samantica (O. samantica)*, *Paracobitis (Barbatula) seyhanensis (P. seyhanensis)* and *Salmo platycephalus* inhabiting only Zamanti River.

O. samantica and *P. seyhanensis* are classified as endangered species (EN) in IUCN Red List (2007). However, these species inhabitate the upper parts of Zamanti River between the elevations of 1,800 and 2,200 m. On the other hand, *Salmo platycephalus* which is a species classified as critically endangered (CR) in IUCN Red List (2007), restricted to the upper tributaries of Zamanti River (Soguksu, Karagoz and Gumusgun Creeks). It should be noted that none of ENERJISA project was proposed on Zamanti River. Although there are other HEPPs under construction or approved projects on Zamanti River, the elevations of these projects are lower than 1,400 m. Therefore, according to the study carried out by Dr. Erk'akan, *O. samantica*, *P. seyhanensis* and *Salmo platycephalus* will not be affected from these projects.

Besides the five species of globally-threatened fish, five other species listed by the IUCN as Vulnerable occur within the CIA Study Area – see Table 4-4. In addition, according to the literature search, five near-threatened species are also believed to occur in the CIA Study Area.

Table 4-4. Threatened Species in the CIA Study Area

Family	Scientific Name	Common Name	Red List 2007 Category*
FISH			
BALITORIDAE	<i>Orthias tschayssuensis</i>	Ray-finned fish	VU
CYPRINIDAE	<i>Alburnus orontis</i>	Bleak	EN
NEMACHEILIDAE	<i>Paracobitis seyhanensis</i>	Stone loach	EN
	<i>Oxyneomacheilus samantica</i>	Stone loach	EN
SALMONIDAE	<i>Salmo platycephalus</i>	Brown Trout	CR
REPTILES			
TESTUDINIDAE	<i>Testudo graeca</i>	Common Tortoise	VU
BIRDS			
ACCIPITRIDAE	<i>Aquila heliaca</i>	Eastern Imperial Eagle	VU
	<i>Aquila clanga</i>	Greater Spotted Eagle	VU
FALCONIDAE	<i>Falco naumanni</i>	Lesser Kestrel	VU
MAMMALS			
RHINOLOPHIDAE	<i>Rhinolophus hipposideros</i>	Lesser Horseshoe Bat	VU

Source: URL 10: Official Website of IUCN Red List

Critically Endangered (CR) - A taxon is Critically Endangered when it is considered to be facing an extremely high risk of extinction in the wild.

Endangered (EN) – A taxon is Endangered when the best available evidence indicates that it is considered to be facing a very high risk of extinction in the wild (defined detailed criteria are applied).

VULNERABLE (VU) - A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future (defined detailed criteria are applied).

EU Bird Directive

The Birds Directive (more formally known as Council Directive 79/409/EEC on the conservation of wild birds) is a European Union directive adopted in 1979. It is one of the EU's two directives in relation to wildlife and nature conservation, the other being the Habitats Directive. The species mentioned in Annex I of this directive shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. Lammergeir (*Gypaetus barbatus*), Eurasian Griffon Vulture (*Gyps fulvus*) and Golden Eagle (*Aquila chrysaetos*) which are protected in Aladaglar IBA, are listed in Annex I of this directive. These species are extremely unlikely to be affected by the HEPPs proposed in the CIA Study Area because they are high mountain species.

4.7.3 Vegetation Communities and Flora

The CIA Study Area includes three different ecoregions as defined by WWF (see Appendix D). These ecoregions are Southern Anatolian montane conifer and deciduous forests (PA1220), Central Anatolian deciduous forests (PA0410) and Eastern Anatolian deciduous forests (PA0420). Detailed flora inventories are included in the EIA reports prepared by DOKAY for the ENERJISA projects.

Southern Anatolian montane conifer and deciduous forests (PA1220)

This ecoregion lies at elevations of up to more than 3,000 m. Most of it lies in Turkey, extending up and down the rocky slopes and deep canyons of the Taurus Mountains. The conservation status of this ecoregion is *Critical/Endangered*. Project sites of all four HEPPs proposed by ENERJISA lie in this ecoregion, but the critical/endangered habitats are not believed to be at risk since most of the habitat in the area of the proposed projects is already degraded by millennia of human use. Furthermore landscape afforestation and forest replacement activities will be carried out. Within this ecoregion, coniferous, deciduous and alpine forests are the main vegetation formations. Most of the forests are coniferous, comprised of Anatolian black pine (*Pinus nigra*), Cedar of Lebanon (*Cedrus libani*), Taurus fir (*Abies cilicica*), and juniper (*Juniperus foetidissima* and *J. excelsa*) (URL 11, Terrestrial Ecoregions, 2008).

Central Anatolian deciduous forests (PA0410)

In the Central Anatolian Deciduous Forests ecoregion whose conservation status is *Vulnerable*, dominant tree species are the cherry, hazelnut, and walnut. A major part of the Zamanti River Basin lies within this ecoregion. Throughout the high plateaus and mountains of this ecoregion, the rugged landscape is dappled with brilliant yellow patches of Turkey oak trees in the fall (URL 11, Terrestrial Ecoregions, 2008). It appears that little of these forest types are along the Goksu River valley..

Eastern Anatolian deciduous forests (PA0420)

This ecoregion lies in Turkey at the western end of the Eastern Anatolian Mountains. A small portion of this ecoregion lies within the eastern end of the CIA Study Area. Large areas of deciduous scrub, open forest, and treeless steppe represent the remains of the original forest habitat. The conservation status of this ecoregion is determined as *Vulnerable*. (URL 11, Terrestrial Ecoregions, 2008).

4.7.4 Aquatic Fauna

Freshwater Ecoregions of the World (FEOW) is a collaborative project supported by WWF and the Nature Conservancy providing the first global biogeographic regionalization of the Earth's freshwater biodiversity, and synthesizing biodiversity and threat data for the resulting ecoregions (URL 14, FEOW, 2008). According to the FEOW map, the CIA Study Area lies within the Southern Anatolia freshwater ecoregion (432). Major habitat type in this ecoregion is temperate coastal rivers. The map of freshwater fish species richness indicates that the number of freshwater fish species is between 67-101. In addition, the number of amphibians in this ecoregion is estimated to be around 11-20 and none of them is identified to be endemic.

As a result of the survey carried out by Prof. Dr. Füsün Erk'akan from Hacettepe University, 31 species and 1 subspecies belonging to 9 families have been determined in the CIA Study Area. According to this study, *Salmo platycephalus*, *Alburnus adanensis*, *Pseudophoxinus zekayi*, *Oxynoemacheilus samanticus*, *Paracobitis seyhanensis*, *Schistura seyhanicola* and *Schistura evreni* are endemic species for Turkish freshwaters. Additionally, *O. samanticus*, *P. seyhanensis* and *Alburnus orontis* are categorized as endangered species and *S. platycephalus* is classified as critically endangered species in IUCN Red List (2007).

4.7.5 Terrestrial Fauna

As a result of literature research, 16 reptiles, 153 birds and 18 mammal species and sub-species are determined likely to be present in the CIA Study Area. The fauna inventory for each ENERJISA project has been presented in its EIA.

4.8 Landscape

The Goksu and Zamanti valleys in which the HEPP projects will be constructed are generally narrow and steep valleys with fast flowing rivers. The valleys and their near vicinity are composed of steep limestone mountains covered with scrub woodlands not higher than 6 m. The flora communities in the region are conifer species namely, juniper and red pine. There are arable land in the valley bottoms.

4.9 Archaeological, Historical and Cultural Resources

Although there are no archaeological, historical and cultural assets in the close vicinity of Kavsak Bendi and Menge HEPP projects, some archaeological sites are present near Yamanli II HEPP project site. These sites, identified by the Law on Protection of Cultural and Natural Assets numbered 2863, are given below:

- Kaleboynu Castle (400 m from Yamanli II 1st Stage HEPP)
- Karakuyu Caves (600 m from Yamanli II 2nd Stage HEPP)
- Karakuyu Necropolis (2.7 km from M1 Quarry)
- Hocabey Necropolis (1.1 km from Hocabey Weir)
- Karakuyu Mausoleum (2.7 km from M1 Quarry)

Since these areas do not overlap with the project site of Yamanli II HEPP, the General Directorate of Cultural Assets and Museums approved the project provided that the necessary mitigation measures will be taken during the construction phase of the Project. Besides, there is a historical bridge near Kopru Dam and HEPP project. The bridge will not be inundated and will not be affected from the construction activities. The related governmental institution has also approved the construction of this project on condition that necessary measures are taken.

All the archaeological and historical sites in the CIA Study Area, the closest projects and the distances are presented in Table 4-5 below. Because of the distances, these sites listed below are not expected to be affected negatively from the projects.

Table 4-5. Archaeological and Historical Sites in the CIA Study Area

Province	District	Name	Location	Type	Distance from the Closest Project
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Karakuyu Village Kepen Area	Archeological Site	Yamanli III Weir 4.6 km
Adana	Saimbeyli	Relics (1 st and 3 rd degree Archeological Site)	Tulu Town Huseyinbelen Neighborhood	Relic	Saimbeyli Weir 1 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Avcipinar Village (Village Entrance)	Relic	Yamanli I HEPP 7.2 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Himmetli Village Oren Area	Relic	Saimbeyli Weir 2.1 km
Adana	Saimbeyli	Relics (3 rd degree Archeological Site)	Ceralan Village Hoyhoybileni Area	Relic	Yamanli I HEPP 23 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Avcipinar Village Karincalitepe Area	Relic	Yamanli I HEPP 7 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Catak Village Duzbag Area	Relic	Saimbeyli Weir 10.5 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Ayvaci Village Center	Relic	Yamanli III Weir 8.3 km
Adana	Saimbeyli	Relics (3 rd degree Archeological Site)	Civikli Village Aksu Neighborhood Masatlik Area	Relic	Yamanli III HEPP 4.5 km
Adana	Saimbeyli	Relics (1 st degree Archeological Site)	Beypinari Village Kuzuluk Area	Relic	Yamanli I Weir 6.5 km
Adana	Tufanbeyli	Church relic (1 st degree Archeological Site)	Ortakoy Village	Relic	Yamanli II (1 st Stage) 22 km
Adana	Tufanbeyli	Necropolis (1 st and 3 rd degree Archeological Site)	Sarkoy Village	Necropolis	Yamanli II (1 st Stage) 36.5 km
Kayseri	Pinarbasi	Sivritepe Tumulus (1 st degree Archeological Site)	Pazarsu Village Tepeustu Area	Tumulus	Bahcelik Dam & HEPP 57 km
Kayseri	Pinarbasi	Tumulus (1 st degree Archeological Site)	Asagiborandere	Tumulus	Yamanli I Weir 25.5 km
Kayseri	Pinarbasi	Cemetery and Kirkgecit Village Settlement (1 st degree Archeological Site)	Hilmiye Koyu	Cemetery	Bahcelik Dam & HEPP 38.5 km
Kayseri	Pinarbasi	Tumulus (1 st degree Archeological Site)	Bestepeler Area	Tumulus	Bahcelik Dam & HEPP 13 km
Kayseri	Pinarbasi	Gurbettepe Tumulus (1 st degree Archeological Site)	Melikgazi Village	Tumulus	Bahcelik Dam & HEPP 8 km
Kayseri	Sariz	Tumulus (1 st and 3 rd degree Archeological Site)	Yesilkent Town	Tumulus	Bahcelik Dam & HEPP 28.5 km

Province	District	Name	Location	Type	Distance from the Closest Project
Kayseri	Sariz	Settlement (1 st degree Archeological Site)	Karapinar Village Angitligol Area	Settlement	Bahcelik Dam & HEPP 26.5 km
Kayseri	Sariz	Relics (3 rd degree Archeological Site)	Mirzaga Village	Relic	Yamanli I Weir 27.5 km
Kayseri	Sariz	Settlement (3 rd degree Archeological Site)	Kurudere Village Cagla Hill	Settlement	Yamanli I Weir 24 km
Kayseri	Sariz	Tumulus (1 st degree Archeological Site)	Bahceli Neighborhood	Tumulus	Bahcelik Dam & HEPP 28.5 km
Kayseri	Sariz	Tavla Tumulus	Tavla Village (Village Entrance)	Tumulus	Yamanli I Weir 35 km
Kayseri	Sariz	Tumulus (1 st degree Archeological Site)	Karapinar Village	Tumulus	Bahcelik Dam & HEPP 26.5 km
Kayseri	Sariz	Daridere Tumulus (1 st degree Archeological Site)	Daridere Village	Tumulus	Bahcelik Dam & HEPP 31 km
Kayseri	Sariz	Tuztasi Necropolis (1 st degree Archeological Site)	Altisogut Village	Necropolis	Bahcelik Dam & HEPP 31 km
Kayseri	Sariz	Yunak Tasi Settlement Area	Kuscu Village, Yunak Tasi Hamlet	Ruin	Bahcelik Dam & HEPP 28 km
Kayseri	Tomarza	Rock Settlement and Necropolis (1 st degree Archeological Site)	Dadaloglu Town	Necropolis	Bahcelik Dam & HEPP 24.2 km
Kayseri	Tomarza	Necropolis (1 st degree Archeological Site)	Tomarza	Necropolis	Gumusoren Dam & HEPP 27 km

4.10 Socio-Economic Characteristics

The CIA Study Area includes Saimbeyli, Feke, Kozan, Aladağ and İmamoğlu districts of Adana Province, and Pınarbaşı, Develi and Yahyalı districts of Kayseri Province. Adana, located in Lower Seyhan Basin, is one of the large provinces of Turkey due to high agricultural and industrial activities. However, Upper Seyhan Basin is not a densely populated area with rather small settlements of Kayseri Province.

Following the implementation of the Baku-Tbilisi-Ceyhan (BTC) Pipeline, the economic importance of the region has increased considerably, since the crude oil extracted in Azerbaijan is being delivered to Ceyhan via this pipeline and sold subsequently to the world markets. There is considerable potential for socio-economic development in the region as a result.

Other socio-economic characteristics of these provinces and districts are presented in the following subparagraphs.

4.10.1 Settlements and Demographics

According to the results of the latest Population Census carried out by the Turkish Statistical Institute (TUIK) in the year 2000, the total population of Adana Province is 1,849,478. Adana is the fifth largest province of Turkey in terms of population making up 2.7% of the country's population. The annual growth rate for 1990-2000 period is 0.17% which is close to that of the average for Turkey (0.18%). The ratio of males and females is almost equal within the total population. The median age of the population is around 23.6 indicating a young population structure. The urban population makes up 75.6 of the total population in Adana whereas that of rural population is 24.4%. The population density of 133 people/km² is considerably higher than the Turkish average of 88 people/km². The mean size of households is 4.7. The fertility level of the Province has decreased over time – the total fertility rate (TFR) being 3.32 in 1980 and 2.68 in 2000. The TFR is slightly higher than the average for Turkey (TFR: 2.53). The mean age at childbearing is 28.2. 71% of the population are Adana-born and there is no difference on the basis of gender. Among those born outside, the majority were born in Şanlıurfa (2.5%) and Mardin (2.4%).

According to the results of the same census, the population of Kayseri Province is 1,060,432. The annual growth rate for 1990-2000 period is 0.12% which is lower than that of the country's average (0.18%). The population of the province makes up 1.6% of the country's population. Again the ratio of males to females is almost equal. The median age of the population is around 24.5, again indicating a young population structure. The urban population in Kayseri is 69.1%, lower than that in Adana, while the rural population is 30.9%. The population density of 62 people/km² is lower than the country's average of 88 people/km² and the mean size of households is 5.5. The fertility level of the Province has decreased over time being 3.73 in 1980 and 2.62 in 2000. The TFR is slightly higher than the average for Turkey (TFR: 2.53). The mean age at childbearing is 27.3. 81% of the population are Kayseri-born and there is not any difference on the basis of sex. Among those born outside, the majority were born in Sivas (3.2%) and Yozgat (2.6%).

Basic demographic indicators of the Provinces and districts located in the CIA Study Area are presented in Table 4-6. The population of the CIA Study Area is 385,338 and population is distributed equally by urban-rural breakdown. The population densities of the districts in the CIA Study Area are lower than the province averages except that of Imamoglu District (153 people/km²) which is higher than the average of Adana Province (133 people/km²). While Imamoğlu (Adana) has the highest annual growth rate, Pınarbaşı (Kayseri) has the lowest figure.

Table 4-6. Basic Demographic Indicators of the Provinces and Districts located in the CIA Study Area

Settlement	Total Population	Urban Population	Ratio of Urban Population (%)	Population Density	Annual Growth Rate ‰
Adana Province	1,849,478	1,397,853	75.58	133	
Kayseri Province	1,060,432	732,354	69.06	62	
<u>CIA Study Area</u>	385,338	192,589	49.98	-	-
<i>Saimbeyli (Adana)</i>	<i>17,149</i>	<i>5,198</i>	<i>30.31</i>	<i>15</i>	<i>- 7.95</i>
<i>Feke (Adana)</i>	<i>20,890</i>	<i>4,632</i>	<i>22.17</i>	<i>17</i>	<i>- 7.74</i>
<i>Kozan (Adana)</i>	<i>130,875</i>	<i>75,833</i>	<i>57.94</i>	<i>70</i>	<i>12.80</i>
<i>Aladağ (Adana)</i>	<i>23,579</i>	<i>6,674</i>	<i>28.30</i>	<i>18</i>	<i>1.59</i>
<i>İmamoğlu (Adana)</i>	<i>43,361</i>	<i>30,428</i>	<i>70.17</i>	<i>153</i>	<i>17.04</i>
<i>Pınarbaşı (Kayseri)</i>	<i>35,388</i>	<i>12,075</i>	<i>34.12</i>	<i>10</i>	<i>- 30.10</i>
<i>Develi (Kayseri)</i>	<i>70,893</i>	<i>35,084</i>	<i>49.49</i>	<i>38</i>	<i>- 2.69</i>
<i>Yahyalı (Kayseri)</i>	<i>43,203</i>	<i>22,665</i>	<i>52.46</i>	<i>28</i>	<i>- 1.93</i>

4.10.2 Education

According to the results of the same population census, the literacy rate for the population aged six and over across Adana Province is 87%. Literacy varies significantly by gender with 94% of men being literate and 80% of women. The proportion of the population that has received at least primary education is 37%, and again this proportion varies by gender being 44% for males and only 29% for females.

The literacy rate in Kayseri Province is 89% being 97% for men and 86% for women respectively. The proportion of the population with at least primary education graduation is 42%, again differing by gender being 43.5% for males and only 24.1% for females.

The literacy status of province and district populations is given in Table 4-7. As indicated, 88% of the population in the CIA Study Area are literate and 37% have completed at least primary school education.

Table 4-7. Province and District Populations Aged Six and Above by Literacy

Settlement	Population *	Literate	Ratio of Literate Population (%)	Primary School Education
Adana Province	1,620,675	1,408,027	86.88	606,910
Kayseri Province	933,036	829,342	88.89	393,931
<u>CIA Study Area</u>	168,848	149,350	88.45	62,389
<i>Saimbeyli (Adana)</i>	4,711	4214	89.45	1,608
<i>Feke (Adana)</i>	4,158	3562	85.67	1,411
<i>Kozan (Adana)</i>	67,267	60,278	89.61	22283
<i>Aladağ (Adana)</i>	5,946	5,168	86.92	2,367
<i>İmamoğlu (Adana)</i>	25,685	22,597	87.98	9,906
<i>Pınarbaşı (Kayseri)</i>	10,512	9,161	87.15	3,697
<i>Develi (Kayseri)</i>	30,780	27,555	89.52	13,460
<i>Yahyalı (Kayseri)</i>	19,789	16,815	84.97	7,657

4.10.3 Livelihoods and Economics

Adana is in the center of Cukurova which is located by the rivers Ceyhan and Seyhan. The rivers have brought Seyhan, Kozan and Catalan dams to the province and these rivers have provided very fertile alluvion lands. Not only the geographic location but also the convenient climate made an advantage for the agriculture. Adana is ranked as the eighth province in Turkey in terms of socio-economic development (www.adana-to.org.tr).

In Adana Province, fertile lands make up 39% of the total area. In this regard, agriculture –cotton cultivation in particular-is the main economic activity in the region. 15% of Turkish cotton production is provided from this region. Animal husbandry, on the other hand, is not as much developed as agricultural activities since meadow and grass lands are quite few (www.adana.gov.tr). However animal husbandry is more developed than agriculture in the mountainous areas. Besides, mountain tourism is another livelihood for the people living in the highlands of Adana Province in the north.

In Kayseri Province, almost 50% of the land area is used for agriculture. However, insufficient irrigation adversely affects the fertility of the lands. Wheat is the major agricultural output, followed by barley and sugar beet. Animal husbandry is also practiced in the Province. Poultry and beekeeping are more prevalent. Industry and trade have the largest shares in the economy of the province. As a consequence of increasing investments and better infrastructure, the province has achieved a remarkable industrial growth since 2000 and has become a favourable environment especially for small and medium enterprises. Kayseri is ranked as the nineteenth province in Turkey in terms of socio-economic development (www.kayseri.gov.tr).

* Literacy level unknowns included

4.10.4 Public Infrastructure (Health, Education, Transportation)

In this section, Adana and Kayseri Environmental Performance Reports (2006) are used as references for the following information on public infrastructure.

Health: In Adana, there is a number of health institutions with varying scale. There are 2,615 beds in the hospitals which are private or belong to state social security institutions whereas the number of beds is 4,710 in state hospitals. Besides hospitals, there is a number of small medical centers called “saglik ocagi”. The number of “saglik ocagi” in Adana is 148 and nine of them are located in the districts of Adana that lie in the CIA Study Area.

There are 23 hospitals in Kayseri including a university hospital, a hospital belonging to a faculty of medicine, an oncological hospital and a dialysis centre. Besides these, there are approximately 400 small scale medical centres in the entire province, especially in small settlements and villages.

Education: In Adana, a total number of 460,318 students continue their education in 411 kindergardens, 718 primary schools, 112 elementary schools and 96 vocational and technical schools. The total number of instructors is 17,380. There is also the Cukurova University with its 10 faculties, 12 colleges, 27 research and application centres, three institutes and one conservatoire.

In Kayseri, there are 248,450 students in a total of 717 schools, ranging from kindergarden to elementary education level. Erciyes University is located in Kayseri, and there are 12 faculties and 13 colleges. A total number of 37 dormitories are in service for accommodation of university students. Besides these, there are 16 public education centres and eight apprenticeship education centres.

Transportation: In Adana, the total road length is 1,084 and this is mostly comprised of state highways and local roads connecting the districts of Adana. Some minor part of the roads in Adana is constituted by express highways, which are still being constructed. Public transportation in the city center is achieved by railway transportation and public buses with a number of 160. Railway is also utilized for transportation of goods and passengers to the neighbouring provinces. Besides these inland means of transportation, there are also ports of certain industrial establishments for transportation of raw materials and goods. There is also an airport located 3.5 km away from the city center.

The total length of roads in Kayseri Province is 4,025. Public buses and railway are utilized as means of transportation. The length of railway within the province is 216 km. There is also an airport in Kayseri which is located at 5 km distance to the city center.

4.11 Environmental Quality

In this section, the existing environmental quality will be discussed in terms of air, water and noise.

4.11.1 Air Quality

Although overall information on the existing air quality of the CIA Study Area is not available, the data recorded for the Environmental Monitoring Study carried out by DOKAY for Tufanbeyli Power Plant Project which lies within the borders of the CIA Study Area can be used on this issue. The results of measurements carried out from August, 2007 until May, 2008 are presented in Table 4-8 below. As seen from the table, all parameters are below the legal limit values.

Table 4-8. Air Quality Measurement Results for Tufanbeyli District*

Months	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)*
August (2007)	1.99	3.54	44
September (2007)	0.99	2.51	52
October (2007)	3.58	3.25	35
November (2007)	2.08	2.58	23
December (2007)	5.21	2.37	24
January (2008)	13.69	3.41	39
February (2008)	1.56	2.19	41
March (2008)	2.24	1.68	37
April (2008)	-	1.83	38
May (2008)	1.69	2.77	15
Legal Limit Values**	20	60	60

* PM₁₀ values are the averages of the measurements carried out for the villages in the vicinity of Tufanbeyli District. SO₂ and NO₂ values are results of the measurements carried out in Tufanbeyli District.

** Current legal limit values stated in Turkish Regulation on Assessment and Management of Air Quality, App-I-A. Limit values for the year 2014 were considered since construction of the projects are expected to be completed in 2014.

Source: Tufanbeyli Power Plant Project, Environmental Monitoring Study Reports, DOKAY

4.11.2 Water Quality

According to Water Pollution Control Regulation (WPCR), the quality of surface waters in Turkey is categorized in four groups. The categories are: Class I - high quality, Class II – low level pollution, Class III – medium level pollution, Class IV – high level pollution.

The water quality of the rivers in Seyhan Basin is presented in Adana Provincial Environmental Performance Report published in 2006 by Adana Provincial Directorate of Environment and Forestry. The maps of water quality in Seyhan Basin are presented in Figure 4-6 and 4-7.

In terms of organic parameters (BOD_5 , COD, TKN), the water quality of the rivers and tributaries in the Seyhan Basin is generally determined as Class II. However, the water quality rises up to Class I with the help of clean tributaries after Goksu and Zamanti joins in Egner Bridge area.

In terms of inorganic and chemical parameters (NH_3 , NO_2 and NO_3), the water quality in the first three stations on Zamanti River (upstream to downstream) is Class IV and it rises to Class II due to the tributaries and nitrogen conversion. Goksu River with a water quality of Class II joins Zamanti River. Seyhan River has a water quality of Class II until Egner Bridge but it decreases down to Class IV there on due to heavy agricultural activities.

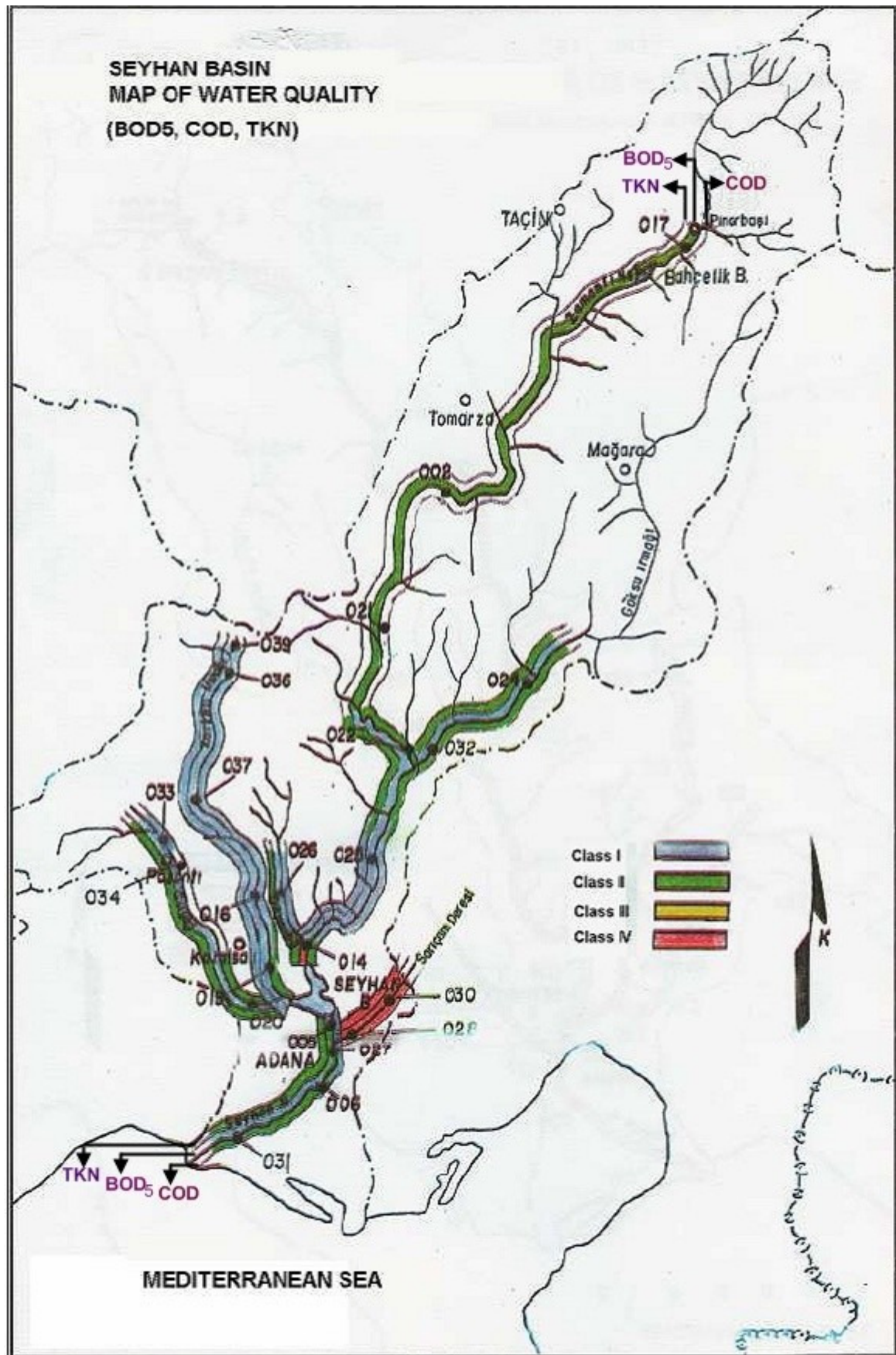


Figure 4-6. Map of Water Quality in Seyhan Basin (Organic Parameters)

Source: Adana Provincial Environmental Performance Report, 2006

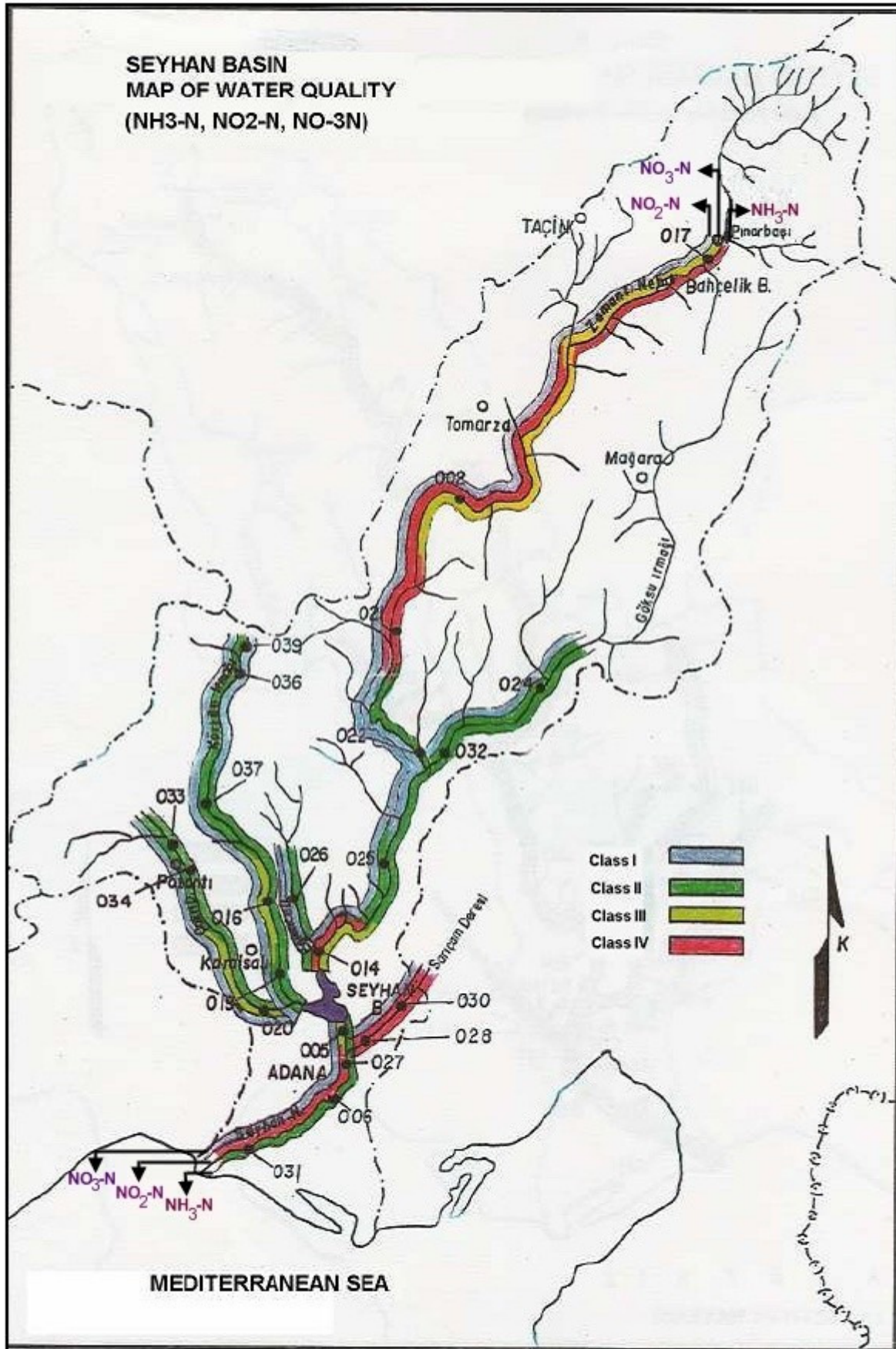


Figure 4-7. Map of Water Quality in Seyhan Basin (Inorganic -Chemical Parameters)

Source: Adana Provincial Environmental Performance Report, 2006

4.11.3 Noise

In December 2007, background noise measurements were carried out by DOKAY at the sensitive receptors in the close vicinity of Yamanli II and Kavsak Bendi HEPP project sites. The noise measurements were carried out by SVAN 949 Model Noise and Vibration measurement device and the results are presented in Acoustic Reports of Yamanli II and Kavsak Bendi HEPP Projects. Table 4-9 presents the results of noise measurements carried out in the day time.

Table 4-9. Results of Noise Measurements near Yamanli II and Kavsak Bendi HEPP Project Sites

Location	L _{max} (dBA)	L _{min} (dBA)	L _{day} (dBA)
Sensitive Receptors near Yamanli II HEPP Project Site (December, 2007)			
Kirikkuyu Settlement	63.3	48.3	53.0
Kaleboynu Village	60.9	46.6	49.7
Aksaagaç Village	69.0	52.6	57.0
Hocabey Village	62.9	46.6	54.6
Sensitive Receptors near Kavsak Bendi HEPP Project Site (December, 2007)			
Karakoyak Settlement	73.4	40.6	49.4
Gokce Village	69.3	38.4	50.1
Cirnazli Settlement	77.2	44.3	53.6

According to the Article 27 of Regulation on Assessment and Management of Environmental Noise (issued in the Official Gazette dated June 4, 2010 and numbered 27601) the L_{day} values measured in the close vicinity of the Kavsak Bendi and Yamanli II HEPP Project sites are classified as Category A (L_{day} <55 dBA) and Category B (L_{day}: 55-64 dBA). Environmental noise factor will not be given priority during the planning and permission procedures for the sites of Category A. On the other hand, the noise factor will be taken into consideration for the permission procedures for the projects to be constructed in the sites of Category B.

5. CUMULATIVE IMPACT ASSESSMENT

5.1 Methodology of Cumulative Assessment and Assumptions

The identification of environmental and social impacts of the hydro-electric power plant (HEPP) projects in the CIA Study Area is based mainly on EIA reports of ENERJISA projects. A matrix, which is presented in Table 5-1, has been used in order to assess the cumulative impacts of these projects. This matrix is based on the widely used risk assessment matrix and modified for the purpose of this CIA study.

Table 5-1. Cumulative Impact Assessment Matrix

Extent of the Impact	Severity of the Impact		
	Severe	Moderate	Mild
Wide	High	Medium	Medium
Medium	High	Medium	Low
Restricted	Medium	Low	Low

The major activities and impacts of the projects have been identified during construction and operation phases. Each impact is rated as “severe”, “moderate” or “mild” with respect to severity, and “wide”, “medium” or “restricted” with respect to extent of the impact. While the severity indicates the importance level and magnitude of the impact, the extent indicates the geographical size of the impact area. The result of the assessment which is either “high”, “medium” or “low” presents the overall significance of the cumulative impact for the projects concerned.

The assessment of cumulative impacts through Chapter 5 has been carried out considering the impacts without considering the mitigation measures for these impacts. Cumulative impacts rated as low are considered to be acceptable and mitigation measures are not deemed necessary, although they may still be undertaken to still further reduce the scale of the impacts or even negate them completely. Cumulative impacts rated as medium and high are considered to be significant and require mitigation measures which will be described in full in Chapter 6. Furthermore, some impacts are identified as “positive” since they have a beneficial aspect for the existing environmental or socio-economic conditions.

In addition, the accumulation pathways of the cumulative impacts will be used for the assessment. While some impacts of multiple projects accumulate in an “additive” manner, some impacts can be synergistic. These impacts which are termed “interactive” impacts interact to produce a total impact greater than the sum of the individual impacts. For instance, environmental impacts that can accumulate in an additive manner include those such as changes in water temperature or concentrations of dissolved gases, erosion, sedimentation, and habitat losses. On the other hand, the synergistic pathway

allows for interactions among multiple impacts through processes such as bioaccumulation. For example, aquatic organisms may be exposed to pulses of pollutants for longer periods of time in an impoundment than in a free flowing river, thus increasing the potential for the bioaccumulation of contaminants. Where a HEPP has a number of effects, the potential for interaction among them can lead to cumulative impacts along this pathway (Cumulative Effects Assessment in the Moose River Basin – Background Literature Review, 1998). In this respect, the impacts resulting from the HEPPs in the CIA Study Area will be categorized as additive or interactive.

The assessment of cumulative impacts is presented in separate sections for construction and operation phases of the HEPPs in the CIA Study Area. For each phase, impacts on physical, biological and socio-economic environment will be assessed separately. Similarly, in each case the projects are categorized into three groups namely, ENERJISA projects, projects under construction or completely approved and finally planned or predicted projects. These groups of projects will be assessed within three Scenarios, namely Scenario A, B and C.

“Scenario A” are ENERJISA projects, whereas “Scenario B” are ENERJISA projects plus HEPPs under construction or completely approved. Finally, “Scenario C” are ENERJISA projects plus HEPPs under construction or completely approved plus planned projects.

Detailed information on these three groups projects in the CIA Study Area is presented in Table 5-2. All are HEPPs; unlike the neighbouring Ceyhan river basin, there are no large-scale irrigation developments planned for the Seyhan Basin.

Table 5-2. Projects Proposed in the CIA Study Area

Project	River	Length of the River Reach Impounded or Diverted ⁽¹⁾ (km)	Percent of the Total Length of River System (%)	Surface Area of the Reservoir (km ²)
Yamanli II Weir and HEPP	Goksu	1 st Stage : 8.2 2 nd Stage: 5.4	1.52 1.00	-
Menge Dam and HEPP	Goksu	14.3	2.65	2.67
Kusakli Weir and HEPP	Goksu	-	0	-
Kopru Dam and HEPP	Goksu	14.8	2.75	2.93
Kavsak Bendi Dam and HEPP	Seyhan	11.0	2.04	2.0
Dogancay Weir and HEPP	Dogan	10.0	1.86	
Total of ENERJISA Projects (Scenario A)		63.7	11.82	7.6
Gumusoren Dam and HEPP	Zamanti	11.6	2.15	10.0 ⁽²⁾
Gicik (Zamanti) Weir and HEPP	Zamanti	1.9	0.35	-
Camlica II Weir	Zamanti	10.7	1.99	-
Camlica III Weir and HEPP	Zamanti	3.9	0.72	-
Indere Dam and HEPP	Zamanti	11	2.04	2.5 ⁽²⁾
Goktas Dam and HEPP	Zamanti	18.2	3.38	6.0 ⁽²⁾
Saritepe Weir and HEPP	Asmaca	1.2	0.22	-
Feki I Weir and HEPP	Goksu	10.0 ⁽³⁾	1.86	
Feki II Dam and HEPP	Goksu	14.5	2.69	2.5 ⁽²⁾
Yamanli III Weir and HEPP	Goksu	14.4	2.67	-
Kilicli I Weir and HEPP	Taslik	10.0 ⁽³⁾	1.86	
Kilicli II Weir and HEPP	Taslik	10.0 ⁽³⁾	1.86	
Maran HEPP	Salam	10.0 ⁽³⁾	1.86	
Kiy HEPP	Salam	10.0 ⁽³⁾	1.86	
Total of HEPP under construction and completely approved projects		137.4	25.49	21
Total of Scenario B		201.1	37.31	28.6
Tatlar Weir and HEPP	Zamanti	9.0	1.67	-
Topaktas Dam and HEPP	Zamanti	6.3	1.17	0.5 ⁽²⁾
Yamanli I Weir and HEPP	Goksu	19	3.53	-
Total of Planned Projects		34.3	6.36	0.5
Grand Total (Scenario C)		175.4	43.67	29.1
Total Length of Goksu, Zamanti, Seyhan and Dogan Rivers in the CIA Study Area		539	-	-
Total CIA Study Area		-	-	13,048

⁽¹⁾ The values represents the length of impounded portion of the river if the project is HEPP with a dam; or diverted portion of the river if the project is un-of-river HEPP.

⁽²⁾ Since the reservoir surface area of these projects are not available, the values are estimated from the similar projects comparing their dam heights and reservoir volumes.

⁽³⁾ Since information about new projects constructed by private companies is not available, length of diverted section of river is assumed to be 10 km considering the average diversion length for all the projects.

Beside these projects, there are two HEPPs which are already operating in the CIA Study Area namely, Bahcelik Dam and HEPP and Camlica I Weir and HEPP. These will be included in the cumulative impact assessment only during operation phase, since the construction of these HEPPs has already been completed.

In order to carry out a basin-wide cumulative impact assessment, some assumptions have been made when dealing with the other projects that are not proposed by ENERJISA due to lack of detailed technical information on these projects. These assumptions will be presented in the subsequent sections separately for the construction and operation phases.

5.2 Summary of Identified Impacts of Proposed ENERJISA Projects

ENERJISA projects are assessed within Scenario A whose general layout is presented in Figure 5-2. The key cumulative impacts in priority order are:

- There is no high significance cumulative impact on physical, biological or socio-economic environment associated with the construction phase.
- There will be impact on vegetation communities, flora and terrestrial fauna resulting from site preparation, excavation and construction of project facilities. The cumulative impact level is rated as low because the extent of the impact is restricted and the severity is moderate.
- The cumulative impact of air emissions, liquid effluents and solid wastes resulting from construction activities is rated as low because the extent of the impact is restricted and the severity is moderate.
- A number of globally-threatened and endemic fish species have been identified from the Seyhan Basin, but only one is affected by the proposed ENERJISA projects. *Alburnus orontis* is classified by IUCN as Endangered, but empirical evidence shows that it survives in lakes as long as it can access fast flowing rivers for spawning. As a result, it is not considered to be impacted by the proposed ENERJISA projects..
- Akdam and Yamanli Transmission Line Corridor are determined taking into consideration of protected areas, archeological sites, major and minor settlements as well as topography in the CIA Study Area (see Figure 2-1). In this respect, there will be no significant impact on biological environment.
- There will be no loss of historic, cultural or aesthetic features during construction.
- The most significant socio-economic impacts during operation phase will result from the loss of private property such as agricultural lands and displacement of

people due to project-related land acquisition and subsequent inundation. Since Yamanli II, Kusakli and Dogancay are run-of-river HEPP, inundation will not occur and people will not be displaced. On the other hand, a few dwellings will be displaced and expropriation will be carried out for Kopru, Menge and Kavsak Bendi HEPP projects.

- The HEPPs with dams, namely Menge, Kopru and Kavsak Bendi, will cause a change of flow regime from a river to a lake system. This change will lead to sediment reduction and change of water quality in the downstream of the dam during operation phase. Besides, the riverbed downstream of the dams will be deteriorated due to sediment reduction.

Detailed assessment of the cumulative impacts resulting from ENERJISA projects during construction and operation phases are assessed within the Scenario A and presented in sections 5.5 and 5.6.

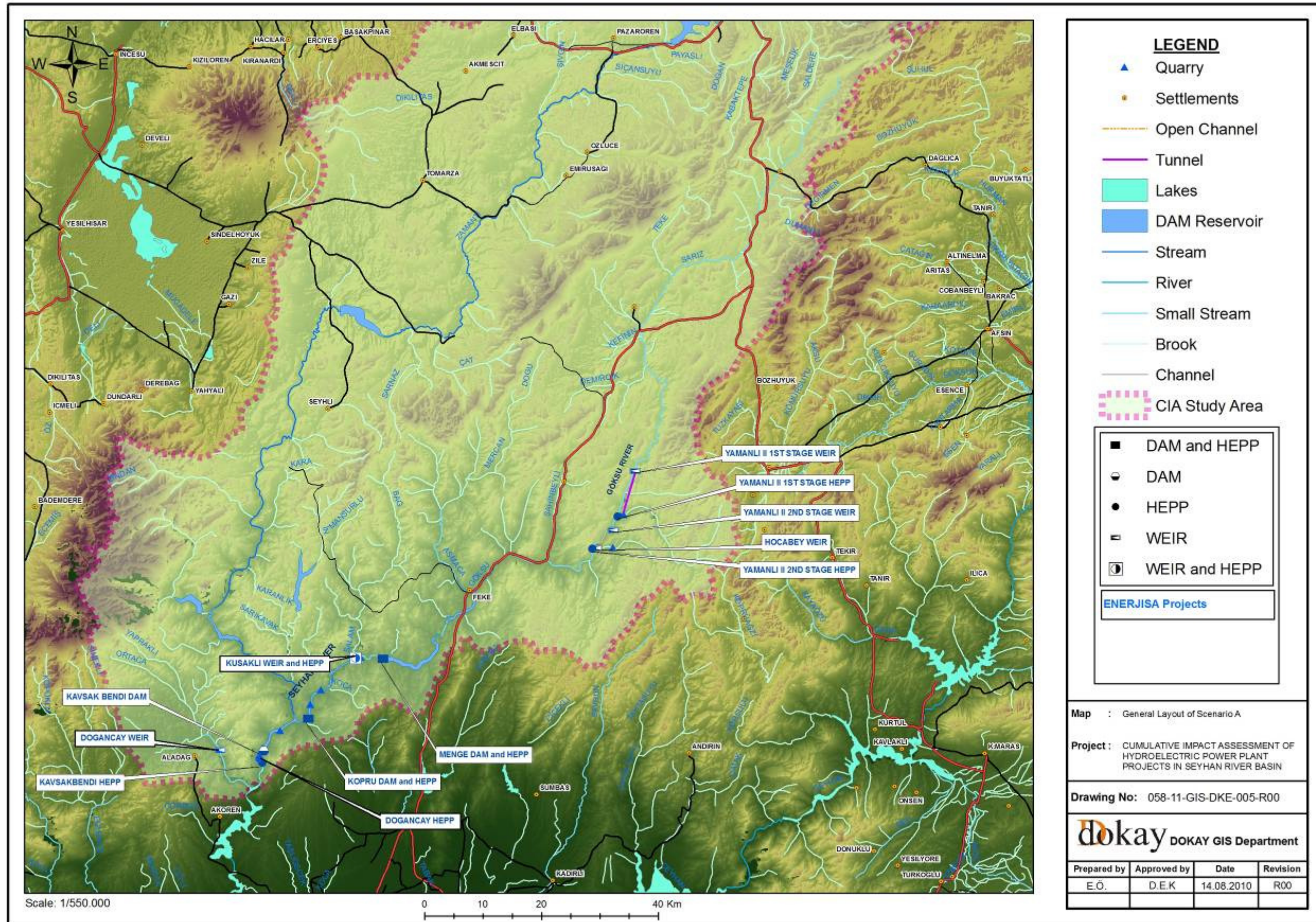


Figure 5-1. General Layout of Scenario A

5.3 Summary of Projected Impacts of Other Projects Under Construction or Completely Approved

In addition to ENERJISA projects, there are a number of HEPPs within the Seyhan basin already under construction or completely approved projects whose construction phase will start in the near future. Therefore, to develop a worst-case Scenario, it has been assumed that the construction phases of all these projects overlap. As a result, the projects given below are included for the assessment of cumulative impacts in the CIA Study Area.

Under Construction:

- Gıcık (Zamanti) Weir and HEPP
- Feke-II Dam and HEPP
- Saritepe Weir and HEPP
- Goktas Dam and I-II HEPP
- Indere Dam and HEPP
- Yamanli III Weir and HEPP
- Camlica III Weir and HEPP
- Kilicli-I Weir and HEPP
- Kilicli-II Weir and HEPP
- Feke-I Weir and HEPP
- Maran HEPP
- Kiy HEPP

Final Design Phase:

- Gumusoren Dam and HEPP

While ENERJISA projects are located along the Goksu and Seyhan rivers; Gumusoren HEPP is proposed for the Zamanti River and its tributaries. Feke-II Dam and HEPP which is already being built is located at the upstream of the Menge Dam and HEPP project of ENERJISA while Kilicli-I, Kilicli-II, Maran and Kiy HEPPs are located in the tributaries of Goksu River at the upstream of Menge Dam and HEPP. Among these HEPPs Gumusoren and Goktas HEPPs are large projects in terms of geographic scale and energy production when compared with other projects. Although the annual energy production of Gumusoren HEPP is 12 GWh, its reservoir volume is 216.9 hm³ since it is also an irrigation purpose project. Goktas HEPP, on the other hand, has a reservoir volume of 133.34 hm³ and an annual energy production of 1,160 GWh.

Although most of the cumulative impacts arising from these projects assessed in Scenario B are similar to those impacts presented for Scenario A, there are differences relating to threatened and endemic fish species. A fish survey undertaken as part of the CIA showed that in addition to *Alburnus orontis* (an Endangered species) there were in addition, one Critically Endangered species, two Endangered species, and four endemic

species present – all restricted to the Zamanti River and occurring mainly in the altitudinal range of 1,800-2,200m. Proposed projects on the Zamanti are all below 1,400m and hence it is predicted that these sensitive species will not be affected. The extent of all other impacts will increase because the increased number of projects cover a wider geographic area.

General layout of Scenario B is presented in Figure 5-3.

Detailed assessment of the cumulative impacts resulting from Scenario B projects during construction and operation phases will be presented in sections 5.5 and 5.6.

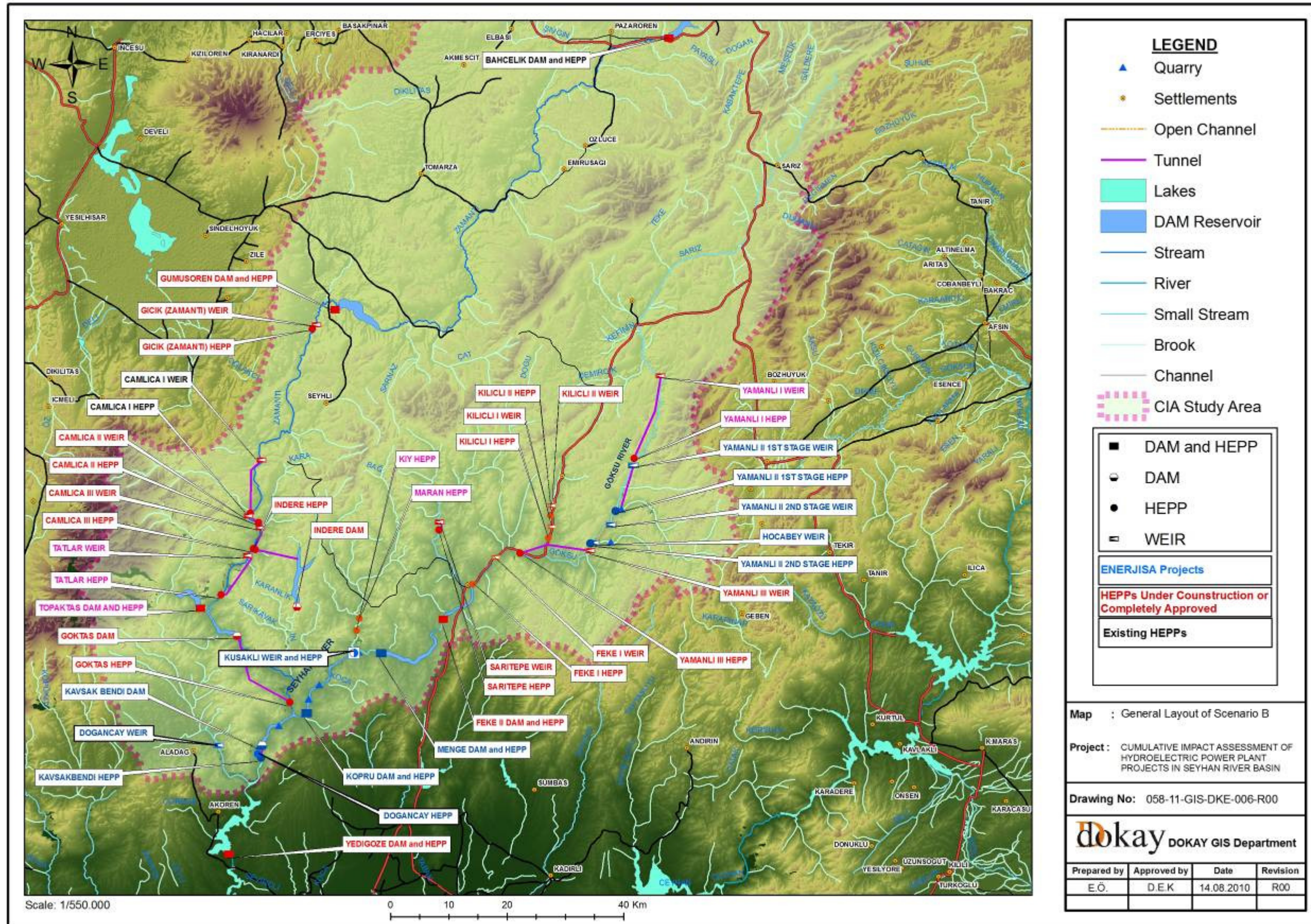


Figure 5-2. General Layout of Scenario B

5.4 Summary of Projected Impacts of Planned or Predicted Projects

In addition to those projects in Scenario B, there are some planned projects in the CIA Study Area. These projects are still in the planning phase, hence, their construction is unlikely to overlap with construction of all other projects in Scenario B. These planned projects are listed below.

- Camlica II Weir and HEPP
- Tatlar Weir and HEPP
- Topaktas Dam and HEPP
- Yamanli I Weir and HEPP
- Yamanli III Weir and HEPP

While Camlica II, Tatlar and Topaktas are cascade HEPPs proposed to be located on Zamanti River, Yamanli I and III are HEPPs planned for the Goksu River.

Planned projects have been assessed within Scenario C for the CIA study. Since the construction phases of these projects will not overlap with those projects considered under Scenario B, it is assumed that there will be no additive impacts under Scenario C beyond those already considered under Scenario B. However, these additional projects will still have individual impacts locally, and may even have additive impacts between themselves, depending upon their final construction schedules.

On the other hand, the projects in this group have been included for the assessment of cumulative impacts for operation phase, because after the construction phase, the projects in this group will be operating together with the projects mentioned under Scenario B.

General layout of Scenario C is presented in Figure 5-4.

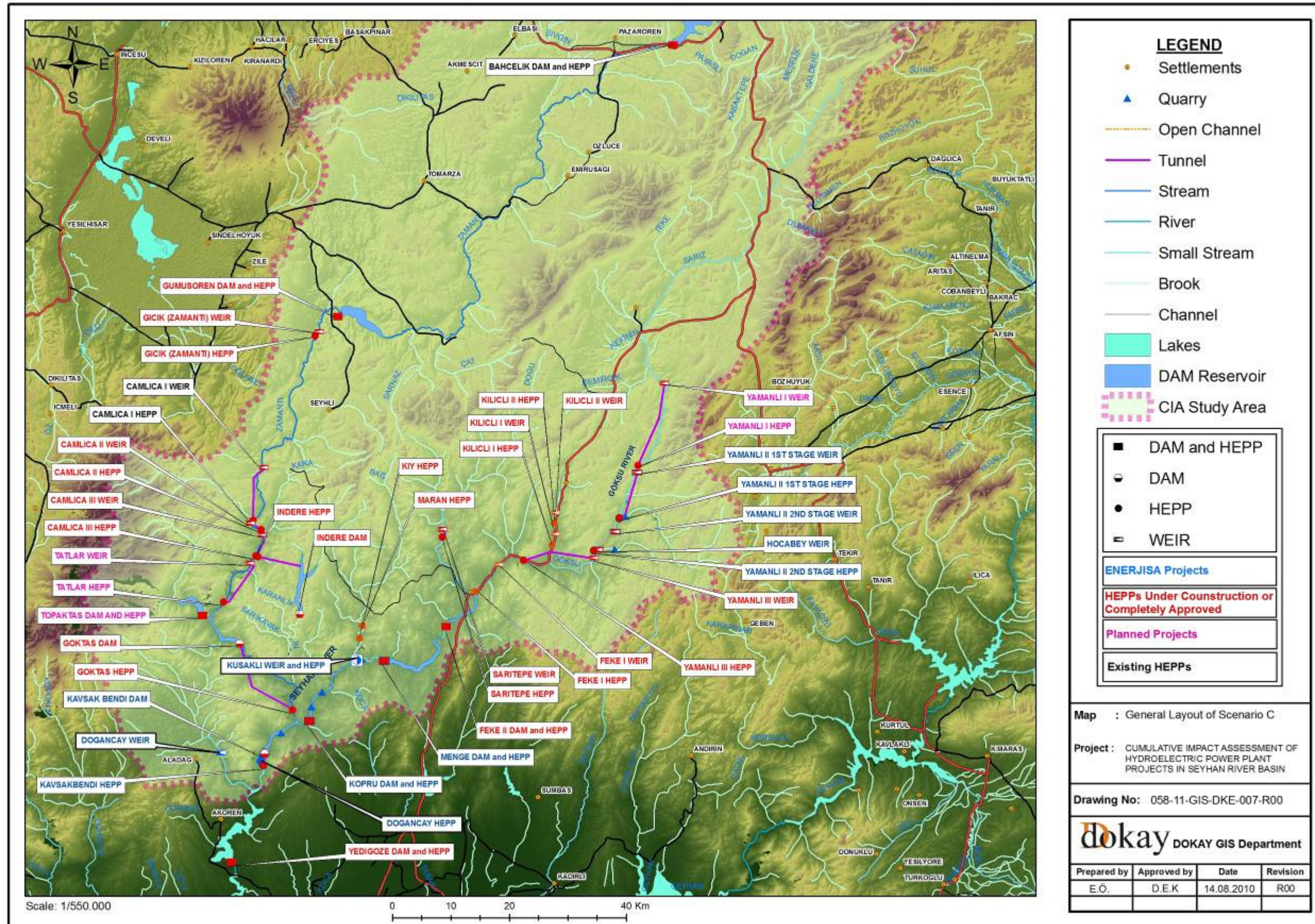


Figure 5-3. General Layout of Scenario C

5.5 Cumulative Impacts of Construction

For the identification and assessment of the potential impacts on physical, biological and socio-economic environment during construction phase of the HEPPs in the CIA Study Area, the main issues listed below have been reviewed.

- Dust and gas emissions
- Wastewater and solid waste generation
- Excavation wastes
- Noise and vibration
- Hazardous substances and wastes
- Vegetation communities and flora
- Faunal elements
- Landscape
- Historic and cultural features
- Local economic opportunities
- Land acquisition process

The cumulative impacts are assessed in accordance with the methodology and categorization described in Section 5-1. Although most of the potential impacts during the construction phase are same for both dam and reservoir HEPPs and for run-of-river type HEPPs, there will be some differences since HEPPs with reservoir are generally larger scale projects. The CIA study has been carried out in accordance with impact-oriented approach rather than the topics given in baseline characteristics of the study area presented in Chapter 4. The reason of this approach is to eliminate irrelevant topics and focus on important issues.

In order to assess the overall cumulative impacts of the ENERJISA projects on the physical environment during construction, the time schedule for the construction phase of these projects should be taken into consideration. This is presented in Figure 5-5. According to this, although construction of Yamanli II and Kusakli will start at different times, and construction of Menge, Kopru and Kavsak Bendi HEPPs have already been started, construction phases of all these projects overlap considerably.

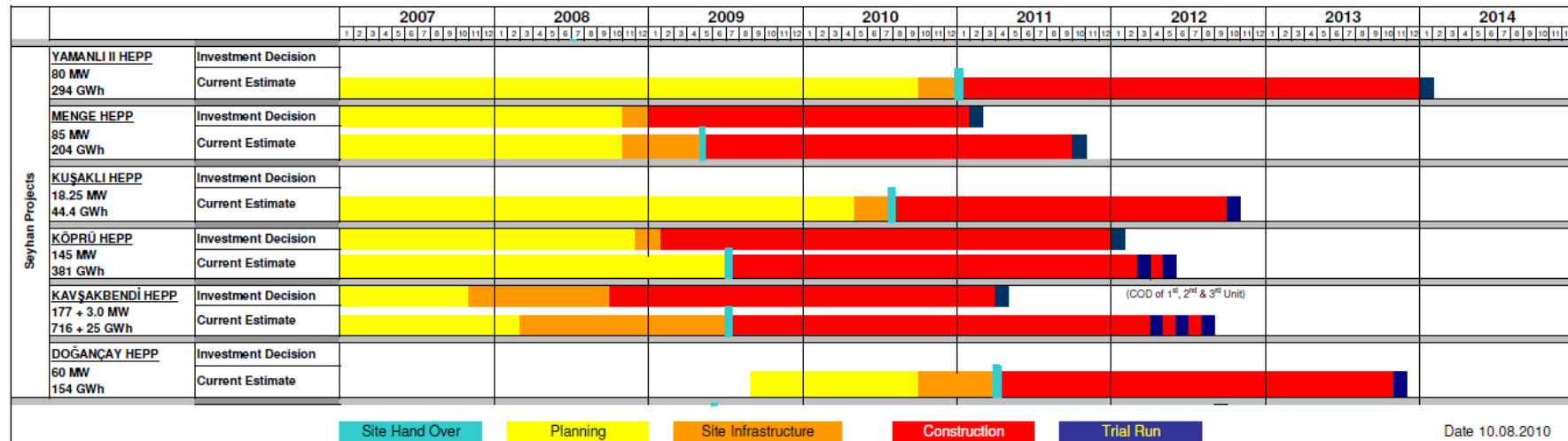


Figure 5-4. Time Schedule for the ENERJISA Projects

Source: ENERJISA Energy Generation Inc. Co.

5.5.1 Physical Environment

Detailed cumulative impacts of the HEPP projects on physical environment are presented below (see Table 5-3).

Air Quality

Scenario A

Major sources of potential impacts on air quality during the construction phase of the HEPPs are generation of dust and gaseous pollutants such as NO_x (Nitrogen oxides), SO₂ (Sulphur dioxide), CO (Carbon monoxide) and VOCs (Volatile organic compounds). Gaseous pollutants will result from engine emissions of various construction machinery. The impact of air emissions on physical environment is the increase in ambient concentrations of these pollutants. Dust concentration may increase due to site preparation, excavation, activities in quarries and crushers, and transportation of equipment and people on unpaved surfaces. The dust emissions resulting from each ENERJISA project have been assessed in individual EIAs and modeling studies have been carried out for the dispersion of dust. The results of modeling studies have indicated that there will be no adverse impact on the nearest receptors. Because of the distances between the project sites of each HEPP, the nearest receptors will not be affected from other projects. Therefore, the cumulative impact of air emissions resulting from ENERJISA projects is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B

Although the same kind of physical impacts of air emissions will be observed as presented for Scenario A, the extent of air pollution resulting from construction activities will increase because the increased number of projects cover a wider geographic area.

Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the air emissions resulting from these projects will not have an impact on the same area. Hence, the air emissions will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of the impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

Since the construction phases of the planned projects in the CIA Study Area will not overlap with those projects considered under Scenario B, it is assumed that there will be no additive impact of air emissions under Scenario C beyond those already considered under Scenario B. However, these additional projects will still have individual impacts

such as the increase in ambient concentrations of dust and gaseous pollutants locally, and may even have additive impacts between themselves, depending upon their final construction schedules.

Water Quality

Scenario A

Wastewater generation is expected from personnel in construction camps and construction related activities in the project sites. Surface water and groundwater may be contaminated due to improper handling and discharge of domestic wastewater and wash water of construction machinery. In addition, because of erosion that will result from excavation to be carried out during construction phase, sedimentation may occur in the river water. The quality of river water will also be affected from the turbidity resulting from in-river construction. Also, the pH of river water may change as a result of improper handling and discharge of run-off water to be generated from concrete batching. Oil and grease spills may contaminate surface waters if they are also not handled properly. The wastewater generation resulting from each ENERJISA project and treatment methods have been assessed in individual EIAs in accordance with the Turkish "*Water Pollution Control Regulation*". The cumulative impact of liquid effluents resulting from ENERJISA projects is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B

Cumulative impacts of the liquid effluents resulting from Scenario B will be the same type of impacts resulting from Scenario A. However, the extent of the impact will increase because the increased number of projects covers a wider geographic area. Therefore, there will be more personnel and machinery in the construction sites of these projects and the wastewater generation will be higher in quantity. Surface water and groundwater contamination may be seen in a wider geographic area if the wastewaters are not handled and discharged properly.

It is assumed that the construction of all these projects will be carried out concurrently. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the liquid effluents resulting from these projects will not have an impact on the same area. Therefore, the liquid effluents will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

Since the construction phases of the planned projects in the CIA Study Area will not overlap with those projects considered under Scenario B, it is assumed that there will be no additive impact of liquid effluents under Scenario C beyond those already considered under Scenario B. However, these additional projects will still have individual impacts on water quality, and may even have additive impacts between themselves, depending upon their final construction schedules.

Solid Wastes

Scenario A

Domestic solid waste generation is expected from the personnel in the construction camps of ENERJISA projects. Besides there will be excavation wastes resulting from construction activities. Improper handling and disposal of solid wastes may cause land, surface water and groundwater contamination. The solid waste generation resulting from each ENERJISA project and disposal methods have been assessed in individual EIAs in accordance with the Turkish “*Solid Wastes Control Regulation*”. The cumulative impact of solid wastes resulting from ENERJISA projects is rated as low because the extent of the impact area is restricted and the severity is moderate.

Scenario B

The extent of impact area will increase within Scenario B. Hence, there will be more personnel and more area to be excavated, so solid waste generation will be higher in quantity. Land, surface water and groundwater contamination may be observed in a wider geographic area if the solid wastes are not handled and disposed properly.

Since it is assumed that the construction of all these projects will be carried out concurrently; the solid wastes will accumulate in an additive manner in the CIA Study Area. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the liquid effluents resulting from these projects will not have any impact on the same area. Therefore the liquid effluents will not interact. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

Since the construction phases of planned projects will not overlap with all other projects proposed in the CIA Study Area, there will be no additive impact resulting from solid wastes. However, they still have individual contributions on basin-wide impacts and

may have additive impacts amongst themselves, depending upon their final construction schedules.

Hazardous Wastes and Substances

Scenario A

Hazardous wastes such as waste oil, waste batteries and accumulators will be generated during the construction phase of ENERJISA projects. Improper handling and disposal of these wastes may cause land, surface water and groundwater contamination. In addition, improper storage and handling and accidental release of hazardous substances such as fuels and chemicals may also cause land, surface water and groundwater contamination. Hazardous waste generation resulting from each ENERJISA project and related disposal methods have been assessed in individual EIAs in accordance with the Turkish “*Hazardous Waste Control Regulation*”. The cumulative impact of hazardous wastes and substances is rated as low because the extent of the impact area is restricted and the severity is moderate.

Scenario B

Cumulative impacts of the hazardous wastes and substances resulting from Scenario B will be the same type of impacts resulting from Scenario A but the geographic extent will be greater because of the larger number of projects. Land, surface water and groundwater contamination may be observed in a wider geographic area if the hazardous wastes and substances are not handled and disposed properly.

Although the hazardous wastes and substances may interact to produce a total impact greater than the sum of the individual impacts, this is unlikely because the geographic distances between the project sites under scrutiny for Scenario B means they will not impact on the same area. Therefore the level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

Since the construction phases of planned projects will not overlap with all other projects proposed in the CIA Study Area, there will be no additive impact resulting from hazardous wastes. However, they still have individual and possibly additive contributions on basin-wide impacts.

Landscape

Scenario A

During construction activities, there will be lots of dust and machinery which will disturb the local landscape. However these will be temporary and restricted to the construction site. In addition, the view of the landscape will change permanently due to excavation works within construction. These activities will be carried out for project facilities, quarries, transmission lines and service roads to be constructed within ENERJISA projects. The cumulative impact is rated as low because the extent of the impact is restricted and the severity is mild.

Scenario B and C

As the number of projects increases, there will be more construction activities therefore more change in the landscape. Considering that construction sites will not overlap, the impact will accumulate in the CIA Study Area in an additive manner. The extent of the impact become medium for Scenario B and wide for Scenario C, so the cumulative impact is rated as low for Scenario B and medium for Scenario C.

Historic and Cultural Features

Scenario A

Historic, cultural or aesthetic features may be affected as a result of site preparation, excavation and construction of HEPP projects. For ENERJISA projects, archeological sites near Yamanli II HEPP and a historical bridge near Kopru Dam and HEPP project will be deteriorated due to construction activities such as blasting. Studies carried out within EIA processes of these projects have indicated that there will be no adverse impact on these archeological and historic features. In addition, the related governmental institution has already approved the construction of these projects on condition that necessary measures are taken. As a result, the cumulative impact level is rated as medium since it is a severe impact and the extent of the impact is restricted to the Yamanli II and Kopru HEPP project sites.

Scenarios B and C

The list of archeological and historic sites close to the projects within Scenario B and C are listed in Section 4.9. Considering the long distances between these projects and the archeological sites, no adverse impact is expected on the sites listed in Table 4-5. As a result, the cumulative impact level is rated as medium similar to Scenario A because the extent of the impact is still restricted to Yamanli II and Kopru HEPP project sites.

Transportation

Transportation of construction machinery, equipment and personnel may cause increased traffic load in the site and access roads. However, considering the geographic distances between all the project sites, this impact will be quiet low for all three Scenarios.

Table 5-3. Cumulative Impacts of the HEPP Projects on Physical Environment During Construction

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Air Quality	Scenario A	1. Increase in ambient dust concentration due to: - Site preparation and excavation - Quarries and crushers - Transportation of the construction machinery on unpaved surfaces 2. Gas generation due to engine emissions of various construction machinery	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium + Moderate	Medium
	Scenario C		Additive	Negative / Medium + Moderate	Medium
2. Water Quality	Scenario A	Surface water and groundwater contamination due to improper handling and discharge of wastewater resulting from: - Personnel (sewage) - Construction machinery (wash water)	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium + Moderate	Medium
	Scenario C		Additive	Negative / Medium + Moderate	Medium
3. Solid Wastes	Scenario A	Land, surface water and groundwater contamination due to improper handling and disposal of solid wastes resulting from: - Construction camps - Excavation wastes from construction activities	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium + Moderate	Medium
	Scenario C		Additive	Negative / Medium + Moderate	Medium
4. Hazardous Wastes and Substances	Scenario A	Land, surface water and groundwater contamination due to - Improper handling and disposal of hazardous wastes such as waste oil, waste batteries and accumulators - Accidental release of hazardous substances	Interactive	Negative / Restricted +Moderate	Low
	Scenario B		Interactive	Negative / Medium +Moderate	Medium
	Scenario C		Interactive	Negative / Medium +Moderate	Medium

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
5. Landscape	Scenario A	Temporary increase in dust and machinery disturbing local people.	Additive	Negative / Restricted + Mild	Low
	Scenario B		Additive	Negative / Medium + Mild	Low
	Scenario C		Additive	Negative / Wide + Mild	Medium
6. Historic and Cultural Features	Scenario A	Impact on historic, cultural or aesthetic features due to site preparation and excavation activities.	Additive	Negative / Restricted + Severe	Medium
	Scenario B		Additive	Negative / Restricted + Severe	Medium
	Scenario C		Additive	Negative / Restricted + Severe	Medium
7. Transportation	Scenario A	Increased traffic load in the site and access roads due to transportation of construction machinery, equipment and personnel.	Additive	Negative / Restricted +Mild	Low
	Scenario B		Additive	Negative / Medium +Mild	Low
	Scenario C		Additive	Negative / Medium +Mild	Low

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

5.5.2 Biological Environment

The assessment of cumulative impacts on biological environment needs to discuss not just the area of impact but sensitivity of the receiving environment. Hence, the important features of the biological environment in the CIA Study Area are given below:

- There is no Endemic Bird Area (EBA) in the CIA Study Area.
- There are two Key Biodiversity Areas (KBAs) within the borders of CIA Study Area. These are Aladaglar and Zamanti KBAs. Aladaglar Important Bird Area (IBA), a national park, and a wildlife improvement area lie within Aladaglar KBA. There is no official protection for any part of the Zamanti KBA.
- A part of Yamanli II HEPP project site lies in Hancerderesi Wildlife Improvement Area (where wild goats are protected). However, the wildlife will not be affected because the construction of transmission tunnel will be carried out underground.
- No endemic, threatened or protected flora species are believed to be present in the CIA Study Area.
- As a result of the survey carried out by Prof. Dr. Füsün Erk'akan from Hacettepe University, 31 species and 1 subspecies belong to 9 families have been determined in the CIA Study Area. According to this study, *Salmo platycephalus*, *Alburnus adanensis*, *Pseudophoxinus zekayi*, *Oxynoemacheilus samanticus*, *Paracobitis seyhanensis*, *Schistura seyhanicola* and *Schistura evreni* are endemic species for Turkish freshwaters. Additionally, *O. samanticus*, *P. seyhanensis* and *Alburnus orontis* are categorized as endangered species and *S. platycephalus* is classified as critically endangered species in IUCN Red List (2007).

Detailed cumulative impacts of the HEPP projects on biological environment are presented below (see Table 5-4).

Terrestrial Vegetation Communities and Flora

Scenario A

The site preparation and excavation to be carried out within the construction phase of HEPPs may cause deterioration of terrestrial vegetation communities and flora. The impacts on terrestrial vegetation communities and flora resulting from each ENERJISA project and related measures have been assessed within the EIA studies. Around 375.5 ha of forest area and 188.2 ha of agricultural lands will be used within the construction of Yamanli II HEPP and related facilities. Other losses resulting from Kopru, Menge and

Kavsak Bendi HEPPs will be discussed under operation phase in the subsequent sections because most of the lands will be affected due to inundation.

According to the flora inventories prepared for each ENERJISA project, no threatened, protected or endemic plant species are believed to be present within the impact area of these projects. The site preparation and excavation will be carried out in accordance with the Turkish "*Regulation on Control of Excavation Material, Construction and Demolition Wastes*". Although additive, the cumulative impact of construction activities resulting from ENERJISA projects on the terrestrial vegetation communities and flora is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B

Within Scenario B, there will be more land to be prepared and excavated because of the increased number of projects covers a wider geographic area. Thus, the extent of the deterioration of the terrestrial vegetation communities and flora will increase. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the impact areas will not overlap. Therefore, the impacts will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

Within the construction phases of planned projects, site preparation and excavation may also lead to loss of vegetation communities and flora. The construction of planned projects will not be carried out at the same time with other projects, therefore this impact will not interact with other impacts. However, the impacts resulting from planned projects still have individual contributions on basin-wide cumulative impacts.

Terrestrial Fauna

Scenario A

During the construction phase of the HEPPs, the terrestrial fauna will be affected due to;

- Degradation of terrestrial habitats
- Increase in ambient dust concentration
- Gaseous pollutants resulting from engine emissions of various construction machinery
- Noise and vibration resulting from blasting

- Disturbance from humans
- Poaching of wild animals by the construction personnel

Furthermore, mammals, birds, reptiles and amphibians whose habitats are affected from the projects will migrate to other locations. According to the fauna inventories prepared for each ENERJISA project, no threatened, protected or endemic species of terrestrial animal are believed to be present within the impact areas. On the other hand, the transmission tunnel to be constructed within the Yamanli II HEPP project is within the borders of the Hancerderesi Wildlife Improvement Area (where wild goats are protected). However, apart from some possible minor disturbance the wildlife will not be affected because the construction of transmission tunnel will be carried out underground. The cumulative impact of construction activities resulting from ENERJISA projects on the terrestrial fauna is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B

Within Scenario B, there will be more terrestrial habitats to be affected because the increased number of projects covers a wider geographic area. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the impact areas will not overlap. Hence, the impacts will not interact and they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

In addition to the projects within Scenario B, there are planned HEPPs in the CIA Study Area. The construction of these projects will not be carried out at the same time with the projects within Scenario B. Therefore the impacts on terrestrial habitats will not interact with other impacts. However, degradation of terrestrial habitats resulting from planned projects still have individual contributions on basin-wide cumulative impacts.

Aquatic Life

Scenario A

During the construction phase of the HEPPs, the aquatic life will be affected negatively due to;

- Improper handling and discharge of wastewater
- Diversion of river water from the river bed for the construction of the dam.
- Increase in sediment amount and turbidity in river water

The stress on aquatic life where the river water is diverted from the river bed for the construction of the dam will only be observed in HEPPs with dam, namely, Menge, Kopru and Kavsak Bendi projects. Besides, the construction of the dam and erosion on excavated areas may result in increase of the sediment in the river water blocking gills of fish and invertebrates. This may smother the aquatic organisms and cause knock-on effects of having reduced food for species further up the foodchain. Although these impacts are significant, it should be noted that they are temporary impacts and can be mitigated considerably with the measures.

In Goksu River where ENERJISA projects are proposed, an endangered fish species was determined by Prof. Dr. Füsün Erk'akan from Hacettepe University. *Alburnus orontis* inhabiting Seyhan and Ceyhan Basin, is a fish species classified as Endangered (EN) in IUCN Red List (2007). Population density of this species is medium level in the Seyhan River Basin. This species may be affected negatively if the necessary measures will not be taken for the sediment increase and subsequent turbidity in river. Related mitigation measures will be presented in Chapter 6. The cumulative impact of construction activities resulting from ENERJISA projects on the aquatic life is rated as medium because it is a severe impact and the extent is restricted.

Scenario B

Impacts on the aquatic life resulting from the construction phase within Scenario B will be the same type of impacts resulting from Scenario A. However, the extent of the impact will increase because the increased number of projects covers a wider geographic area. Since it is assumed that the construction of all these projects will be carried out concurrently; the impacts on aquatic life will accumulate in an additive manner in the CIA Study Area.

According to the field study carried out by Prof. Dr. Füsün Erk'akan from Hacettepe University, 31 species and 1 subspecies belong to 9 families have been determined in the Zamanti, Goksu and Seyhan rivers. Among these species, *O. Samanticus* and *P. seyhanensis* inhabiting only Zamanti River and *Alburnus orontis* inhabiting Goksu River are categorized as endangered species. *S. platycephalus* which is another endemic fish species to Zamanti River is classified as critically endangered species in IUCN Red List (2007). However, the endangered species inhabiting Zamanti River will not be affected from the construction activities because the elevations of HEPP projects proposed on Zamanti River are lower than 1,400 m and these species inhabitate the upper parts of Zamanti River between the elevations of 1,800 and 2,200 m. It should be noted that none of ENERJISA project was proposed on Zamanti River. For the projects to be located on Goksu River, if the mitigation measures will not be taken

On the other hand, similar to Scenario A if the necessary measures will not be taken for the sediment increase and subsequent turbidity in river, *Alburnus orontis*

inhibiting Seyhan Basin will be affected negatively. Related mitigation measures will be presented in Chapter 6. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the projects will not affect the same area in the rivers. The level of cumulative impact is rated as high because it is a severe impact and the extent is medium.

Scenario C

Within the construction phases of planned projects, construction activities may also affect the aquatic life in the rivers. The construction of these projects will not be carried out at the same time with the projects within Scenario B. Thus, the impacts on aquatic life will not interact with other impacts. However, construction activities of planned projects still have individual contributions on basin-wide impacts and may have additive impacts amongst themselves, depending upon their final construction schedules.

Table 5-4. Cumulative Impacts of the HEPP Projects on Biological Environment During Construction

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Terrestrial Vegetation Communities and Flora	Scenario A	Deterioration of vegetation communities and flora due to construction activities	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Medium +Moderate	Medium
2. Terrestrial Fauna	Scenario A	1. Damage to terrestrial fauna due to: - Increase in ambient dust concentration - Gaseous pollutants resulting from engine emissions of various construction machinery - Poaching of wild animals 2. Migration of the animals due to degradation of terrestrial habitats	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Medium +Moderate	Medium
3. Aquatic Life	Scenario A	1. Stress on aquatic life due to improper handling and discharge of wastewater 2. Stress on aquatic life where the river water is diverted from the river bed for the construction of the dam (Valid for HEPPs with dams, namely Menge, Kopru and Kavsak Bendi) 3. Smothering of aquatic organisms due to increase in sediment in river water	Additive	Negative / Restricted +Severe	Medium
	Scenario B		Additive	Negative / Medium +Severe	High
	Scenario C		Additive	Negative / Medium +Severe	High

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

5.5.3 Socioeconomic Environment

Cumulative impacts of the ENERJISA projects on socio-economic environment during construction phase are presented in Table 5-5. Detailed assessment is presented below.

Loss of Land

Scenario A

There will be loss of land (private property, forest, agricultural lands, etc.) due to construction of the HEPPs facilities, quarries, transmission lines and camps. Around 15 ha of private property will be used within the construction of Yamanli II HEPP and related facilities. Loss of land for the purpose of Kopru, Menge and Kavsak Bendi HEPPs will be discussed under operation phase in the subsequent sections because most of the lands will be affected due to inundation.

Loss of privately-owned agricultural lands may lead to negative impacts on livelihoods and standards of living of people. Expropriation procedures will be carried out for land acquisition in accordance with Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects. The cumulative impact level resulting from land acquisition is rated as low because few properties are involved so the extent of the impact is restricted and the severity is moderate.

Scenario B and C

Within Scenario B and Scenario C, there will be more private property to be affected from the construction of the HEPPs because the increased number of projects covers a wider geographic area. The impacts of loss of land will accumulate in an additive manner in the CIA Study Area. However there is no information on the loss of land within these projects. The land acquisition, and expropriation procedures within Scenario B and C will also be carried out in accordance with the Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects. The cumulative impact level is rated as medium because the extent of the impact is medium for Scenario B, wide for Scenario C and the severity is moderate.

Health Risk to Personnel and Local Community

Scenario A

During the construction phase of the HEPPs, personnel in the construction site and camps will be affected negatively due to;

- Improper handling and disposal of hazardous wastes,
- Accidental release of hazardous substances due to improper storage and handling,
- Increase of dust and gas concentrations resulting from construction activities
- High noise levels and vibration resulting from operation of construction machinery and blasting,
- Occupational accidents in the construction site

Beside the personnel, high noise levels and vibration and dust emissions resulting from construction activities may also affect the local community negatively.

The noise to be generated from each ENERJISA project has been assessed within individual EIAs in Acoustic Reports in accordance with the Turkish “*Regulation on Assessment and Management of Environmental Noise*”. The results of these studies have indicated that there will be no adverse impact on the nearest receptor. The cumulative impact level is rated as medium since it is a severe impact and the extent of the impact is restricted.

Scenario B and C

Within Scenario B and C, there will be more personnel and community to be affected from because the increased number of projects covers a wider geographic area. Considering the geographic distances between the project sites under scrutiny, it should be noted that the impact areas will not overlap. Therefore, the impacts will not interact and they will accumulate in an additive manner in the CIA Study Area. The cumulative impact level is rated as high for both Scenario B and C since it is a severe impact and the extent of the impact is medium.

Employment Opportunities

Scenario A

Beside negative impacts resulting from the construction of HEPP projects, there are also positive impacts such as employment opportunities for local people. Within ENERJISA projects it is foreseen that nearly 1,700 people will be employed for the construction phase. In addition to positive impacts on livelihoods and standards of living of

people, this increase in the employment rates will contribute indirectly to development of the local economy.

Scenarios B and C

There will be more people employed in the construction phase when the number of projects increases. Within Scenario B and C, as the employment rates increase, the positive impact on livelihoods and standards of living of people will also increase. Thus, improvement in the local economy and development will be valid in a wider geographic area.

Improvement of Infrastructure

Scenario A

HEPPs will also contribute to the local economy and development due to improvement of existing infrastructure. Furthermore new infrastructure will be constructed such as transmission lines and roads, e.g. at Akdam and Yamanli and such roads will improve access to markets, increase social mobility, and generally bring indirect economic benefits.

Scenario B and C

As the increased number of projects covers a wider geographic area, more improvement is expected for the existing infrastructure and construction of new ones. Therefore there will be a greater contribution to local economy and development.

Table 5-5. Cumulative Impacts of the HEPP Projects on Socio-economic Environment During Construction

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Loss of Land	Scenario A	Social disruption and impact on livelihoods of people due to loss of private property such as agricultural lands.	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Wide +Moderate	Medium
2. Health Risk to Personnel and Local Community	Scenario A	1. Health risk to personnel resulting from improper handling and disposal of hazardous wastes 2. Accidental release of hazardous substances due to improper storage and handling 3. Disturbance to personnel and local community due to high noise levels and vibration resulting from operation of construction machinery and blasting 4. Occupational accidents in the construction site	Additive	Negative / Restricted +Severe	Medium
	Scenario B		Additive	Negative / Medium +Severe	High
	Scenario C		Additive	Negative / Medium +Severe	High
3. Employment Opportunities	Scenario A	Contribution to local economy and development resulting from employment opportunities for local people	Additive	Positive	
	Scenario B		Additive	Positive	
	Scenario C		Additive	Positive	
4. Improvement of Infrastructure	Scenario A	Contribution to local economy and development due to construction of new infrastructure such as transmission lines and routes	Additive	Positive	
	Scenario B		Additive	Positive	
	Scenario C		Additive	Positive	

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

5.6 Cumulative Impact of Operation

For the identification and assessment of the potential impacts on physical, biological and socio-economic environment during operation phase of the HEPPs in the CIA Study Area, the main issues listed below are reviewed.

- Domestic wastewater and solid waste generation
- Inundation and related issues such as:
 - Loss of land and displacement of people
 - Vegetation communities and flora
 - Faunal elements
 - Landscape
 - Historic and cultural features
- Change in water quality and related impact on aquatic life
- Employment opportunities

The cumulative impacts during operation phase are assessed in accordance with the methodology described in Section 5-1.

For the assessment of cumulative impacts on physical, biological and socio-economic environment resulting from all these projects, it is assumed that all HEPPs will be operating concurrently.

5.6.1 Physical Environment

Cumulative impacts of the projects on physical environment during operation phase are presented in Table 5-8.

Water Quality

Scenario A

Domestic wastewater will be generated from the personnel during the operation phase of the ENERJISA projects. It is foreseen that nearly 126 people will be working during the operation phase of six ENERJISA projects. Assuming that wastewater generation per capita is 200 L/day, the total wastewater to be generated by the personnel will be 25,2 m³/day. Land, surface water and groundwater may be contaminated due to improper handling and discharge of domestic wastewater. Necessary infrastructure will be present in the HEPPs in accordance with the related legislation. The wastewater generation resulting from each ENERJISA project and treatment methods have been assessed in individual EIAs in accordance with the Turkish "*Water Pollution Control Regulation*". The cumulative impact of domestic wastewater is rated as low because the extent of the impact is restricted and the severity is mild.

Scenario B

There will be 18 HEPPs operating concurrently in the CIA Study Area within Scenario B. As the number of projects increase, there will be more personnel and the wastewater generation will be higher in quantity. Although there is no information on how many personnel will be working for the projects within Scenario B, it is worth to assume that nearly 540 personnel (30 personnel/project * 18 projects) will be working. As a result, total wastewater generation is expected to be 108 m³/day (540 personnel * 200 L/day-capita) during the operation phases of the projects within Scenario B. In addition the extent of the impact will also increase because the increased number of projects covers a wider geographic area.

Surface water and groundwater contamination may be seen in a wider geographic area if the wastewaters are not handled and discharged properly. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the domestic wastewater resulting from these projects will not have an impact on the same area and will be handled separately for each project. Hence, they will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as low because the extent of the impact is medium and the severity is mild.

Scenario C

There will be 26 HEPPs operating in the CIA Study Area concurrently within Scenario C. Assuming that nearly 780 personnel (30 personnel/project * 26 projects) will be working within Scenario C. As a result, total wastewater generation is expected to be 156 m³/day (780 personnel * 200 L/day-capita) during the operation phases of the projects. The impacts resulting from improper handling and discharge of wastewater will be observed in a wider geographic area. Similar to the Scenario B, considering the geographic distances between the project sites, the impact areas will not overlap. Therefore the impacts will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is mild.

Solid Wastes

Scenario A

Domestic solid waste will be generated from the personnel during the operation phase of the ENERJISA projects. Assuming the domestic solid waste generation is 1.5 kg/capita-day, the total amount of solid wastes will be 189 kg/day (1.5 kg/capita-day * 126 personnel). Land, surface water and groundwater may be contaminated due to improper handling and discharge of solid wastes. The solid wastes resulting from each ENERJISA

project and disposal methods have been assessed in individual EIAs in accordance with the Turkish “*Solid Wastes Control Regulation*”. The cumulative impact of domestic solid waste is rated as low because the extent of the impact is restricted and the severity is mild.

Scenario B

There will be 18 HEPPs operating concurrently in the CIA Study Area within Scenario B. Assuming that nearly 540 personnel (30 personnel/project *18 projects) will be working, domestic solid waste generation will be 810 kg/day (540 personnel * 1.5 kg/capita-day) during the operation phases of the projects within Scenario B. As the increased number of projects covers a wider geographic area, the extent of the impact will also increase. Thus, land, surface water and groundwater contamination may be seen in a wider geographic area if the wastewaters are not handled and discharged properly. Considering the geographic distances between the project sites under scrutiny for Scenario B, it should be noted that the domestic solid wastes resulting from these projects will not have an impact on the same area and will be handled separately for each project. Therefore they will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as low because the extent of the impact is medium and the severity is mild.

Scenario C

There will be 26 HEPPs operating in the CIA Study Area concurrently within Scenario C. Assuming that nearly 780 personnel (30 personnel/project *26 projects) will be working within Scenario C, domestic solid waste generation will be 1170 kg/day (780 personnel * 1.5 kg/capita-day) during the operation phases of the projects. The impacts resulting from improper handling and discharge of wastewater will be observed in a wider geographic area. Similar to the Scenario B, considering the geographic distances between the project sites, the impact areas will not overlap and the wastes will be handled separately for each project. Therefore the impacts will not interact, but they will accumulate in an additive manner in the CIA Study Area. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is mild.

Inundation

The most significant impact of the operation phase of HEPP projects with dam on the physical environment is inundation resulting from damming the river. Since the valley in which the Goksu River passes through is narrow and steep for most of the project sites, the area to be inundated will be quite limited for ENERJISA projects. The surface areas of the reservoirs of Menge, Kopru and Kavsak Bendi HEPPs are 2.67 km², 2.93 km² and 1.42 km², respectively. Approximately 29.1 km of the Goksu river and 10 km of Seyhan River will be impounded within ENERJISA projects (see Table 5-2). The lengths of Goksu and Seyhan rivers within the CIA Study Area are 200 km and 20 km, respectively. The

loss of lands within Kopru, Menge and Kavsak Bendi HEPPs are presented in Table 5-6 below.

Table 5-6. Loss of Lands within ENERJISA HEPPs with dam

Projects	Loss of Land		
	Private Property (ha)	Forest Area (ha)	Land Belonging to Treasury (ha)
Kopru Dam and HEPP	23.68	289.18	-
Menge Dam and HEPP	-	176.67	-
Kavsak Bendi Dam and HEPP	41.00	2.52	1.59
Total	64.68	468.37	1.59

* Losses within Yamanli II, Kusakli and Dogancay HEPP projects are excluded from the table because all the loss of land resulting from these project will occur in construction phase.

As seen from Table 5-6, 64.68 ha of private property, 468.37 ha of forest area and 1.59 ha of agricultural land will be used for the construction and formation of the reservoirs. As a result, because inundation will occur in a limited area, only a few dwellings will be displaced within these projects. The level of cumulative impact is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B

In addition to ENERJISA HEPPs with dams, there will be four more HEPPs (Feke, Gumusoren, Indere and Goktas HEPPs) operating concurrently in the CIA Study Area within Scenario B. As the number of HEPPs increase, more land will be inundated and extent of the impact will also increase because Gumusoren, Indere and Goktas HEPPs are located on Zamanti River. Within Scenario B, 43.6 km of Goksu River, 40.8 km of Zamanti River and 11 km of Seyhan River will be impounded. The lengths of Goksu, Zamanti and Seyhan Rivers within CIA Study Area are 200 km, 306 km and 20 km, respectively. Since the reservoir surface area of these projects are not available, the values are estimated from the similar projects comparing their dam heights and reservoir volumes. The surface areas of Feke-II, Gumusoren, Indere and Goktas HEPP reservoirs are estimated as 2.75 km², 10 km², 2.5 km² and 6 km², respectively (see Table 5-2).

As a result, the level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

In addition to Scenario B, only one HEPP with dam namely, Topaktas HEPP which is also located on Zamanti River, will be included for Scenario C. Topaktas HEPP is a relatively small project in terms of reservoir capacity. The volume of the reservoir is 1.47 hm³ and therefore the area to be inundated is estimated to be around 0.5 km². Within

Scenario C, 101.7 km of total length of the rives in the CIA Study Area which is 525 km will be impounded. Total surface area of the reservoirs will be 29,1 km²(see Table 5-2).

The level of cumulative impact is rated as medium, because the extent of the impact is still medium similar to Scenario B.

Greenhouse Gas Emissions

Scenario A

If the inundated land is heavily wooded and not cleared sufficiently prior to flooding, decomposition will form carbon dioxide and deplete oxygen levels in the water and subsequent anaerobic decomposition will form methane. As a result, significant amounts of these greenhouse gases could be emitted from the reservoirs.

Table 5-7. Reservoir Volumes of the HEPPs in the CIA Study Area

HEPPs with dam	Reservoir Volume (millions m ³)
ENERJISA Projects	
Menge Dam and HEPP	50.8
Kopru Dam and HEPP	93.2
Kavsak Bendi Dam and HEPP	30.0
HEPPs under construction or completely approved	
Feke Dam and HEPP	63.07
Bahcelik Dam and HEPP	216.14
Gumusoren Dam and HEPP	202.9
Indere Dam and HEPP	60.34
Goktas Dam and HEPP	133.34
Planned Projects	
Topaktas Dam and HEPP	1.47
Other HEPPs for comparison	
Yedigoze Dam and HEPP	642.8
Seyhan Dam and HEPP	1200

As seen from the reservoir volumes given in Table 5-7, the reservoirs of the ENERJISA projects are relatively small when compared with Yedigoze and Seyhan HEPPs which are located downstream of Kavsak Bendi HEPP. Furthermore, inundated lands are not heavily wooded so greenhouse gas emissions are predicted to be insignificant. Hence, the level of cumulative impact is rated as low because the extent of the impact is restricted and the severity is mild.

Scenario B

In addition to ENERJISA HEPPs with dams, there will be five more HEPPs (Bahcelik, Feke, Gumusoren, Indere and Goktas HEPPs) operating concurrently in the CIA Study Area within Scenario B. As the number of HEPPs increase, there will be more reservoirs and extent of the greenhouse gas emissions will also increase because

Gumusoren, Indere and Goktas HEPPs are located on Zamanti River. The level of cumulative impact is rated as low because the extent of the impact is medium and the severity is mild.

Scenario C

In addition to Scenario B, only one HEPP with dam namely, Topaktas HEPP which is also located on Zamanti River, will be included for Scenario C. The level of cumulative impact is rated as low, because the extent of the impact is still mild similar to Scenario B.

Hydrology

Scenario A

Damming the river and creating a lake-like environment has profound impacts on the hydrology of the river. Dramatic changes occur in the timing of flow: quality, quantity and use of water, aquatic biota, and sedimentation dynamics in the river basin (Environmental Assessment Sourcebook, Volume III, WB, 1992). For ENERJISA projects, these impacts may be observed within Kopru, Menge and Kavsak Bendi HEPPs because these projects constitute a cascade dam system on the Goksu River. Beside this change in flow regime resulting from the HEPPs with dam, the hydrology of the river will also change due to the diversion of the river water within the run-of-river HEPPs. There will be a decrease in water level between the weir and the powerhouse. This impact may be observed in Yamanli II project, because it is a run-of-river HEPP. The level of cumulative impact is rated as medium because it is a severe impact but the extent is restricted.

Scenario B

Within Scenario B, because many cascade run-of-river HEPPs and dams will be operating on Goksu and Zamanti rivers, the hydrology of these rivers will change locally especially where cascade HEPPs are located. While the quantity of the river water will decrease along cascade run-of-river HEPPs, the quality of water will change especially due to sedimentation observed in reservoirs. The overall level of cumulative impact is rated as high because the extent of the change in hydrology is medium and the impacts on quality and quantity of the river water are severe issues because they may cause knock-on effects on aquatic life in the river.

Scenario C

There will be 26 HEPPs operating in the CIA Study Area concurrently within Scenario C. In addition to Scenario B, one HEPP with dam (Topaktas HEPP) located on a tributary of Zamanti River will be included. As a result of the construction of final four run-of-river HEPPs (Camlica II, Tatlar, Yamanli II, Yamanli III) in the CIA Study Area, there will

be two separate cascade run-of-river systems on the Zamanti and Goksu rivers. The cascade run-of-river system on Zamanti begins after Gumusoren HEPP and extends over a length of nearly 50 km on Zamanti River. The other cascade system begins with Yamanli I Weir and covers a length of 45 km on the Goksu River. Within these cascade systems, there will be a decrease in water level between the weirs and powerhouses.

Beside the run-of-river cascade HEPPs, Feke, Menge and Kopru located on the Goksu River, Topaktas, Goktas and Indere HEPPs on Zamanti River; and Kavsak Bendi HEPP on Seyhan River will constitute a cascade dam system at the south of the CIA Study Area. In this region, the flow regime of Zamanti and Goksu will change from river to pond system. The overall level of cumulative impact is rated as high similar to Scenario B because it is a severe impact and the extent is medium.

Sediment

Scenario A

Impoundment of the river leads to sediment reduction and change of water quality downstream of the dam. Also, reduction in sediment moving downstream from the dam leads to degradation of the river channel below the facility. This phenomenon also leads to potential impacts on the biological environment such as the degradation of aquatic habitats. Owing to small reservoir volumes and low retention times for the ENERJISA projects, no significant change in water quality is expected. Hence, the level of cumulative impact is rated as medium because it is a severe impact but the extent of the impact is restricted.

Scenario B

Besides, as the number of projects increase in a cascade dam system, the problem of sediment reduction and change of water quality in the downstream of the dam will become significant. The level of cumulative impact is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

In addition to Scenario B, only one HEPP with dam namely, Topaktas HEPP which is also located on Zamanti River, will be included for Scenario C. The level of cumulative impact is rated as medium, because the extent of the impact is still medium similar to Scenario B.

Evaporation

Scenario A

Within the ENERJISA projects, the reservoir surface areas of Menge, Kopru and Kavsak Bendi HEPPs are 2.67 km², 2.93 km² and 1.42 km², respectively. Since the reservoir surfaces are relatively small, water loss from evaporation will be limited. Therefore, the level of cumulative impact is rated as low because the extent of the impact is restricted and the severity is mild.

Scenarios B and C

In addition to ENERJISA HEPPs with dams, there will be five more HEPPs (Bahcelik, Feke, Gumusoren, Indere and Goktas HEPPs) operating concurrently in the CIA Study Area within Scenario B. Among these projects, Bahcelik and Gumusoren are the HEPPs whose reservoir surface areas are 12.13 km² and 10 km². Therefore, the level of cumulative impact is rated as low because the extent of the impact is medium and the severity is mild. The cumulative impact level is also low for Scenario C, because there is only one HEPP (Topaktas HEPP) included for Scenario C and its reservoir surface area is quite small compared to the projects in Scenario B (see Table 5-7).

Irrigation

Scenario A

None of the ENERJISA projects will be used for irrigation of agricultural lands.

Scenario B and C

Within Scenario B, there will be loss of river water due to irrigation resulting from multi purpose HEPPs. These HEPPs and areas to be irrigated are presented below;

- Bahcelik Dam and HEPP (49,033 ha)
- Gumusoren Dam and HEPP (3,000 ha)
- Gicik (Zamanti) Weir and HEPP (52,000 ha)

Bahcelik, Gumusoren and Gicik are cascade HEPPs on the Zamanti River. The annual amount of irrigation water to be withdrawn from Zamanti River within Gicik HEPP is around 100 million m³. There is no information on the size of irrigation water withdrawals from the other projects. However, the total annual irrigation water to be withdrawn for Bahcelik and Gumusoren HEPPs can be assumed as around 100 million m³ because the sum of areas to be irrigated within these HEPPs is nearly equal to the area to be irrigated within Gicik HEPP. Considering that the annual average flow rate of Zamanti

River where it exits the Kayseri Province is approximately 1,347 million m³ (Kayseri Environmental Performance Report, 2006) while Bahcelik HEPP is operating, the severity of loss of water due to irrigation is a moderate level impact. Since the extent of the impact is restricted, the cumulative impact level is rated as low. The assessment is the same for Scenario C, because there is no other multi purpose dam among planned projects.

Table 5-8. Cumulative Impacts of the HEPP Projects on Physical Environment During Operation

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Water Quality	Scenario A	Land, surface water and groundwater contamination due to improper handling and treatment of domestic wastewater generated from the personnel	Additive	Negative / Restricted + Mild	Low
	Scenario B		Additive	Negative / Medium + Mild	Low
	Scenario C		Additive	Negative / Wide + Mild	Medium
2. Solid Wastes	Scenario A	Land, surface water and groundwater contamination due to improper handling and disposal of domestic solid wastes	Additive	Negative / Restricted + Mild	Low
	Scenario B		Additive	Negative / Medium + Mild	Low
	Scenario C		Additive	Negative / Wide + Mild	Medium
3. Inundation	Scenario A	Loss of land (agricultural, forest, private property, etc.)	Additive	Negative / Restricted + Moderate	Low
	Scenario B		Additive	Negative / Medium + Moderate	Medium
	Scenario C		Additive	Negative / Medium + Moderate	Medium
4. Greenhouse Gas Emissions	Scenario A	Formation of anaerobic condition in the HEPP reservoirs and emissions of greenhouse gases resulting from inundated terrestrial vegetation and flora	Additive	Negative / Restricted + Mild	Low
	Scenario B		Additive	Negative / Medium + Mild	Low
	Scenario C		Additive	Negative / Medium + Mild	Low

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
5. Hydrology	Scenario A	1. Change of flow regime from river to pond system (valid for HEPPs with dam) 2. Decrease in water level in the river between the weir and the powerhouse (valid for run-of-river HEPPs).	Additive	Negative / Restricted +Severe	Medium
	Scenario B		Additive	Negative / Medium + Severe	High
	Scenario C		Additive	Negative / Wide + Severe	High
6. Sediment	Scenario A	1. Sedimentation of the reservoir and loss of storage capacity. 2. Sediment reduction and change in water quality in the downstream due to impoundment 3. Scouring of the riverbed in the downstream of dams due to sediment reduction	Additive	Negative / Restricted +Severe	Medium
	Scenario B		Additive	Negative / Medium + Severe	High
	Scenario C		Additive	Negative / Medium + Severe	High
7. Evaporation	Scenario A	Loss of water due to evaporation on the reservoir surface	Additive	Negative / Restricted +Mild	Low
	Scenario B		Additive	Negative / Medium +Mild	Low
	Scenario C		Additive	Negative / Medium +Mild	Low
8. Irrigation	Scenario A	Loss of water due to irrigation of agricultural lands	N.A.		
	Scenario B		Additive	Negative / Restricted +Moderate	Low
	Scenario C		Additive	Negative / Restricted +Moderate	Low

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

5.6.2 Biological Environment

Cumulative impacts of the projects on biological environment during operation phase are presented in Table 5-9.

Terrestrial Vegetation Communities and Flora

Scenario A

Within ENERJISA projects, there will be loss of terrestrial vegetation communities and flora due to inundation. However, the total forest area that will be inundated is nearly 468.37 ha and afforestation and landscape works will be carried out in order to compensate the losses as far as practical. According to the fauna inventories prepared for each ENERJISA project, no threatened, protected or endemic species are believed to be present within the impact areas. The cumulative impact of ENERJISA projects during operation phase on the terrestrial vegetation is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B and C

In addition to ENERJISA reservoirs, there will be five more HEPPs operating concurrently in the CIA Study Area within Scenario B. Among these, Bahcelik and Gumusoren HEPPs will have the large reservoirs totaling 22 km²; therefore more terrestrial vegetation will be affected due to inundation. Although there is no flora inventories prepared for these projects, no threatened, protected or endemic species are believed to be present within the impact areas. The level of cumulative impact of these projects on the terrestrial fauna is rated as medium because the extent of the impact is medium and the severity is moderate. The impact level will not change in Scenario C, because only one small scale HEPP will be included for the assessment. Hence, the cumulative impact on vegetation communities and flora is rated as medium for Scenario C.

Terrestrial Fauna

Scenario A

During the operation phase of the HEPPs with dams, the terrestrial fauna will be affected due to;

- Releases of water especially during test operations
- Inundation of the habitats

Mammals, birds, reptiles and amphibians whose habitats are inundated will move to other locations. Some smaller animals will not be able to cross the river it becomes a series of lakes, and hence it will represent a local barrier to free movement. According to the fauna inventories prepared for each ENERJISA project, no threatened, protected or endemic terrestrial animal species are believed to be present within the impact areas. The cumulative impact of the ENERJISA projects during the operation phase on the terrestrial fauna is rated as low because the extent of the impact is restricted and the severity is moderate.

On the other hand, damming the river may also have a positive impact on terrestrial fauna. Formation of a lake-like environment will provide habitat for waterbirds and feeding area for other terrestrial animals.

Scenario B

Among those projects additional to the ENERJISA ones in Scenario B, Bahcelik and Gumusoren HEPPs have the large reservoirs, therefore more mammals, birds, reptiles and amphibians will be affected and be forced to move due to inundation. Although no fauna inventories have been prepared for these projects, no threatened, protected or endemic terrestrial animal species are believed to be present within the impact areas. The level of cumulative impact of these projects on the terrestrial fauna is rated as medium because the extent of the impact is medium and the severity is moderate.

Scenario C

In addition to Scenario B, only one HEPP with a dam, namely Topaktas HEPP located on Zamanti River, will be included for Scenario C. Topaktas is a small scale HEPP and again it is believed that there are no threatened, protected or endemic terrestrial animal species within its impact area. The level of cumulative impact is rated as medium, because the extent of the impact is still medium similar to Scenario B.

Aquatic Life

Scenario A

During the operation phase of the HEPPs, the most significant potential cumulative impacts will be observed in aquatic environment. The potential impacts and their assessment are given below:

According to the survey carried out by Prof. Dr. Erk'akan from Hacettepe University, *Alburnus orontis* was determined in the rivers of Seyhan and Ceyhan Basin. This species is a fish species classified as Endangered (EN) in IUCN Red List (2010.2).

Population density of this species is medium level in the Seyhan River Basin. This species prefers fast flowing water in order to breed and then they return to still water. However, it was observed in Ceyhan River during the field study that, this species is well-adapted to still water and prefers to spawn in the shallow, clean and vegetation habitats in the river. According to the study carried out by Dr. Erk'akan, when the ENERJISA HEPPs are constructed on Goksu River, this species will migrate to the tributaries discharging into reservoirs in order to breed. Then they will pass from one tributary to another through the littoral zones of the reservoirs. Therefore there will be no formation of separate metapopulations separated by the dams so gene flow will continue among the populations of this species which are living in these tributaries. As a result, the survival of this species within Seyhan Basin after the construction of ENERJISA projects is not in doubt. The level of this cumulative impact is rated as low because the extent of the impact is restricted and the severity is mild.

Other fish migration may be hindered when fish ladders are not constructed on the dams. However, it should be noted that fish migration to the upstream is already hindered since there is no fish ladder in the downstream HEPPs; namely, Yedigoze (under construction), Catalan and Seyhan Dams (at the downstream of Yedigoze HEPP). Therefore, the fish inhabiting the lower Seyhan Basin have either already adapted to the existing reservoir systems or died out. In addition, damming the river may affect the physical stability of river channels in the downstream resulting from sediment reduction. River bed degradation downstream of dams can also lead to the loss of important in-stream spawning grounds for fish. The level of this cumulative impact on aquatic life is rated as low because the extent of the impact is restricted and the severity is moderate.

Aquatic organisms may be exposed to pulses of pollutants for longer periods of time in an impoundment than in a free flowing river, thus increasing the potential for the bioaccumulation of contaminants. However, no significant change in water quality is expected due to the small reservoir volumes and low retention times. Therefore, the level of this cumulative impact on aquatic life is rated as low because the extent of the impact is restricted and the severity is moderate.

Aquatic life may also be affected by the decrease of water level downstream of the HEPPs due to diversion of water for energy generation. The cases leading to this impact are explained below:

- This impact is valid for both run-of-river type HEPPs (Yamanli II, Kusakli and Dogancay) and HEPPs with a dam and a powerhouse located at the end of a transmission tunnel (Kavsak Bendi HEPP) In the first type, the water level will decrease between the weir and the powerhouse. In the second type, because the water is diverted from the reservoir and transmitted via a tunnel to the powerhouse, the water level between these structures will decrease.

- Decrease in amount of water in the river bed during filling of the reservoir. This impact is valid for the HEPPs with a powerhouse at the toe of the dam (Kopru and Menge HEPPs).

In order to compensate both cases, sufficient amount of water which is approved by the MoEF will be released from the weirs and dams in order to maintain the aquatic life in the stream. It is believed that the levels of these environmental flows will be determined by the Montana method. The level of cumulative impact of water level decrease on aquatic life is rated as medium because it is a severe impact but the extent of the impact is restricted.

Scenario B

In addition to *Alburnus orontis*, there are three other fish species determined during the field study, namely *Oxynoemacheilus (Schistura) samantica (O. samantica)*, *Paracobitis (Barbatula) seyhanensis (P. seyhanensis)* and *Salmo platycephalus* inhabiting only Zamanti River.

O. samantica and *P. seyhanensis* are classified as endangered species (EN) in IUCN Red List (2007). However, these species inhabitate the upper parts of Zamanti River between the elevations of 1,800 and 2,200 m. On the other hand, *Salmo platycephalus* which is a species classified as critically endangered (CR) in IUCN Red List (2010.2), restricted to the upper tributaries of Zamanti River (Soguksu, Karagoz and Gumusgun Creeks). It should be noted that none of ENERJISA project was proposed on Zamanti River. Although there are other HEPPs under construction or approved projects on Zamanti River, the elevations of these projects are lower than 1,400 m. Therefore, according to the study carried out by Dr. Erk'akan, *O. samantica*, *P. seyhanensis* and *Salmo platycephalus* will not be affected from these projects.

The impacts expected from the projects within Scenario B are the same type of impacts discussed in Scenario A for *Alburnus orontis*. Since there will be 18 HEPPs on two main tributaries, the extent of the impact will become wider. The overall level of cumulative impact on endangered fish species is rated as low because the geographic extent is medium and the severity of the impact is mild.

Scenario C

Within Scenario C, there will be many cascade run-of-river and dam projects. The cascade run-of-river system on Zamanti begins after Gumusoren HEPP and extends over a length of nearly 50 km on Zamanti River. The other cascade system begins with Yamanli I Weir and covers a length of 45 km on Goksu River. The overall level of cumulative impact on endangered fish species is rated as medium because the extent is wide and the severity is mild.

Table 5-9. Cumulative Impacts of the HEPP Projects on Biological Environment During Operation

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Terrestrial Vegetation Communities and Flora	Scenario A	1. Loss of terrestrial vegetation and flora due to inundation	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Wide +Moderate	Medium
2. Terrestrial Fauna	Scenario A	1. Sudden release of water especially during test operation leads to the flooding of terrestrial fauna 2. Migration of terrestrial fauna (mammals, birds, reptiles and amphibians) due to inundation	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Wide +Moderate	Medium
	Scenario A	3. Formation of a lake-like environment providing habitat for waterbirds and feeding area for other terrestrial animals.	Positive		
	Scenario B		Positive		
	Scenario C		Positive		
3. Aquatic Life	Scenario A	1. Impact on endangered and endemic fish species due to blocking of migration and adaptation problems	Additive	Negative / Restricted +Mild	Low
	Scenario B		Additive	Negative / Medium +Mild	Low
	Scenario C		Additive	Negative / Wide +Mild	Medium
	Scenario A	2. Increase in the potential for bioaccumulation of contaminants in the aquatic organisms due to change of flow regime	Interactive	Negative / Restricted +Moderate	Low
	Scenario B		Interactive	Negative / Medium + Moderate	Medium
	Scenario C		Interactive	Negative / Wide + Moderate	Medium

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
3. Aquatic Life	Scenario A	3. Hindered fish migration and disruption of fish habitat due to lack of fish ladders on the dams	Additive	Negative / Restricted +Moderate	Low
	Scenario B	4. Loss of in-stream spawning grounds for fish due to deterioration of the riverbed in the downstream of dams resulting from sediment reduction	Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Wide +Moderate	Medium
	Scenario A	5. Impact on aquatic life in the downstream resulting from: - Decrease in amount of water in the river bed due to diversion of water for energy generation (valid for run-of-river type HEPPs) - Decrease in amount of water in the river bed until the reservoir is filled just before the operation phase (valid for the HEPPs with dam)	Additive	Negative / Restricted +Severe	Medium
	Scenario B		Additive	Negative / Medium +Severe	High
	Scenario C		Additive	Negative / Wide +Severe	High

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

5.6.3 Socioeconomic Environment

Cumulative impacts of the HEPP projects on socioeconomic environment during operation phase are presented in Table 5-10.

Inundation

Scenario A

There will be loss of land (private property, forest, agricultural lands, etc.) due to inundation. Loss of private property such as agricultural lands may lead to negative impacts on livelihoods and standards of living of people. Within ENERJISA projects, there will be loss of private property due to construction. Expropriation procedures will be carried out for land acquisition in accordance with Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects. The cumulative impact level resulting from land acquisition is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B and C

Within Scenario B and Scenario C, there will be more private property to be inundated because the increased number of projects covers a wider geographic area. The impacts of loss of land will accumulate in an additive manner in the CIA Study Area. However there is no information on the loss of land within these projects. The land acquisition, and expropriation procedures within Scenario B and C will also be carried out in accordance with the Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects. The cumulative impact level is rated as medium because the extent of the impact is medium for Scenario B, wide for Scenario C and the severity is moderate.

Displacement of People

Scenario A

People will be displaced due to project-related land acquisition or inundation within the HEPP projects. Hence, there will be social disruption and impact on standard of living of displaced people. Within ENERJISA projects, because Yamanli II is a run-of-river HEPP, inundation will not occur and people will not be displaced. On the other hand, a few dwellings may be displaced and expropriation will be carried out for Kopru, Menge and Kavsak Bendi HEPP projects. The displacement and expropriation process will be carried out in accordance with Turkish Electricity Market Law, Electricity Market Licensing

Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects and Resettlement Law. The cumulative impact level resulting from displacement of people is rated as low because the number of people involved is low and the extent of the impact is restricted, and the severity is moderate.

Scenario B and C

Within Scenario B and C, there will be more people to be affected from the construction of the HEPPs because the increased number of projects covers a wider geographic area. Owing to the distances between the project sites, people to be affected from the construction of one project, will not be affected from another project. Therefore, the impacts of displacement will accumulate in an additive manner in the CIA Study Area. The land acquisition, expropriation and resettlement procedures will also be carried out in accordance with the Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects and Resettlement Law. The cumulative impact level is rated as medium because the extent of the impact is medium for Scenario B, wide for Scenario C and the severity is moderate.

Health Issues

Scenario A

Damming the river and creating a lake-like environment will cause an increase in the potential of water- based insect-born diseases such as malaria. These diseases have a direct adverse impact on human health. However, the reservoirs of Menge, Kopru and Kavsak Bendi HEPPs are relatively small and their retention times are low. Therefore, the conditions supporting the proliferation of insects will not occur in these projects. The level of cumulative impact of water- based insect-born diseases is rated as low because the extent of the impact is restricted and the severity is moderate.

Scenario B and C

Within Scenario B and Scenario C there will be more projects operating concurrently. Among these projects, Gumusoren and Goktas HEPPs are large projects in terms of reservoir volume. Therefore the potential for water- based insect-born diseases is higher than Scenario B. In addition, because the increased number of projects cover a wider geographic area, the extent will also increase. Therefore, the level of cumulative impact of water- based insect-born diseases is rated as medium because the extent of the impact is medium and the severity is moderate.

Employment Opportunities

Scenario A

Beside negative impacts resulting from the operation of HEPP projects, there are also positive impacts such as employment opportunities for local people. Within ENERJISA projects it is foreseen that nearly 110 people will be employed for the operation phase. In addition to positive impacts on livelihoods and standards of living of people, increase in the employment rates will contribute to local economy and development indirectly.

Scenario B and C

There will be more people employed in the operation phase when the number of projects increases. Within Scenario B and C, as the employment rates increase, the positive impact on livelihoods and standards of living of people will also increase. Thus, improvement in the local economy and development will be valid in a wider geographic area.

Energy Production

Scenario A

Another positive impact of ENERJISA projects on socioeconomic environment is contribution to the local and national electricity interconnection system. When all ENERJISA projects are operating concurrently, total annual energy production will be nearly 1,500 GWh. The total annual energy production of existing HEPPs in Seyhan Basin, namely Bahcelik and Camlica I HEPPs which are in the CIA Study Area as well as Seyhan and Catalan HEPPs which are located in the downstream of the CIA Study Area is nearly 1,400 GWh. In this respect, it is clear that ENERJISA projects will make a significant contribution to the local electricity production.

Scenario B and C

There will be 13 HEPPs operating concurrently in the CIA Study Area within Scenario B generating electricity of 3,600 GWh annually. Within Scenario C, there will be 18 HEPPs operating in the CIA Study Area generating nearly 4,200 GWh of electricity annually. These amounts of energy will make a significant contribution to the local and national electricity interconnection system.

Table 5-10. Cumulative Impacts of the HEPP Projects on Socio-economic Environment During Operation

Impact Reference	Sub-section*	Impact Description	Additive / Interactive	Positive or Negative and Severity if Negative	
1. Inundation	Scenario A	Impact on livelihoods of local people resulting from loss of private property such as agricultural lands due to inundation	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Medium +Moderate	Medium
2. Displacement of People	Scenario A	Social disruption and impact on standard of living of displaced people resulting from project-related land acquisition or inundation	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Wide +Moderate	Medium
3. Health Issues	Scenario A	Increase in potential of water- based insect-born diseases such as malaria.	Additive	Negative / Restricted +Moderate	Low
	Scenario B		Additive	Negative / Medium +Moderate	Medium
	Scenario C		Additive	Negative / Medium +Moderate	Medium
4. Employment Opportunities	Scenario A	Contribution to local economy and development resulting from employment opportunities for local people	Additive	Positive	
	Scenario B		Additive	Positive	
	Scenario C		Additive	Positive	
5. Electricity Generation	Scenario A	Contribution to the local and national electricity interconnection system	Additive	Positive	
	Scenario B		Additive	Positive	
	Scenario C		Additive	Positive	

6. ENVIRONMENTAL MANAGEMENT AND MONITORING

Environmental Management and Monitoring Plans (EMMPs) are part of the impact assessment process in order to implement the requirements of the regulatory authorities and to provide sufficient information to mitigate the impacts. EMMPs for each ENERJISA project are being prepared by DOKAY according to the IFC Performance Standards.

6.1 Responsibilities of the Project Sponsor

The HEPP projects of ENERJISA will be financed by a consortium of banks (the Lenders) including the IFC, the private-sector unit of the World Bank Group; WestLB, a European commercial bank in Germany; Akbank, a Turkish commercial bank; and EIB, the long-term lending bank of the EU. The Project Sponsor, ENERJISA, is responsible for the fulfillment of the requirements of these Lenders as well as commitments mentioned in the EIA Reports in accordance with the Turkish environmental legislation.

IFC and WestLB follow IFC Performance Standards and the World Bank's environmental safeguard policies described in "*Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment*". The IFC Performance Standards (PS) listed below establish requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment.

- PS 1: Social and Environmental Assessment and Management System
- PS 2: Labor and Working Conditions
- PS 3: Pollution Prevention and Abatement
- PS 4: Community Health, Safety and Security
- PS 5: Land Acquisition and Involuntary Resettlement
- PS 6: Biodiversity Conservation and Sustainable Natural Resource Management
- PS 7: Indigenous Peoples
- PS 8: Cultural Heritage

In addition to these standards, ENERJISA will be responsible for following OP 4.01. World Bank uses this policy to examine the potential environmental risks and benefits associated with lending operations. Since the projects proposed by ENERJISA are Category A projects according to OP 4.01, a full environmental assessment is required. Therefore, ENERJISA is responsible for the compliance of each EIA study carried out for the HEPP projects with the OP 4.01 and related other safeguard policies including Involuntary Resettlement (OP 4.12) and Safety of Dams (OP 4.37).

Although the displacement of people related to energy generation projects are clarified through provisions in Turkish legislation, there are no provisions regarding the consultation process through the resettlement of people. Consultation and grievance mechanism are required by IFC. In this respect, ENERJISA is planning to prepare a

Resettlement Action Plan in accordance with the IFC Performance Standards and safeguard policies of World Bank.

On the other hand, EIB follows EU Directives on environmental and socio-economic issues, mainly including the Directives on Strategic Environmental Assessments (SEA) and Water Framework Directives (WFD). Therefore, ENERJISA will be responsible for compliance of the activities to be carried out during the construction and operation phases of the HEPPs with EU environmental legislation.

Monitoring Responsibilities

ENERJISA will also be responsible for fulfilling the requirements in the EMMPs for the facilities that will be constructed by the contractors. The contractors have to commit and provide the conditions mentioned in the tender document. The requirements that need to be fulfilled by ENERJISA are listed below:

- Assigning an HSE engineer to implement the EMMP as the HSE authority and to follow the compliance with internal audits,
- Training operation and maintenance staff to raise the environmental consciousness to provide their contribution to the environmental performance of the projects,
- Fulfilling the requirements of Turkish Environmental Legislation and taking necessary mitigation measures,
- In addition to the present legal framework, fulfilling the new national or international legislation that may come into force or be issued during operational phase.

While DOLSAR is conducting the engineering studies of Yamanli II and Kavsak Bendi HEPPs, TEMELSU is carrying out these studies for Kopru and Menge HEPPs. DOLSAR and TEMELSU are preparing documents required for the construction tender. Therefore, the EMMPs including the assessment of measures against environmental impacts that may occur during construction will be presented to the firms upon request with tender documents prior to the proposal period. The main responsibilities of the contractors to be determined by tender are as presented below:

- In order to contribute the environmental performance of the projects, training the construction staff to raise the environmental consciousness and assigning a person responsible for “Health, Safety and Environment” (HSE),
- Fulfilling the requirements of Turkish Environmental Legislation, and taking necessary mitigation measures,
- Acquiring required licenses in accordance with the national legislation to conduct construction activities,

- In addition to the present legal framework, fulfilling the new national or international legislation that may come into force or be issued during construction phase.

6.2 Relevant Responsibilities of Other Organizations and Agencies

Besides ENERJISA, there are many other developers planning to commence HEPP projects in Seyhan Basin. In accordance with the relevant legislation, these developers are also responsible to monitor environmental performance of their projects, and take necessary mitigation measures against adverse impacts of their projects.

In addition to ENERJISA, there are other organizations, agencies and institutions responsible during the construction and operation of the ENERJISA projects. These related parties are listed below:

Ministry of Environment and Forestry (MoEF): According to Articles 18 and 19 of Turkish Environmental Impact Assessment Regulation issued on the Official Gazette dated July 17, 2008 and numbered 26939, MoEF is responsible for the monitoring and control of the compliance of waste management activities of the projects with the relevant legislation related with the environment.

General Directorate of Nature Protection and National Parks: General Directorate of Nature Protection and National Parks that is responsible for determination, protection, planning, arrangement, development, management and protection of the protected areas such as national parks, nature protection areas and recreational areas is associate directorate of MoEF. As mentioned in Section 5.5.2, transmission tunnel to be constructed within the Yamanli II HEPP project is within the borders of Hancerderesi Wildlife Improvement Area which is under the control of General Directorate of Nature Protection and National Parks. In order to mitigate any potential impacts of the Yamanli II HEPP project on this improvement area, Hancerderesi Wildlife Improvement Area Management Plan was prepared by Adana Provincial Directorate of Nature Protection and National Parks, controlled by General Directorate of Nature Protection and National Parks and approved by the Ministry of Environment and Forestry. The implementation of this plan will be controlled by the Adana Provincial Directorate of Nature Protection and National Parks.

General Directorate of State Hydraulic Works: Being an associate directorate of MoEF, General Directorate of State Hydraulic Works is the authorized institution on overall water resources planning, managing, execution and operation. In this respect, it is empowered to plan, design, construct and operate dams and hydroelectric power plants. As the general procedure, master plan and feasibility reports are prepared for the development of ENERJISA Project. Main data required during this period are collected by DSI from the river basin surveys which are related with flow and meteorological, soil classification, agricultural economy, erosion, maps, geological conditions etc issues.

During the operational phases of the projects, the water level in the reservoir will be measured and recorded by State Hydraulic Works.

Adana Metropolitan Municipality and Other Related Municipalities: Adana Metropolitan Municipality and other municipalities of the districts will be responsible with the handling of the solid wastes, constructional wastes and wastewater to be originated from the Project activities of ENERJISA.

Adana Governorate: As stated throughout this report, different parties will have responsibilities on development, construction and operation of the projects. In accordance with Law on Provincial Administration, Adana Governorate will be responsible for the coordination of local parties as being the highest regional administrative entity. Moreover, in case of realization of expropriation and resettlement, Adana Governorate will select the sites for relocation of the affected households.

6.3 Proposed Mitigation Measures

6.3.1 Construction Phase

Mitigation measures for cumulative impacts on the physical, biological and socio-economic environment resulting from construction phase related activities of the HEPP projects are presented in Table 6-1, Table 6-2 and Table 6-3, respectively.

ENERJISA is the responsible party to minimize or eliminate possible environmental impacts of the projects. In this sense, for construction phase, ENERJISA will ensure that the EMMP is added to the tender documents before the contractor is determined. The mitigations stated in the tables below will be the responsibility of the contractor. Therefore, to guarantee the environmental performance of the projects, the contractor will be aware of his/her responsibilities in the construction phase before putting out to tender and prepare the bid taking these points into consideration.

Table 6-1. Mitigation Measures for Cumulative Impacts on Physical Environment During Construction

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
1. Air Quality	Scenario A	1. Dust generation	Restricted + Moderate	1. Work sites shall be watered under warm, dry and windy weather conditions. Material shall be loaded and unloaded without slueing; 30 km/hour speed limit shall be set on non-paved roads. Top of the trucks will be covered while carrying the excavation materials. Dust suppression system will be installed in the crushers.	In spite of the mitigation measures, low level dust and gaseous pollutants are expected especially around service roads	N.A	
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C	2. Gaseous pollutant generation	Medium + Moderate	2. Exhaust emissions of the heavy machinery shall regularly be measured, controlled and recorded by authorized institutions.		Medium + Mild	Low
2. Water Quality	Scenario A	Wastewater generation	Restricted + Moderate	Wastewaters will be collected in septic tank after treatment in a package treatment plant installed at the project sites. Treated wastewaters will be disposed outside of the basin because the river water in the basin is used as a potable water (in accordance with the Turkish Water Pollution Control Regulation)	No residual impact	N.A.	
	Scenario B		Medium + Moderate			N.A.	
	Scenario C		Medium + Moderate			N.A.	
3. Solid Wastes	Scenario A	1. Domestic solid wastes	Restricted + Moderate	1. Domestic solid wastes will be collected in the closed containers at the project site and handled by related municipalities at their waste disposal sites. Solid wastes will be transported to the waste disposal sites by trucks with necessary license and transportation costs will be paid by ENERJISA or the contractor.	No residual impact	N.A.	
	Scenario B		Medium + Moderate			N.A.	
	Scenario C	2. Excavation and demolition solid wastes	Medium + Moderate	2. Some portion of the excavated materials will be stored in the construction site to be used as backfill and aggregate material for concrete. Recyclable wastes will be collected separately and recycled. Remaining part will be transported by trucks with necessary license and disposed to the proper disposal sites in compliance with Regulation on Control of Excavation Material, Construction and Demolition Wastes.		N.A.	

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
4. Hazardous Wastes and Substances	Scenario A	Hazardous waste generation Release of hazardous substances	Restricted + Moderate	Hazardous wastes will be handled in compliance with Regulation on Control of Hazardous Wastes, Regulation on Waste Oil, Regulation on Control of Used Batteries and Accumulators (i.e., disposal of these wastes to a proper landfill or collection by a company certified by the MoEF for collection and disposal)	No residual impact	N.A.	
	Scenario B		Medium + Moderate			N.A.	
	Scenario C		Medium + Moderate			N.A.	
5. Landscape	Scenario A	Temporary increase in dust and machinery disturbing local people.	Restricted + Mild	No mitigation measure	Temporary increase in dust and machinery disturbing local people.	Restricted + Mild	Low
	Scenario B		Medium + Mild			Medium + Mild	Low
	Scenario C		Wide + Mild			Wide + Mild	Medium
6. Historic, Cultural or Aesthetic Features	Scenario A	Disruption of historic, cultural or aesthetic features	Restricted + Severe	Construction activities and blasting works will not be carried out near archeological sites in the vicinity of Yamanli II and Kopru HEPPs.	Low level potential risk	Restricted + Moderate	Low
	Scenario B		Restricted + Severe			Restricted + Moderate	Low
	Scenario C		Restricted + Severe			Restricted + Moderate	Low
7. Transportation	Scenario A	Increased traffic load	Restricted + Mild	Drivers of the vehicles carrying materials to construction site should obey speed limit of 30 km/hr. Warning signals should be installed around the sites where heavy construction facilities are carried out.	No residual impact	N.A.	
	Scenario B		Medium + Mild			N.A.	
	Scenario C		Medium + Mild			N.A.	

* Scenario A: ENERJISA Projects

Scenario B: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects

Scenario C: ENERJISA Projects + HEPPs under Construction or Completely Approved Projects + Planned and Predicted Projects

Table 6-2. Mitigation Measures for Cumulative Impacts on Biological Environment During Construction

Impact Reference	Sub-section*	Impact Type	Severity	Mitigation Measure	Residual Impact	Residual Severity	
1. Terrestrial Vegetation Communities and Flora	Scenario A	Deterioration of vegetation communities and flora	Restricted + Moderate	Vegetative top soil will be stripped prior to excavation works and will be stored in the construction site separately to be used in landscaping. Afforestation will be carried out in order to compensate the loss of forest areas. These activities will be carried out in accordance with the Article 43 of Turkish Regulation on Control of Excavation Material, Construction and Demolition Wastes (entered into force within European Landscape Convention adopted by Turkey in 2004). The construction activities will be carried out in accordance with the Turkish Regulation on the Permissions to be given for Forest Areas.	In addition to mitigation measures, the nature will compensate the impacts and losses in time.	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Medium + Moderate			Medium + Mild	Low
2. Terrestrial Fauna	Scenario A	1. Damage to terrestrial fauna due to poaching	Restricted + Moderate	1. Construction personnel will be prohibited from hunting of the terrestrial fauna in accordance with the Decisions of Central Hunting Commission, Terrestrial Hunting Law numbered 4915. 2. The provisions of Bern Convention and CITES (both conventions are adopted by Turkey) will be followed.	The fauna species migrated from their habitats will come back when the construction phase is over if their habitats are not degraded.	Restricted + Mild	Low
	Scenario B	2. Migration of the animals due to degradation of terrestrial habitats	Medium + Moderate			Medium + Mild	Low
	Scenario C	2. Migration of the animals due to degradation of terrestrial habitats	Medium + Moderate			Medium + Mild	Low
3. Aquatic Life	Scenario A	Stress on aquatic life from:	Restricted + Severe	1. Since the wastewaters will not be disposed to the rivers, there will be no impact on aquatic life resulting from the wastewater. 2. The impacts resulting from the diversion of the river will be minimized in accordance with the Regulation on Fishery Products, Article 8 and 11	In spite of the mitigation measures, low level impact on aquatic life is expected.	Restricted + Mild	Low
	Scenario B	1. Wastewater discharge 2. Diversion of river water	Medium + Severe			Medium + Mild	Low
	Scenario C	3. Sediment increase and turbidity	Medium + Severe			Medium + Mild	Low

Table 6-3. Mitigation Measures for Cumulative Impacts on Socio-economic Environment During Construction

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
1. Loss of Land	Scenario A	Impact on livelihoods of people	Restricted + Moderate	People will be provided compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods. Land acquisition and expropriation will be carried out in accordance with the related national legislation.	The measures will minimize the impacts, however there will be low level residual impact	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Wide + Moderate			Wide + Mild	Medium
2. Health Risk to Personnel and Local Community	Scenario A	1. Hazardous wastes and substances 2. High noise levels and vibration 3. Occupational accidents	Restricted + Severe	1. Proper storage, handling and disposal procedures will be followed in accordance with the Turkish Regulation on Occupational Health and Safety. Explosive materials such as dynamite will be stored away from the residential areas and construction sites and handled in compliance with relevant regulations. Necessary permits will be taken for the use of explosives 2. Noise levels, vibration and all related measures are assessed in Acoustic Reports within EIA process. Local community will be informed prior to blasting. Construction works should be carried out during the day time period (07:00-19:00) stated in Turkish Regulation on Assessment and Management of Environmental Noise. 3. Use of personnel protective equipments and compliance with the procedures stated in the Turkish Regulation on Occupational Health and Safety.	1. No residual impact 2. Noise levels will comply with the legal limits. 3. There still will be occupational accidents despite the measures	Restricted + Moderate	Low
	Scenario B		Medium + Severe			Medium + Moderate	Medium
	Scenario C		Medium + Severe			Medium + Moderate	Medium

6.3.2 Operational Phase

Mitigation measures for cumulative impacts on the physical, biological and socio-economic environment resulting from operational phase related activities of the HEPP projects are presented in Table 6-4, Table 6-5 and Table 6-6, respectively.

Table 6-4. Mitigation Measures for Cumulative Impacts on Physical Environment During Operation

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
1. Water Quality	Scenario A	Domestic wastewater generation	Restricted + Mild	Domestic wastewater will be collected in septic tanks in accordance with the relevant national standard, and then will be transferred to the nearest municipality treatment plant.	No residual impact	N.A.	
	Scenario B		Medium + Mild			N.A.	
	Scenario C		Wide + Mild			N.A.	
2. Solid Wastes	Scenario A	Domestic solid wastes generation	Restricted + Mild	Domestic solid wastes will be collected in the closed containers at the project sites and handled by related municipalities at their waste disposal sites. Domestic solid wastes will be transported to the waste disposal sites by trucks with necessary license.	No residual impact	N.A.	
	Scenario B		Medium + Mild			N.A.	
	Scenario C		Wide + Mild			N.A.	
3. Inundation	Scenario A	Loss of land	Restricted + Moderate	No mitigation measure for loss of lands. On the other hand biological and socio-economic consequences of loss of land are presented in Table 6-5 and Table 6-6.	Loss of land	Restricted + Moderate	Low
	Scenario B		Medium + Moderate			Medium + Moderate	Medium
	Scenario C		Medium + Moderate			Medium + Moderate	Medium
4. Greenhouse Gas Emissions	Scenario A	Greenhouse gas emissions from the reservoirs	Restricted + Mild	The vegetation in the area to be inundated will be cleared prior to flooding.	Low level greenhouse gas emissions	Restricted + Mild	Low
	Scenario B		Medium + Mild			Medium + Mild	Low
	Scenario C		Medium + Mild			Medium + Mild	Low

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
5. Hydrology	Scenario A	1. Change of flow regime	Restricted + Severe	1. Change of flow regime is a natural consequence of HEPPs with dam projects. However there are some mitigation measures for the biological impacts of this phenomenon which is mentioned in Table 6-5.	Change of flow regime from river system to a series of lakes	Restricted + Severe	Medium
	Scenario B		Medium + Severe			Medium + Severe	High
	Scenario C		Wide + Severe			Wide + Severe	High
	Scenario A	2. Decrease in water level	Restricted + Severe	2. The flow in the river will be monitored and if needed, the amount of water to be released will be adjusted in accordance with the project optimization.	There still will be a decrease in water level instead of the measures.	Restricted + Moderate	Low
	Scenario B		Medium + Severe			Medium + Moderate	Medium
	Scenario C		Wide + Severe			Wide + Moderate	Medium
6. Sediment	Scenario A	1. Sedimentation of the reservoir	Restricted + Severe	1. Removal of sediments (flushing, sluicing)	Amount of sediment will be minimized in the reservoir	Restricted + Moderate	Low
	Scenario B	2. Change of water quality	Medium + Severe	2. Because of small reservoirs and low retention times for ENERJISA projects, water quality will not change. No mitigation measure is available.		Medium + Moderate	Medium
	Scenario C	3. Scouring of the riverbed	Medium + Severe	3. Sediment will be released.		Medium + Moderate	Medium
7. Evaporation	Scenario A	Loss of water	Restricted + Mild	Although there is no mitigation measure for loss of water through evaporation, it should be noted that evaporation will not occur in significant amounts for ENERJISA projects because the surface areas of the reservoirs are relatively small.	Relatively small amount of water loss	Restricted + Mild	Low
	Scenario B		Medium + Mild			Medium + Mild	Low
	Scenario C		Medium + Mild			Medium + Mild	Low
8. Irrigation	Scenario A	Loss of water	N.A.	No mitigation measure is available	Loss of water	N.A.	
	Scenario B		Restricted + Moderate			Restricted + Moderate	Low
	Scenario C		Restricted + Moderate			Restricted + Moderate	Low

Table 6-5. Mitigation Measures for Cumulative Impacts on Biological Environment During Operation

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
1. Terrestrial Vegetation Communities and Flora	Scenario A	Loss of terrestrial vegetation and flora due to inundation	Restricted + Moderate	There will be limited loss of forest area due to inundation. However, afforestation and landscape works will be carried out in order to compensate the losses.	In addition to mitigation measures, the nature will compensate the impacts and losses in time.	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Wide + Moderate			Wide + Mild	Medium
2. Terrestrial Fauna	Scenario A	1. Flooding of terrestrial fauna	Restricted + Moderate	1. Warning of animals prior to release of water. In addition, instead of sudden release, water will be released gradually, so that animals will have enough time to leave the site.	Despite of warning, animals will still be affected from the flooding	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Wide + Moderate			Wide + Mild	Medium
	Scenario A	2. Migration of terrestrial fauna	Restricted + Moderate	2. There is no mitigation measure for the migration of terrestrial fauna. However they will find new habitats where they migrate.	Migration of terrestrial fauna	Restricted + Moderate	Low
	Scenario B		Medium + Moderate			Medium + Moderate	Medium
	Scenario C		Wide + Moderate			Wide + Moderate	Medium
3. Aquatic Life	Scenario A	1. Adaptation and migration problem for endangered and endemic fish	Restricted + Mild	Bio-monitoring can be suggested periodically for continuing the gene flow constantly among the populations which are used the tributaries of streams for breeding, and take precaution for against the problems afterwards. The other populations of <i>A. orontis</i> , living in the Orontes Basin and other local populations living in the tributaries of the Seyhan and Ceyhan River Basins can be used for bio-monitoring.	There still will be a low level risk	Restricted + Mild	Low
	Scenario B		Medium + Mild			Medium + Mild	Low
	Scenario C		Wide + Mild			Wide + Mild	Medium

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
3. Aquatic Life	Scenario A	2. Bioaccumulation	Restricted + Moderate	No mitigation measure is available. Because of small reservoirs and low retention times for ENERJISA projects, there will be low level accumulation of pollutants.	Bioaccumulation	Restricted + Moderate	Low
	Scenario B		Medium + Moderate			Medium + Moderate	Medium
	Scenario C		Wide + Moderate			Wide + Moderate	Medium
	Scenario A	3. Hindered fish migration 4. Loss of in-stream spawning grounds	Restricted + Moderate	2. It should be noted that fish migration in Seyhan River to the upstream is hindered since there is no fish ladder in the downstream HEPPs; namely, Yedigoze (under construction), Catalan and Seyhan Dams (at the downstream of Yedigoze HEPP). Therefore, the fish inhabiting the lower Seyhan Basin have already adapted to the existing reservoir systems. 3. No mitigation measure is available.	2. Hindered fish migration 3. Loss of in-stream spawning grounds	Restricted + Moderate	Low
	Scenario B		Medium + Moderate			Medium + Moderate	Medium
	Scenario C		Wide + Moderate			Wide + Moderate	Medium
	Scenario A	5. Decrease in amount of water in the river bed	Restricted + Severe	4. Environmental flow will be released: For aquatic life in the downstream of Yamanli II HEPP, 0.4 m ³ /s water from Stage I Weir, 0.68 m ³ /s from Stage II Weir and 20 L/s from Hocabey Weir will be released. Environmental flow to be released from Dogancay Weir is 1 m ³ /s and 250 L/s for December-May and June-November periods. For Kopru and Menge HEPPs, no need to release water	4. Although the environmental flow will be released, there will be residual impact	Restricted + Moderate	Low
	Scenario B		Medium + Severe			Medium + Moderate	Medium

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
	Scenario C		Wide + Severe	in the operation phase because the powerhouse is at the toe of the dam. However before the operation of the plant sufficient amount of water will be released nearly during a month until the reservoir is filled with water. For Kavsak Bendi Dam and HEPP (since the powerhouse is located at the end of a transmission tunnel), 9.42 m ³ /s of environmental water will be released for aquatic life in the downstream.		Wide + Moderate	Medium

Table 6-6. Mitigation Measures for Cumulative Impacts on Socio-economic Environment During Operation

Impact Reference	Sub-section*	Impact Type	Severity	Proposed Mitigation	Residual Impact	Residual Severity	
1. Inundation	Scenario A	Impact on livelihoods of local people	Restricted + Moderate	People will be provided compensation for loss of assets at full replacement cost and other assistance to help them improve or at least restore their standards of living or livelihoods.	The measures will minimize the impacts, however there will be low level residual impact	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Medium + Moderate			Medium + Mild	Low
2. Displacement of People	Scenario A	Project-related land acquisition or inundation	Restricted + Moderate	The expropriation for Kopru, Menge and Kavsak Bendi HEPP projects and resettlement of a few dwellings will be carried out in accordance with Turkish Electricity Market Law, Electricity Market Licensing Regulation, Expropriation Law, Cabinet Decree that enables immediate expropriation for energy generation projects and Resettlement Law. Accordingly, alternative housing and/or cash compensation will be made available prior to relocation.	The measures will minimize the impacts, however there will be low level residual impact	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Wide + Moderate			Wide + Mild	Medium
3. Health Issues	Scenario A	Water- based insect-born diseases	Restricted + Moderate	Vector control	Minimized potential for diseases	Restricted + Mild	Low
	Scenario B		Medium + Moderate			Medium + Mild	Low
	Scenario C		Medium + Moderate			Medium + Mild	Low

7. ONGOING MONITORING ACTIVITIES

Environmental monitoring studies are being conducted for HEPP projects of ENERJISA. These studies are designed to monitor cumulative impacts of the HEPP projects in the basin. In the context of these studies, seasonal water quality monitoring and fish fauna monitoring studies are carried out in project sites of the HEPPs of ENERJISA.

Brief information about these monitoring studies are presented in the following sections. Detailed information about monitoring studies is available in respective monitoring reports.

7.1 Surface Water Quality Monitoring Studies

Surface quality monitoring studies for Kopru and Menge HEPP projects started in Summer 2009 whereas monitoring studies for Kavsak Bendi HEPP project started in Spring 2010. DOKAY prepares an Environmental Monitoring Report quarterly for each project.

Four surface water quality monitoring studies have been conducted for Kopru and Menge HEPP projects since monitoring studies for these projects started in Summer 2009 whereas monitoring studies for Kavsak Bendi HEPP project started in Spring 2010 and two monitoring studies have been conducted for this project.

In the context of water quality monitoring studies, water samples are taken at upstream and downstream locations of each project site. For Menge and Kopru HEPP projects, water samples are taken from Goksu River, while sampling is carried out in Seyhan River for Kavsak Bendi Dam and HEPP project.

Water samples taken are analyzed in order to determine pH, Chemical Oxygen Demand, oil and grease, total coliform and fecal coliform. Analysis results are assessed according to inland water quality classes given in Table-1 of Water Pollution Control Regulation (WPCR). Also, concentration of total suspended solids and electrical conductivity of water sample are assessed in accordance with the quality criteria for irrigation waters given in Notice on Technical Procedures of the WPCR.

Surface water analysis carried out in samples taken from the upstream and downstream of project sites indicate a decrease in water quality although construction activities of the projects are not at a level to pose any impacts on quality of Goksu and Seyhan rivers. Therefore, it is considered that environmental factors (e.g. seasonal rainfalls) primarily affect the water quality in these streams.

7.2 Fish Fauna Monitoring Studies

Besides surface water quality monitoring studies carried out for HEPP projects of ENERJISA, a seasonal fauna monitoring study is being conducted by DOKAY in order to determine ichthyofauna, to show population densities, growth, reproduction-feeding status of the current freshwater species, to identify endemic species and determine relevant protection status in the project sites of planned and ongoing HEPPs of ENERJISA and surrounding tributaries.

Two studies have been conducted in Yamanli II HEPP, Menge HEPP, Kopru HEPP, Kusakli HEPP and Kavsak Bendi HEPP project sites and surrounding creeks in Winter and Spring 2010.

Similar results have been obtained during studies conducted in winter and spring. Three species (*Capoeta damascina*, *Squalius lepidus*, *Garra rufa*) from Cyprinidae family have been caught in Hançer Creek, Salam Creek, Balıklı Creek and Fındırın Creek covering Seyhan Basin HEPP sites. Among these three species, the two economically important fish species, *Capoeta damascina* and *Squalius lepidus* species, have been assessed in terms of growth, reproduction and feeding biologies.

Results of the fish fauna monitoring study conducted in Winter 2010 are given below.

- Age of *Capoeta damascina*, which is one of the economically important fish, changes between II-V. The shortest total length among the examined samples is 8.10 cm while the longest total length is measured as 26.0 cm. In addition to that, the lowest weight is 5.70 g while the highest weight is measured as 244.90 g.
- It has been determined that all *Capoeta damascina* samples fished within the scope of the study on reproduction are male and their Gonadosomatic Index (GSI) value, which indicates the reproduction period, has been averagely calculated as 1.29.
- The study on the feeding biology revealed that *Capoeta damascina* has an omnivorous feeding habit and feeds on Rotifera from zooplanktonic organisms and Bacillariophyceae and Chlorophyta from phytoplanktonic organisms.
- The other economically important fish species is *Squalius lepidus*. It has been determined that the male fish caught in Hancer Creek is III years old and its total length, weight and GSI values are 10 cm, 23 g and 0.12 respectively; while the total length of the other fish caught in Fındırın Creek, which is determined to be IV years old, is 17.0 cm, its weight is 32.0 g and its GSI is 0.31.
- The study on the feeding biology of *Squalius lepidus* indicated that this species feeds on zooplanktonic organisms.

- The fieldworks conducted for Winter 2010 period revealed that the proposed HEPPs do not have any negative impacts on growth, reproduction and feeding biologies of the economically important fish species *Capoeta damascina* and *Squalius lepidus*.

Results of the fish fauna monitoring study conducted in Spring 2010 are given below.

- As in Winter 2010, three species (*Capoeta damascina*, *Squalius lepidus*, *Garra rufa*) belonging to Cyprinidae family have been caught in Salam Creek, Findırın Creek, Balıklı Creek, Kocadere and Hançer Creek covering Seyhan Basin HEPPs areas.
- As a result of the survey, it has been determined that *Capoeta damascina*, which is important in economical terms and which is present in all sampling points, is the most dominant species within the population.
- When compared to the date in Winter 2010, it has been determined that the fresh water fauna and population densities in both periods have been similar and HEPPs do not have an adverse effect.
- It has been determined that among the economic fish species, the age of *Capoeta damascina* changed between II-V years and 7.5% of its population is II years old while 83% of its population is III years old, 7.5% of its population is IV years old and 2% of its population is V years old.
- Minimum and maximum total lengths of the examined samples have been measured in males as 7.4 cm and 23.0 cm while they have been measured for females as 16.0 cm and 20.1cm. In addition to that, the lowest and highest weight values are 23 g and 103 g for males while they are 43 g and 89 g for females.
- During the laboratory study made regarding the reproduction biology of *Capoeta damascina* caught in the project area during Spring 2010 it has been determined that 94.3% of the fish that have been caught is formed of males while 5.7% of them are females. GSI values that are evidencing the reproduction period has been estimated as 16.7 in males as maximum while it has been estimated as 18.2 in females as maximum.
- It has been determined that stomachs of the 90% of the *Capoeta damascina* samples examined in Spring 2010 period have been empty and the fish with full stomachs have been fed with Rotifer from zooplankton organisms and Bacillariophyceae from phytoplankton organisms. As in Winter 2010, it has also been determined for the Spring 2010 that zooplankton organisms dominate the food choice of *Capoeta damascina*.
- When the growth, reproduction and feeding biology of *Capoeta damascina* fish, which have economical importance, are examined generally in the survey made in

Spring 2010, it has been determined that there is no negative effect on the fish resulting from the projects that are being implemented.

8. GENERAL ASSESSMENT AND CONCLUSION

The potential cumulative impacts of the HEPP projects in the CIA Study Area have been assessed in accordance with the three Scenarios defined, i.e. ENERJISA projects; ENERJISA projects plus projects approved or under construction; and ENERJISA projects plus projects under construction, approved or planned. The CIA study has shown that a number of impacts from these energy projects will be unavoidable, but that their significance can be reduced or offset by appropriate mitigation. Of greatest importance, however, is that while many of these impacts are cumulative, such accumulation is additive not interactive, hence the total cumulative impact is not greater than the sum of the parts.

Scenario A

Within this Scenario, the potential cumulative impacts expected from only the ENERJISA projects have been assessed. The study shows that the cumulative impacts are no greater than the sum of individual impacts with the exception of the interactive impacts resulting from hazardous wastes and bioaccumulation risk for the aquatic organisms. The main cumulative impacts are related to aquatic life. But these can be largely mitigated with the release of environmental flows and biomonitoring of the fish species.

Scenario B

In Scenario B, the HEPPs already under construction and those completely approved projects whose construction phase will start in the near future within the CIA Study Area have been assessed together with the ENERJISA projects. We believe that it is possible that these projects could have significant cumulative impacts on the biological environment due to the presence of rare and endemic fishes in the Zamanti River – they are absent from the Goksu and Seyhan Rivers. However, most of these cumulative impacts may arise from the construction and operation of the other proposed HEPPs in the CIA Study Area. Since ENERJISA projects are not proposed to be constructed on the Zamanti River, they make no contribution to those potentially significant impacts. Therefore, even if the ENERJISA projects were not constructed, the significance of the cumulative impacts expected from the HEPPs under construction and completely approved projects would not be reduced.

Scenario C

For Scenario C, additional planned projects have been included for the CIA study. The consequences of the cumulative impacts can only increase within this Scenario but again, it is the Zamanti River where the main significance of these will lie since that is the most sensitive river in biological terms. As with Scenario B, not proceeding with the

ENERJISA projects on the Goksu and Seyhan Rivers will have no effect on the significance of the cumulative biological impacts expected from Scenario C.

Conclusion

As a result of this CIA it is concluded that all major adverse cumulative impacts can be mitigated to acceptable levels through the measures proposed, except for the following key residual negative impacts given below in the order of their importance:

- Change of flow regime from river to lake system affecting the aquatic and terrestrial ecosystem in the vicinity.
- Loss of vegetation communities, flora and terrestrial fauna habitats resulting from construction of project facilities and inundation
- Change of water quality resulting from sediment reduction in the downstream of the dams and in the reservoir.

These residual impacts will be monitored according to the programme given in Chapter 6, and necessary management measures will be taken as appropriate by the responsible parties.

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