LE GÜNEŞ
ELEKTRİK ÜRETİM A.Ş

APA SOLAR POWER PLANT PROJECT

Environmental and Social Impact Assessment Report

ENCON ÇEVRE DANIŞMANLIK LTD. ŞTİ.

ANKARA, DECEMBER 2017

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LIST OF ABBREVIATIONS

AC	Alternative current
CBO	Community based organization
CHC	Central Hunting Commission
CIA	Cumulative impact assessment
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CSP	Concentrated Solar Power Plants
DC	Direct current
Decibels	dB
DMI	General Directorate of State Meteorological Services
DSI	General Directorate of State Hydraulic Works
EAFZ	East Anatolian Fault Zone
ECA	Export Credit Agencies
EIA	Environmental Impact Assessment
EIE	Survey Authority of Electricity Affairs
EMRA/EPDK	Republic of Turkey Energy Market Regulatory Authority
ERP	Emergency Response Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ETP	Energy Technology Perspectives
EU	European Union
FOS	Flow Observation Stations
GDRS	General Directorate of Rural Services
GES	Apa Solar Power Plant
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GPS	Global Positioning System
Hz	Hertz
IAPCR	Industrial Air Pollution Control Regulation
IEA	The International Energy Agency
IFC	International Finance Corporation
ILO	International Labour Organisation
IUCN	The International Union for Conservation of Nature
JRC	European Union Joint Research Center
KBA	Key Biodiversity Areas
KGM	General Directorate of Highways
KOIZ	Konya Organized Industrial Zone

LIST OF ABBREVIATIONS

KOSKI	Konya Water and Sewerage Administration
MEDAS	Konya Meram Electricity Distribution Company
MGM	General Directorate of Meteorology
MoEU	Turkish Ministry of Environment and Urbanization
MSDS	Material Safety Data Sheets
NAFZ	North Anatolian Fault Zone
NREL	National Renewable Energy Laboratory
OECD	Organisation for Economic Co-operation and Development
OIZ	Organize Industrial Zones
Pa	Pascals
PID	Potential Induced Degradation
PM	Particulate Matter
PV	Photovoltaic
RAMEN	Regulation on the Assessment and Management of Environmental Noise
RDTP	Red Data Book of Turkish Plants
RIVM	Dutch Environment and Public Health Institute
SGHAT	Solar Glare Hazard Analysis Tool
SRI	Standardized Rainfall Index
TEIAS	Turkish Electricity Transmission Company
TRDB	Turkish Red Data Book
TurkStat	Turkish Statistical Institute
UCTEA	Union of Chambers of Turkish Engineers and Architects
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VEC	Valued Ecosystem Components
VOCs	Volatile Organic Compounds
WBGU	The German Global Advisory Council
WDA	Wildlife Development Area
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This Environmental and Social Impact Assessment (ESIA) Report is prepared to describe the Apa Solar Power Plant (GES) Project (Project) and its possible environmental and social impacts together with the measures planned to be taken to avoid, minimize and/or mitigate those identified impacts. It will also define the legal and administrative framework applicable to the Project and characterize the baseline environmental and social conditions prevailing in the area where the Project will be conducted.

1.1. Project Background

Apa Solar Power Plant (GES) Project is planned to be constructed on an area of 26.17 hectares, that is located in Baglar vicinity within the boundaries of Apa neighborhood of Cumra District in Konya Province (Project Area or EIA Area), by LE Gunes Elektrik Uretim A.S. (Project Owner or Company). The Project Area is approximately 55 kilometers (air distance) south of Konya city center and 30 kilometers (air distance) southwest of Cumra district center. Within the scope of the activity, it is aimed to produce electricity by using photovoltaic technology in the power plant to be installed in the Project Area. The Project Area is shown in Figure 1.1.

The Project Area is located on premises which is a former poor quality pasture. For the use of the part of the premises within the scope of the Project, the necessary permission (allocation purpose change) was taken within the frame of the Pasture Law by the consent of Konya Province Pasture Commission and approval of Konya Governorship and the registration and title deed transactions were completed in the name of the state treasury.

License application for the Apa GES Project was initially made on June 13, 2013 to the Energy Market Regulatory Authority (EMRA), in accordance with the current electricity market legislation, referring to a planned capacity of 38.18 MW. In progress, the planned power plant capacity was adjusted to 13.1 MW as a result of the competition held in Konya 1 Region for obtaining the connection right to 13.1 MW capacity.

In accordance with the relevant provisions of Electricity Market Law numbered 6446 and the Electricity Market License Regulation, a preliminary license for 30 months (starting from the date of 21.04.2016) has been granted to the Project Owner for Apa GES (with the decision of EMRA numbered 6225-24) in order to obtain necessary approvals, permits, licenses and as such to initiate the investment.

Solar power plants are classified according to their installed power capacity in the lists given in Annex-1 (Projects subject to full EIA) and Annex-2 (Projects subject to Screening-Elimination Criteria) of Turkish Environmental Impact Assessment (EIA) Regulation published in the Official Gazette dated 25.11.2014 and numbered 29186. According to the regulation, solar power plants having capacity of 10 MWe or above are listed in Annex-1 and the ones having capacity between 1 MWe and 10 MWe are listed in Annex-2. Since APA GES Project is planned to have a capacity of 13.1 MW, it is subject to EIA according to the Turkish EIA Regulation. In this context, the EIA study for the Project was conducted by ENCON Cevre Danismanlik Ltd. Sti. and EIA Positive Decision was received on April 18, 2017 from the Turkish Ministry of Environment and Urbanization (MoEU).

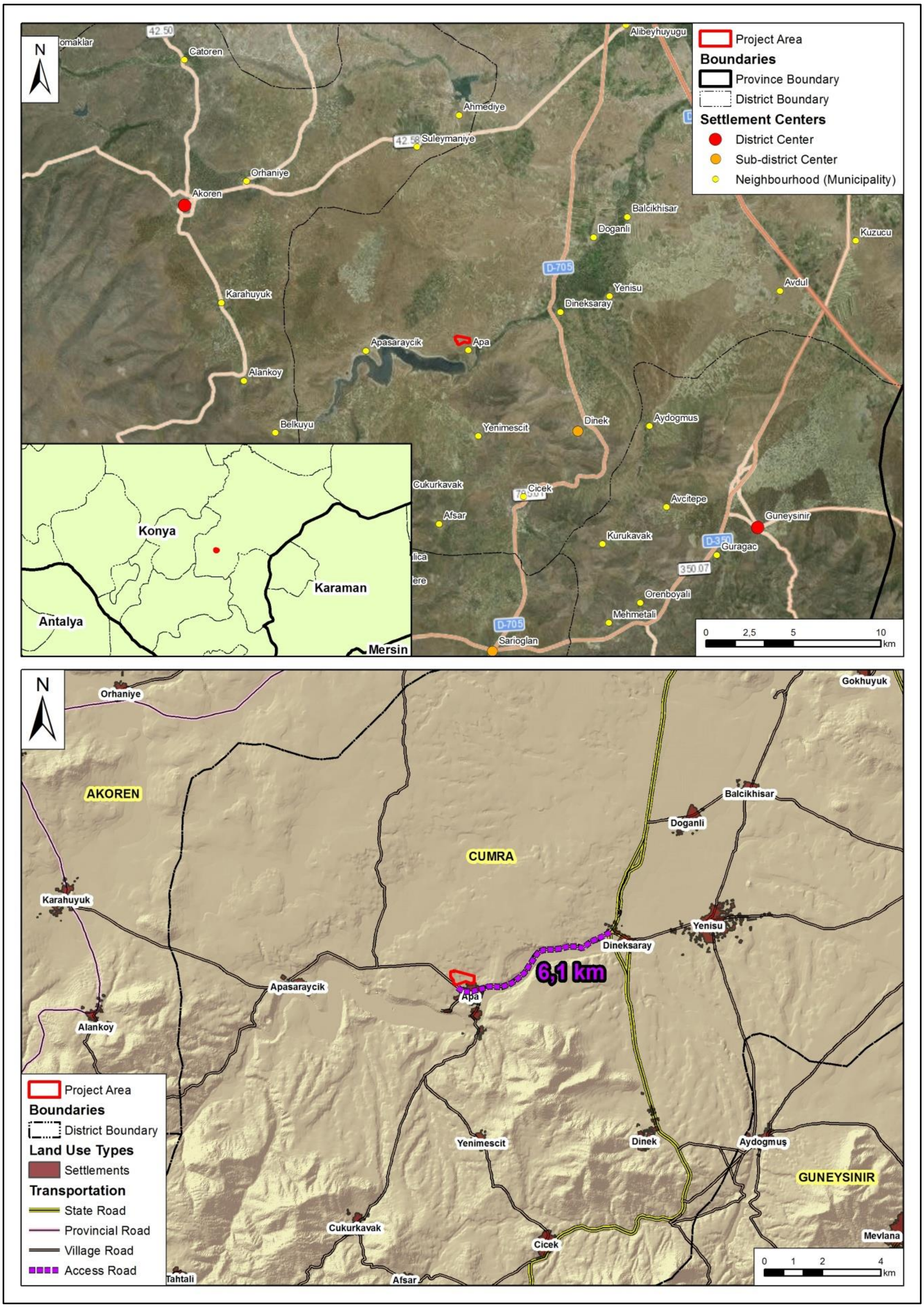


Figure 1.1. Site Location Map of The Project Area

1.2. Need for the Project

The energy demand situation in Turkey is parallel to the worldwide. Turkey is the country with the fastest increase in energy demand among the OECD countries over the last 10 years. Since 2002, Turkey is also the second country after China in increasing energy demand in the world (*Ministry of Foreign Affairs, 2016*). This continuously increasing energy demand and insufficient levels of domestic resource utilization increase the external energy dependency. Energy import increased by 175.9% between 2009 and 2014, as shown in Table 1.1, where general energy data for Turkey has been demonstrated (*EMRA, 2015*). On the other hand, only 27% of the total energy demand is supplied from domestic resources while the remaining part is supplied from various import resources being mainly oil and natural gas.

Table 1.1. Installed Power, Production and Consumption Data for Turkey

Subject	Unit	2009	2013	2014	Change (%)	
					2009-2014	2013-2014
Installed Power	MW	44,761	64,007	69,520	11.1	8.6
Peak Demand	MW	29,870	38,274	41,003	7.5	7.1
Production	GWh	194,813	242,121	251,962	5.9	4.1
Import	GWh	812	7,429	7,953	175.9	7.1
Export	GWh	1,546	1,227	2,696	14.9	119.7
Consumption	GWh	194,079	248,324	257,220	6.5	3.6

Source: EMRA, 2015

According to the information given in Table 1.1, production and consumption in 2014 increased by 4.1% and 3.6%, respectively, compared to 2013. Compared with the average of the last five years of 5.9% and 6.5%, it seems that there is a slight decrease in both production and consumption. In 2014, peak demand and installed power have increased by 7.1% and 8.6% respectively, and compared to five years average, it can be seen that pace of increase again tends to decrease. However, it should be taken into consideration that the increase in installed power at this point is above increase in peak demand. With the development of the interconnection requirement with Europe, import continued to increase in the previous years, but the rate of increase slowed down to 7.1%. In the current situation, this amount is expected to increase as construction lines are completed and new lines are built. In export, there was an increase of about 120% in 2014 compared to the previous year. However, the export/import ratio is still at 1/3 level (*EPDK, 2015*).

International public opinion highlights the importance of using more sustainable systems (e.g. systems based on renewable energy sources) in energy production in the near feature. Scientific and technological researches and developments are running on the use of renewable energy resources. On the other hand, necessary policies are enacted in various parts of the world in this respect. For example, by 2020, the European Union will have had developed policies and plans to maintain 20% of its energy needs from renewable sources. When considering all available alternative energy sources, the sun is the most important source of renewable energy, providing a non-consumable and non-decremental energy for the world. In consequence of the analysis of energy needs and resources performed for the years 2050s and 2100s, The German Global Advisory Council (WBGU) pointed out that the sun is an energy source that will make a significant contribution to meeting the global energy demand in the future. According to the analyzes performed for the year 2100, it is predicted that less than 15% of the world's energy demand will be supplied from petroleum, coal and nuclear sources and about 70% from photovoltaic or thermal systems based on solar energy. It is obvious that it is crucial to put energy efficiency and related policies into practice for the occurring of this change in the energy sector (*World Energy Council, 2013)*.

Work on utilizing solar energy has gained momentum, especially since the 1970s, solar energy systems have shown great progress in terms of technological progress and cost efficiency over time, and solar energy has accepted itself as a clean energy source for environment (*World Energy Council Turkish National Commitee, June 2009*). As a result, the sun has become an important alternative source for energy production both in the world and in Turkey.

Thanks to researches on electricity generation from solar energy, in recent years a great increase in the use of photovoltaic power systems has been observed in the world. Germany, China, Japan and Italy are pioneer countries in photovoltaic installed capacity *(Ren21, 2015, European Photovoltaic Industry Association, January 2012)*. The photovoltaic installed power capacity in the world has increased six fold since 2009 (in the last 5 years), reaching a total of 138.9 GW by 2013. Around 40 GW has been added to this installed power capacity only in 2014 and the photovoltaic installed capacity of the world has reached to 177 GW by 2014 *(Ren 21, 2015, European Photovoltaic Industry Association, 2014)*. Worldwide photovoltaic installed power capacity by years has been demonstrated in Figure 1.2.

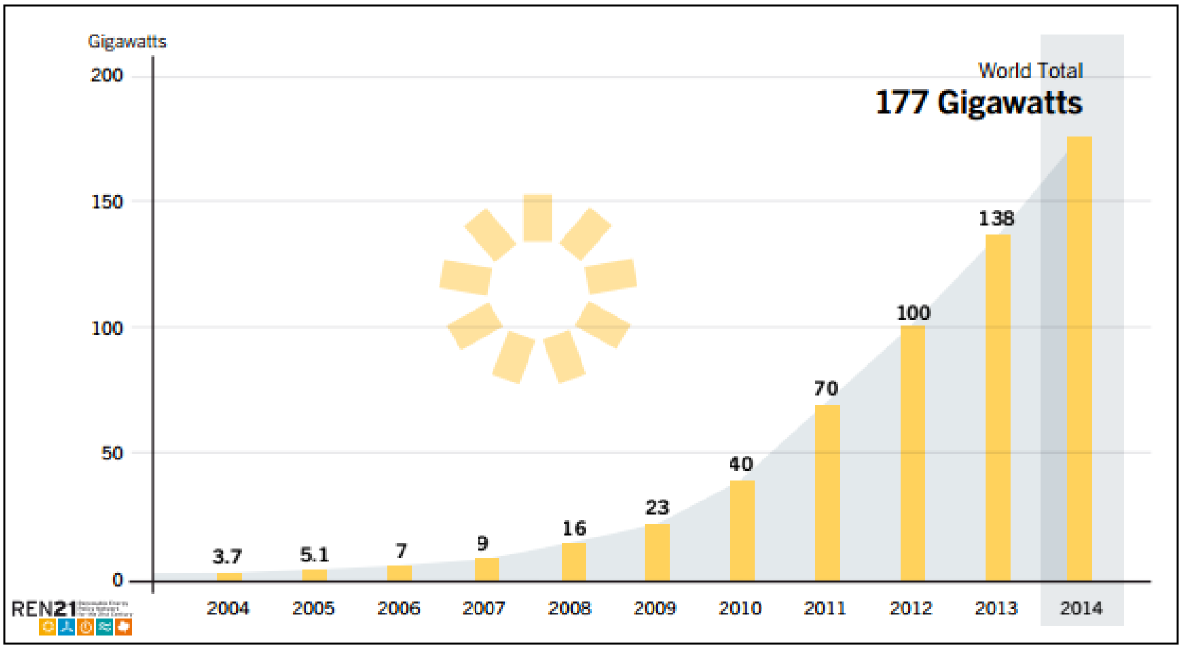


Figure 1.2. Worldwide Photovoltaic Installed Power Capacity by Years
(*Source: Ren21, 2015*)

While the developments in photovoltaic power generation in the world continues, the total installed power capacity of solar power plants in Turkey reached to 290 MW with more than 400 unlicensed solar power plants. This corresponds to only 0.4% of the total installed capacity *(TEIAS, January 2016)*. A total of 585.9 MW installed power capacity has been allocated to licensed GES projects planned by the investors in various provinces with GES competitions held by TEIAS besides unlicensed solar power plants. Information on licensed GES capacities allocated to various provinces by TEIAS has been demonstrated in Table 1.2. The investment processes of the mentioned licensed power plants, including the Apa GES Project, continue at different stages and the licensed power plants have the potential to contribute to the existing power generation in the country.

Table 1.2. Licensed GES Capacities Allocated by TEIAS

Province	Capacity Allocated (MW)	Province	Capacity Allocated (MW)
Elazig	8.00	Nigde	26.00
Erzurum	4.90	Kayseri	15.00
Mus	9.00		10.00
Hakkari	21.00	Adana	9.00
Sirnak	11.00	Sivas	9.00
Siirt-Batman-Mardin	9.00	Van-Agri	9.95
Sanliurfa-Diyarbakir	7.00		9.95
Antalya	18.61		9.95
	10.39		45.00
	23.40		2.15
	5.60	Bitlis	16.00
Denizli	5.00	Malatya-Adiyaman	9.95
	10.00		10.00
	3.00		2.05
Konya	5.00	Mersin	35.00
	9.90	Isparta-Afyon	18.00
	18.00	Burdur	6.00
	13.10		20.00
	6.00	Karaman	4.88
	9.98		33.12
	9.98	Mugla-Aydin	6.00
	9.80		14.00
	8.00	Kahramanmaras-Adiyaman	7.00
	2.24		10.00
			10.00
Total capacity allocated (MW)			**585.9**

When the information presented above on solar energy plants in worldwide, Europe and Turkey is evaluated together, the need for solar energy investments in our country, which has more solar potential than most European countries, with a sunshine duration exceeding 2,600 hours per year, clearly emerges.

With the planned Apa GES Project, the electric energy equivalent to the demand of approximately 10,250 dwellings will be produced. Therefore, the Project will contribute to supply the increased energy demand of our country without being dependent on external resources.

1.3. Aim and Basis of the ESIA Report

In order to fulfill the requirements of the Turkish EIA Regulation, EIA process was initiated by submitting the EIA Application File (prepared for the Project by ENCON Cevre Danismanlik Ltd. Sti.) to the Ministry of Environment and Urbanization (MoEU) on May 16, 2016. A public participation meeting within the scope of EIA process also conducted to inform local community of the area that is possibly affected by project activities and assess their opinion about the subject on June 16, 2016 at a tea house at Apa neighborhood, which is the nearest settlement to the Project Area. After submitting the EIA Report to the MoEU for review and evaluation and its acceptance as final report, EIA Positive Decision was received on April 18, 2017 from the MoEU.

The Project Owner has sought international finance for the Project, which has an anticipated investment value of 16.5 million dollars. All major international financial institutions commonly require environmental and social assessment of the projects to be financed, regardless of the fact that they have significant (Category A) or limited/less significant (Category B) potential impacts on environmental or social aspects. According to generally accepted international standards and guidelines adopted by those financial institutions, this assessment typically involves the preparation of an Environmental and Social Impact Assessment (ESIA) Report, which would include an Environmental and Social Management Plan (ESMP), while the scope of these reports and plans may be structured based on the significance of anticipated impacts.

In this context, this ESIA Report has been prepared to meet the environmental and social requirements of potential international lenders, following the requirements defined in the following international standards and guidelines:

- IFC's Performance Standards on Environmental and Social Sustainability
- IFC's General Environmental, Health and Safety Guidelines
- The Equator Principles

This ESIA Report covers the information and assessments contained in the Turkish EIA Report prepared in accordance with the requirements of national EIA Regulation, where relevant, while making necessary elaborations to address the additional requirements of the international environmental and social standards, where necessary. In this respect, the ESIA aims to identify all the potential environmental and social impacts of the Project, define the relevant avoidance, minimization and/or mitigation measures and inform all the interested stakeholders about the Project, its potential impacts and the environmental and social management system to be employed.

1.4. Structure of the ESIA Report

The ESIA studies covered description of the Project, analysis of national environmental legislation and international requirements, stakeholder identification (focusing on those directly affected) and engagement, environmental and social baseline information, impact identification, prediction, and analysis, generation of mitigation or management measures, evaluation of significance of impacts and residual impacts.

The impact assessment process included the identification of mitigation and control measures and adopted the principles of 'prevention, mitigation and restoration' in accordance with the mitigation hierarchy. Residual effects were also assessed and control methods, including monitoring plans, were identified in each subject area.

This report constitutes of a comprehensive integrated assessment of the Project, combining compliance with Turkish regulatory requirements and with the requirements of Equator Principles and IFC’s Sustainability Framework. The ESIA Report has been prepared to provide an integrated assessment of the Project across all relevant social and environmental media and across all phases of the Project.

The ESIA Report has been structured as follows:

- Chapter 1 Introduction
- Chapter 2 Policy, Legislative and Regulatory Framework
- Chapter 3 Project Description
- Chapter 4 Analysis of Alternatives
- Chapter 5 Geology, Natural Hazards, Soil Characteristics and Land Use
- Chapter 6 Air Quality, Meteorological Conditions and Climate Change
- Chapter 7 Noise
- Chapter 8 Water Resources
- Chapter 9 Waste Generation
- Chapter 10 Ecology and Biodiversity
- Chapter 11 Protected Areas, Landscape and Visuality
- Chapter 12 Socio-Economic Environment
- Chapter 13 Labor and Working Conditions
- Chapter 14 Traffic and Transport
- Chapter 15 Stakeholder Engagement
- Chapter 16 Cumulative Impact Assessment
- Chapter 17 Environmental and Social Management Plan

1.5. ESIA Approach

Key ESIA stages could be summarized as; screening, scoping, compilation of environmental and social baseline data, impact assessment framework, design of mitigation measures and monitoring, stakeholder engagement and cumulative impacts.

The first stage in the international ESIA process involves ‘screening’ or categorization of the Project in line with the expected environmental risk (as required by Equator Principle 1 and IFC screening criteria). Projects are assigned a category of A, B, or C, in descending order of environmental and social sensitivity. The screening stages included the following key steps:

- Identification of Project components and activities;
- Identification of likely physical, ecological and human receptors based on existing knowledge of the environmental and social baseline conditions and professional expertise;
- Examination of relevant national and international legislative requirements.

Apa GES Project has been categorized as Category B, which is defined as Projects with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures

Scoping for this report has been done by considering mainly the Turkish EIA Report prepared for the Project to meet Turkish EIA requirements and by using expert judgment, where necessary. The result of the scoping has been directly reflected to the chapters of this report as described in the previous section (Section 1.4. Structure of the ESIA Report).

Baseline environmental and social data collected for the Turkish EIA studies of Apa GES Project have been used by considering not duplicating of any existing data.

In the context of impact assessment framework, impact identification, prediction and evaluation were done based on the baseline conditions (in the project area and area of influence) and the project activities anticipated to cause impacts. In this regard, potential affected ecosystem components/receptors and their sensitivity were identified in terms of establishing the baseline. Then, impacts were identified and predicted using various methods including mathematical modelling, past experience from similar projects, expert judgement, interdisciplinary team assessments, etc. The evaluation of impact significance (before mitigation and significance of residual impacts) is based on the sensitivity of the receptors and the criteria values regarding impact magnitude (e.g. topic-specific legislation, regulations or standards).

In terms of designing mitigation measures; Avoid (make changes so that the impacts is avoided altogether), Minimise (apply measures to reduce the size of the impacts), Repair (take action to repair and/or restore the affected environment) and Offset (implement measures to offset or compensate for the impact) mitigation hierarchy has been followed for the Project. Where the impact assessment identified impacts as potentially arising, further mitigation measures have been developed and the steps or actions to be taken were described. Once feasible mitigation measures were identified and agreed, potential impacts were reassessed, assuming the mitigation measures were effectively implemented as planned. Where a residual impact was considered of Medium or High significance, an iterative process has been undertaken to further investigate opportunities for mitigation, according to the mitigation hierarchy.

Based on the findings of the environmental and social assessment process and the outcomes of stakeholder engagement, a programme of mitigation actions and management controls has been prepared to address the Project's identified potential environmental and social impacts and issues and other performance improvement measures. These are captured within an Environmental and Social Management Plan (ESMP), which covers all phases of the Project. The ESMP is based on the findings in this ESIA.

Stakeholder consultation has been a part of the ESIA process. Stakeholder engagement was and continues to be undertaken throughout the development of the Project to ensure that all interested parties are aware and informed of the Project and have an opportunity to provide input regarding potential project impacts and mitigation measures. To date, consultations have been undertaken with various governmental and non-governmental organizations both within the scope of the Project and within the scope of Turkish EIA studies of Apa GES. A Stakeholder Engagement Framework has also been prepared for the Project within this scope.

The assessment of cumulative impacts is a long established requirement for any comprehensive ESIA. Potential cumulative impacts that may result from the incremental impacts from other past, existing or future (reasonable foreseeable) developments/activities implemented or planned in the region are assessed within the scope of cumulative impacts.

1.6. Impact Assessment Methodology

The assessments of possible environmental and social impacts that the project should manage during the activities to be carried out in the land preparation, construction, operation and closure phases and the measures to be taken against the possible effects are described in the following sections. Table 1.3 represents an interaction matrix that summarizes each environmental and social element discussed in the following chapters and the possible actions that might cause or potentially create benefits for these elements at different stages of the Project. The environmental and social elements to which the project may interact, the impact assessment work on these elements and the general approaches to planned preventive mechanisms to be established and the mitigation measures planned to be taken according to the evaluation results will be presented in the following sections.

The magnitude and severity of the impact are taken into consideration when determining the significance of the impact in the impact assessment studies. By using quantitative and numerical methods in the evaluation within the scope of this EIA study, the predicted magnitude of the impact is qualified for each appropriate environmental and social subject as wide, local and restricted; and the severity of the impact is considered as high, medium and low according to the sensitivity/value of the receiver/source exposed to the impact, as much as possible. Then, the significance of the impact is determined according to the Table 1.4 (see also Table 1.5 for general criteria to be used in determining the magnitude of the impact and Table 1.6 for general criteria to be used in determining severity of the impact). In determining the magnitude and severity of the impact, residual impacts after the mitigation measures taken are also considered.

In terms of designing mitigation measures; Avoid (make changes so that the impacts is avoided altogether), Minimize (apply measures to reduce the size of the impacts), Repair (take action to repair and/or restore the affected environment) and Offset (implement measures to offset or compensate for the impact) mitigation hierarchy has been followed for the Project. Where the impact assessment identified impacts as potentially arising, further mitigation measures have been developed and the steps or actions to be taken were described. Once feasible mitigation measures were identified and agreed, potential impacts were reassessed, assuming the mitigation measures were effectively implemented as planned. Where a residual impact was considered of Medium or High significance, an iterative process has been undertaken to further investigate opportunities for mitigation.

Table 1.3. Matrix Representing Environmental and Social Impact Sources, Activities and Possible Interacts (Before Mitigation Measures Are Taken)

Source of Impact and Activity	Environmental and Social Factors															
	Environmental												Social			
	Land Use Properties	Topography	Soil Environment	Geology	Biological Environment	Surface Waters	Groundwater	Air Environment	Background Noise Level	Traffic Load	Landscape and Visuality	Protected Areas	Local Socioeconomic Env.	Community Health and Safety	Occupational Health and Safety	National Economy
Land Preparation and Construction Phase																
Land Use/Provision	N												N			
Vegetation Clearing, Levelling Works and Construction Activities		N	N		N	N		N	N		N				N	
Provision of Material, Equipment and Service								N		N			P	N		P
Water Supply and Use													N		N	
Use of Energy								N								
Generation of Domestic Wastewater			N			N	N						N	N	N	
Generation of Solid Waste			N			N	N				N		N	N	N	
Employment of Workforce													P			P
Installation of Energy Transmission Line	N		N		N			N		N	N		N		N	
Operation Phase																
Electricity Generation In Facility/Operation								P			N		P			P
Cleaning of Panels			N										N			
Water Supply and Use (Domestic)													N		N	
Generation of Domestic Wastewater			N			N	N						N	N	N	
Generation of Solid Waste (Domestic and Generated from Maintenance Activity)			N			N	N						N	N	N	
Provision of Material, Equipment and Service													P			
Employment of Workforce													P			
Closure Phase																
Reveling of On-Site Structures		N	N					N	N		N				N	
Rehabilitation Activities	P															
Water Supply and Use													N		N	
Generation of Domestic Wastewater			N			N	N						N	N	N	
Generation of Solid Waste			N		N	N	N							N	N	
Employment													P			

N	Possible Negative Impact
P	Possible Positive Impact

Table 1.4. Interaction Matrix for Significance Assessment

		Severity of Impact		
		High (3)	**Medium (2)**	**Low (1)**
Magnitude of Impact	**Wide (A)**	High (A3)	Medium (A2)	Medium (A1)
	Local (B)	High (B3)	Medium (B2)	Low (B1)
	Restricted (C)	Medium (C3)	Low (C2)	Low (C1)

Significance of Impact	**High**	The significance of impact must be reduced absolutely; action cannot be continued without lowering the effect.
	Medium	If possible, it can be reduced to a lower level by taking appropriate measures, if not lowered, risk can be accepted and activity can be continued
	Low	As long as legal requirements and safety criteria are provided, activity can be continued without a need for an additional measure

Source: adopted from World Bank, June 2012; L. Canter, 1993.

Table 1.5. Criteria for Determining the Magnitude of Impact

Magnitude of Impact	Description
Wide (A)	Beyond the Project Influence Area (regional)
Local (B)	Project Influence Area (the area around Project area with 1 km radius) (local)
Restricted (C)	Project Area (footprint)

Table 1.6. Criteria for Determining the Severity of Impact

Severity of Impact	Description
High (3)	Very sensitive and valuable Receptor/Source
Medium (2)	Sensitive and valuable Receptor/Source
Low (1)	Slightly sensitive and slightly valuable Receptor/Source

1.7. Area of Influence of the Project

The Turkish EIA Regulation defines the area of influence as "*the area affected by a planned project before operation, during operation and after operation*". The area of influence may be different for different types of impacts and different environmental components (physical, biological, social) (*World Bank ESMAP, December 2012*). For example; the impact area for water quality assessments in a project and the impact area for air quality assessments will be different from each other.

At the scoping stage, by taking each environmental and social element (land use and soil characteristics, biological environment (flora and fauna), surface water and groundwater resources, air quality, background noise level and socio-economic environment) and the scale and nature of the project activities into consideration, possible impact types related to the Project have been determined. Later, during the assessment of environmental and social impacts, possible area of influence for each type of impact was identified.

The impacts on land use characteristics, soil environment and biological environment during the construction of the plant will be limited to the Project Area. There will be no air emissions that could affect outside the facility, as deep excavation and quality filling work will not be carried out within the scope of land preparation and construction works, and no new road is expected to for main transportation. The use of process water or chemical/hazardous substances will not be the subject of electricity energy production activity at the plant. Likewise, there will be no flue gas emissions or other units that may be an emission source (e.g. PM10, CO_2, NO_x, SO_x) during electricity production. For these reasons, no impact outside the facility border is anticipated during the operation phase. However, when considering the socio-economic issues and visual characteristics of the Project and the possible noise that might occur during temporary construction activities, it has been found appropriate to include the Apa neighborhood into the area of influence. Within this scope, the reservoir belonging to the Apa Dam (that is in operation and located in the south of the Project Area) is considered as a natural border and thus it has been concluded an area of influence having 1 km radius (which would also cover the Apa neighborhood) will be sufficient for assessing the possible impacts. The area of influence determined in this context is shown in Figure 1.3.

On the other hand, the provision of premises required for the 31.5 kV medium voltage power transmission line, to be used for the connection to the Alibeyhuyugu Transformer Station located approximately 18 kilometers north (air distance) of Apa GES, will be carried out by the relevant authorized institutions in accordance with the Electricity Market Law No. 6446 . In this respect, the area needed for the establishment of transmission towers and the area where the easement right will be given along the electric power transmission line will be within the scope of another project that would be developed under the responsibility of the related electricity distribution company.

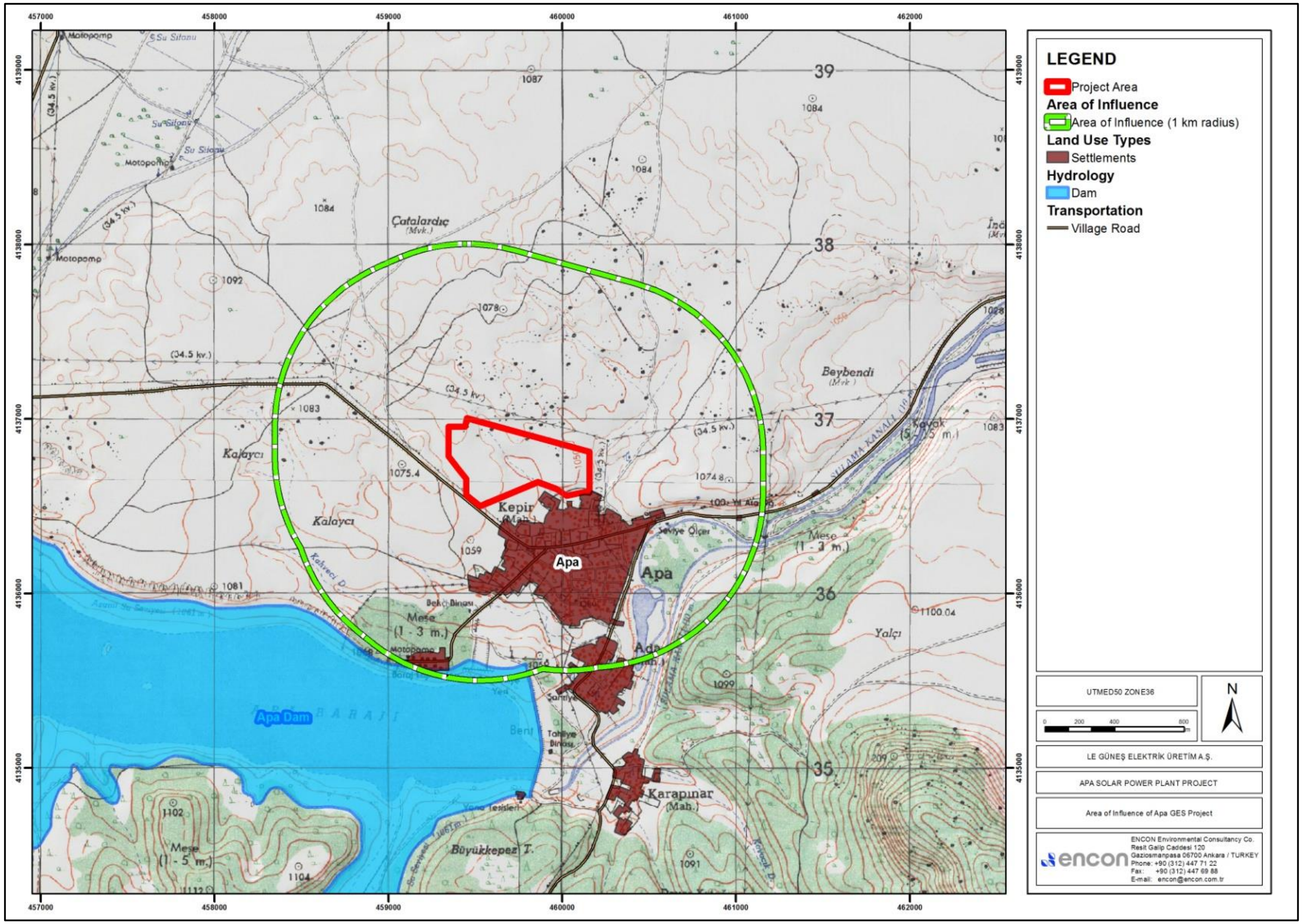


Figure 1.3. Area of Influence of Apa GES Project

CHAPTER 2

POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK

2. POLICY, LEGISLATIVE AND REGULATORY FRAMEWORK

2.1. Legal Framework for Environmental Protection and Conservation in Turkey

Turkish environmental regulations were developed in line with national and international initiatives and standards, and some of them have been revised recently to be harmonized with the EU Directives in the scope of pre-accession efforts of Turkey.

The Ministry of Environment and Urbanization (former Ministry of Environment and Forestry) is the responsible organization for the implementation of policies adopted for protection and conservation of the environment, and for sustainable development and management of natural resources. The Ministry of Environment and Forestry was first established as an Under-secretariat of the Prime Minister's office in 1987 and became the Ministry of Environment in August 1991 by the Establishment Law No. 443. The Ministry of Environment and Forestry was established in 2003 through a merger of the previously separate Ministry of Environment and Ministry of Forestry. Then, the environment part of the Ministry of Environment and Forestry was separated and merged with the Ministry of Public Works and Settlement to form the Ministry of Environment and Urbanization (MoEU) in 2011.

The MoEU (central organization) is based in Ankara and it has provincial directorates in each province. The MoEU has an overall coordinating role for the development and implementation of environmental policies in Turkey, including the approximation process for the EU environmental Acquis. The central organization is mainly composed of the following primary directorates and departments:

- General Directorate of Geographic Information Systems (GIS)
- General Directorate of Natural Assets Conservation
- General Directorate of Spatial Planning
- General Directorate of Environmental Management
- General Directorate of Environmental Impact Assessment, Permit and Inspection
- General Directorate of Structural Works
- General Directorate of Infrastructure and Urban Transformation Services
- General Directorate of Professional Services
- Department of Strategy Development
- Department of EU Investments
- Department of Foreign Relations

Main environmental responsibilities of the MoEU are summarized below:

- Prepare the legislation on environment, public works, and housing development and monitor and audit the related implementations;
- Identify the principles and policies on environmental protection, rehabilitation of environment and prevention of environmental pollution, develop standards, criteria and programs in this context; outline the principles for implementing and monitoring these standards and criteria; undertake the works related to climate change;
- Assess the impacts of all facilities/activities that pollute the environment due to their activities resulting in solid, liquid or gaseous waste disposal/discharge into receiving environments; monitor, audit and issue the permits of such facilities/activities;

- Perform the measurements/analyses and monitoring studies concerning receiving environments;
- Establish the plans and policies regarding the global climate change and measures to be taken against its effects.

For the management of environmental issues, MoEU collaborates with other ministries (including their provincial organizations where relevant), government agencies and relevant stakeholders, such as Ministry of Transport, Maritime Affairs and Communications (General Directorate of Highways), Ministry of Forestry and Water Affairs (General Directorate of Nature Protection and National Parks, General Directorate of Water Management, General Directorate of State Hydraulic Works, General Directorate of Forestry, General Directorate of Meteorological Services), Ministry of Food, Agriculture and Husbandry (General Directorate of Agricultural Reform), Ministry of Culture and Tourism (General Directorate of Cultural Heritage and Museums), Ministry of Energy and Natural Resources (General Directorate of Mining Affairs, General Directorate of Mineral Research and Exploration), Ministry of Finance (General Directorate of National Estate), Ministry of Labor and Social Security (General Directorate of Occupational Health and Safety, General Directorate of Labor) and Ministry of Health (General Directorate of Basic Health Services).

The Turkish Environmental Law (Law No: 2872; Date of Ratification: 1983), which came into force in 1983, addresses environmental issues on a very broad scope. According to the basic principles that govern the application of the Environmental Law, and as stated in the Constitution, citizens as well as the state bear responsibility for the protection of environment. Complementary to the Environmental Law and its regulations, other laws also govern the protection and conservation of the environment, resources and cultural and natural assets, the prevention and control of pollution, the implementation of measures for the prevention of pollution, health, and safety and labor issues. Some of these laws are:

- Conservation of Cultural and Natural Assets Law (Law No: 2863, Date of Ratification: 1983)
- Energy Efficiency Law (Law No: 5627 , Date of Ratification: 2007)
- Forestry Law (Law No: 6831 , Date of Ratification: 1956)
- Groundwater Law (Law No: 167 , Date of Ratification: 1960)
- Labor Law No: 4857, Date of Ratification: 2003)
- Law on Soil Protection and Land Use (Law No: 5403; Date of Ratification 2005)
- Law on Soil Protection and Land Use (Law No: 6537; Date of Ratification 2014)
- Law on Utilization of Renewable Energy Sources for the Purpose of Generating Electrical Energy (Law No: 5346 , Date of Ratification: 2005)
- Municipality Law (Law No: 5393 , Date of Ratification: 2005)
- National Parks Law (Law No: 2873 , Date of Ratification: 1983)
- Occupational Health and Safety Law (Law No: 6331, Date of Ratification: 2012)
- Pastures Law (Law No: 4342 , Date of Ratification: 1998)
- Public Health Law (Law No: 1593, Date of Ratification: 1930)
- Social Insurances and General Health Insurance Law (Law No: 5510, Date of Ratification: 2006)
- Use of Renewable Energy Sources for Production of Electrical Energy Law (Law No: 5346, Date of Ratification: 2005)

2.2. Turkish Legislative and Permitting Framework

Activities to be carried out within the scope of the Project must be conducted in accordance with the provisions of relevant Turkish legislation. Within this context, any license and/or permit must be obtained for the upcoming stages of the Project in accordance with the mentioned regulations.

2.2.1. Environmental Legislation and Regulatory Requirements

The Project is required to comply with various Turkish environmental regulations in line with the activities being or planned to be conducted within the scope of the proposed Project, as well as in implementing related management plans. In line with the Environmental Law and other supplementary laws, several regulations, communiqués and ordinances have been published since 1983. A comprehensive (though non exhaustive) list of relevant regulations, communiqués and ordinances is given below:

Air Quality Control and Management

- Regulation Concerning Follow up of Greenhouse Gas Emissions, Official Gazette date: May 31, 2017, No: 30082.
- Regulation on the Control of Air Pollution from Heating, Official Gazette date: January 13, 2005, No: 25699.
- Regulation on the Control of Exhaust Emissions, Official Gazette date: March 11, 2017, No: 30004.
- Industrial Air Pollution Control Regulation, Official Gazette date: December 20, 2014, No: 29211.
- Regulation on Assessment and Management of Air Quality, Official Gazette date: June 6, 2008, No: 26898.

Environmental Management, Permitting and Planning

- Environmental Auditing Regulation, Official Gazette date: November 21, 2008 and No: 27061.
- Environmental Impact Assessment Regulation, Official Gazette date: November 25, 2014 and No: 29186.
- Regulation Concerning Environmental Land Use Plans, Official Gazette date: November 11, 2008 and No: 27051.
- Regulation on Permits and Licenses that are to be obtained in accordance with the Environmental Law, Official Gazette date: February 24, 2010, No: 27503.
- Regulation for Starting up and Operating a Work Place, Official Gazette date: August 10, 2005, No: 25902.

Health and Safety

- Communiqué on Hazard Classes List related to Occupational Health and Safety, Official Gazette date: March 29, 2013, No: 28602.
- First Aid Regulation, Official Gazette date: July 29, 2015, No: 29429.
- Heavy and Hazardous Works Regulation, Official Gazette date: June 16, 2004, No: 25494.
- Health and Safety Signs Regulation, Official Gazette date: September 11, 2013, No: 28762 (based on EU Council Directive 92/58/EEC dated June 24, 1992).

- Regulation Concerning the Use of Personal Protection Equipments at Workplaces, Official Gazette date: July 2, 2013, No: 28695 (based on EU Council Directive 89/656/EEC dated November 11, 1989).
- Regulation on Health and Safety in Fixed Term and Temporary Employment, Official Gazette date August 23, 2013, No: 28744
- Regulation on Health and Safety Measures in the Use of Work Equipments, Official Gazette date: April 25, 2013, No: 28628.
- Regulation on Health and Safety Measures to be taken at Works Involving Chemicals, Official Gazette date: August 12, 2013, No: 28733.
- Regulation on Methods and Essentials of Work Health and Safety Training for Workers, Official Gazette date: May 15, 2013, No: 28648.
- Regulation on Occupational Health and Safety, Official Gazette date: December 9, 2003, No: 25311) (based on EU Council Directive 89/391/EEC dated June 6, 1989)
- Regulation on Radiation Safety, Official Gazette date: March 24, 2000, No: 23999.

Management of Chemicals and Other Dangerous Substances

- Regulation Concerning the Classification, Packaging, and Labeling of Dangerous Substances and Preparations, Official Gazette date: December 11, 2013, No: 28848, repeated.
- Regulation Concerning the Preparation and Distribution of Material Safety Data Sheets for the Dangerous Substances and Preparations, Official Gazette date: December 26, 2008, No: 27092 (repeated).
- Regulation on the Inventory and Control of Chemicals, Official Gazette date: December 26, 2008, No: 27092 (repeated).

Nature Protection

- Regulation on Pastures, Official Gazette date: July 31, 1998, No: 23419.
- Regulation on the Protection of Wetlands, Official Gazette date: April 4, 2014, No: 28962.
- Regulation on Procedures and Principles Concerning the Protection of Game and Wild Animals and their Habitats and Combat with their Pests, Official Gazette date: October 24, 2005, No: 25976.

Noise Control and Management

- Regulation on the Assessment and Management of Environmental Noise, Official Gazette date: June 4, 2010, No: 27601.
- Regulation on the Environmental Noise Emission caused by Equipments used Outdoors, Official Gazette date: June 30, 2016, No: 29758.

Soil Quality Control and Management

- Implementation Regulation on Soil Protection and Land Use, Official Gazette date: December 15, 2005, No: 26024.
- Regulation on the Control of Soil Pollution and Polluted Areas by Point Sources, Official Gazette date: June 8, 2010, No: 27605.

Waste Management

- Regulation of Waste Management, Official Gazette date: April 2, 2015, No: 29314.
- Regulation Concerning the Landfill of Wastes, Official Gazette date: March 26, 2010, No: 27533.
- Regulation on the Control of Excavation Materials, Construction and Demolition Wastes, Official Gazette date: March 18, 2004, No: 25406.
- Regulation on the Control of Medical Wastes, Official Gazette date: January 25, 2017, No: 29959.
- Regulation on the Control of Packaging Wastes, Official Gazette date: August 24, 2011, No: 28035.
- Regulation on the Control of Waste Batteries and Accumulators, Official Gazette date: December 31, 2015, No: 29579 (4th repeated).
- Regulation on the Control of Waste Oils, Official Gazette date: July 30, 2008, No: 26952.
- Regulation on the Control of Waste Tires, Official Gazette date: March 11, 2015, No: 29292.
- Solid Wastes Control Regulation, Official Gazette date: April 05, 2005, No: 25777.

Water Quality Control and Management

- Ordinance on Groundwater Resources, Official Gazette date: August 8, 1961, No: 10875.
- Regulation Concerning Protection of Ground Waters against Pollution and Deterioration, Official Gazette date: May 22, 2015, No: 29363.
- Regulation Concerning Quality of Surface Waters Planned or Used as Drinking Water Supply, Official Gazette date: June 29, 2012, No: 28338.
- Regulation Concerning Water for Human Consumption, Official Gazette date: March 7, 2013, No: 28580.
- Regulation on the Control of Pollution Caused by Dangerous Substances in Water Environment, Official Gazette date: November 26, 2005, No: 26005.
- Regulation on Pit Opening Where Sewer System Construction is not Applicable, Official Gazette date: March 19, 1971, No: 13783.
- Surface Water Quality Management Regulation, Official Gazette date: April 15, 2015, No: 29327.
- Water Pollution Control Regulation, Official Gazette date: December 31, 2004, No: 25687.

General

- Regulation Concerning Buildings to be built at Disaster Zones, Official Gazette date: July 14, 2007, No: 26582.
- Regulation Concerning the Buildings to be built in Earthquake Zone, Official Gazette date: February 6, 2007, No: 26454.
- Regulation Concerning the Decrease of Ozone Depleting Substances, Official Gazette date: April 7, 2017, No: 30031.
- Regulation Concerning the Increase of Efficiency in the Usage of Energy and Energy Resources, Official Gazette date: October 27, 2011, No: 28097.
- Regulation on Control of Large-Scale Industrial Accidents, Official Gazette date: August 18, 2010, No: 27676.

- Regulation on the Implementation of the Law Concerning Private Security Services, Official Gazette date: September 26, 2009, No: 27358.

The Project Owner shall comply with the requirements of current national legislations and codes of practice, and fulfill all other legal requirements. Therefore, during each and every stage of the planned project and implementation of related management plans, all activities should be carried in accordance with certain standards and limits set by the above mentioned laws and regulations and any license and/or permit required for the upcoming stages of the project should be acquired accordingly.

2.2.2. Environmental Impact Assessment Procedure

Under Article 10, Environmental Law sets out the general scope of the Environmental Impact Assessment (EIA) procedure in Turkey, indicating that institutions, agencies and establishments that lead to environmental problems as a result of their planned activities are obliged to prepare Environmental Impact Assessment report or Project Information File. Based on this legal framework, the EIA Regulation was put into force for the first time after being published in the Official Gazette numbered 21489 and dated on February 7, 1993. Since then there had been several amendments in the first regulation and new EIA regulations were published in 2008 and 2013 repealing the former regulations in force. The latest EIA Regulation has been published in the Official Gazette dated 25.11.2014 and numbered 29186, which repealed the 2013 EIA Regulation.

Under its annexes, the EIA Regulation categorizes investments as projects subject to full EIA (Annex-1) and projects subject to screening-elimination criteria (Annex-2). This categorization is done based on the type of activity and/or plant capacity. If the planned investment is defined as an activity under Annex-1 of the EIA Regulation, a full EIA Report is required. For Annex-2 activities, first a Project Information File is prepared in accordance with a limited format specified in the Annex-4 of the EIA Regulation and the MoEU ("Ministry") evaluates the need for a full EIA process for the project. As a result of this evaluation if "EIA Necessary Decision" is given, a full EIA is prepared for the project. Otherwise, an "EIA is not Necessary Decision" is issued and no further EIA Report is required for the project. In accordance with the EIA Regulation, the company, which will prepare the EIA Report or the Project Information File on the behalf of project owner, is required to hold a "Competency Certificate" and to employ the required technical accordingly.

<u>Full EIA Process (EIA Report for Annex-1 Projects and Annex-2 Projects Assigned with EIA Necessary Decision)</u>

The full EIA process starts with the submittal of an EIA Application File, summarizing the characteristics of the project and the impact area, and the potential environmental impacts and mitigation measures. This file is prepared in line with the format provided in Annex-3 of the EIA Regulation. Then, the MoEU General Directorate of Environmental Impact Assessment, Permit and Inspection establishes a Scoping and Review and Evaluation Committee ("Committee") from related governmental agencies and institutes (if deemed necessary depending on the scope and type of the project universities, representatives of the relevant research organizations, experts, professional chambers, unions, associations and non-governmental organizations may be asked to participate in the Committee), which also includes the project owner and the consultant that would prepare the EIA report. With the formation of this Committee, the scoping phase starts.

In the scoping stage, the Ministry and the related Governorate(s) announces to the public by using appropriate communication tools (e.g. announcements, notice boards, internet, etc.) that the Project application has been made, EIA process has been initiated, and the views and proposals about the Project may be submitted to the Governorate or the Ministry until completion of EIA process.

The next step in scoping is the determination of the date(s) for the Public Participation Meeting and the submittal of scoping views. Once these dates are set, the Ministry sends a copy of the EIA Application File to the Committee members and informs them about the dates set for the Public Participation Meeting and the submittal of scoping views.

The time and location of the Public Participation Meeting would be determined by the relevant Provincial Directorate(s) of the Ministry in cooperation and coordination with the EIA Consultant. The meeting place should be at a location easily accessed by the people mostly affected by the project. Afterwards, the date, time, place and scope of the meeting is announced on the web page of the Ministry, on the announcement boards of the relevant governorates and municipalities, and in one national and one local newspaper (at least ten calendar days before the date of the meeting).

The Public Participation Meeting is chaired by the Provincial Director of Environment and Urbanization or an official assigned by the Provincial Director. During the meeting, a brief and understandable presentation is given to the participants by the competent EIA Consultant to the public. The opinions of participants are obtained and necessary explanations made to address the questions and concerns of the participants. The issues raised by the public are documented in the official meeting minutes to be considered and addressed in the EIA Report. Copies of the official minutes of meeting are kept by the Governorate and the Ministry. By this mechanism, Public Participation Meeting provide an open platform to all interested parties to participate and submit their views, concerns and questions about the Project.

Following the Public Participation Meeting, based on the views and proposals of the Committee and the public, the Special EIA Report Format is drawn up by the Ministry. The competent EIA Consultant prepares the EIA Report in line with the special format and submits the draft report to the Ministry for review and evaluation. The Ministry sets a date for the Review and Evaluation Meeting and sends a copy of the Draft EIA Report and information on the date of Review and Evaluation Meeting to the Committee members. The start of the review process and that the Draft EIA Report is disclosed to public view is announced by the Ministry and its relevant Provincial Directorate(s) using appropriate communication tools (e.g. announcements, notice boards, internet, etc.). From the announcement date to the report finalization through the Review and Evaluation Meeting(s), public can review the Draft EIA Report and submit their views and comments to the Ministry or its Provincial Directorate. These comments are taken into consideration by the Committee members and the competent EIA Consultant addresses them in the EIA Report. Questions or comments of the Committee members are answered and/or discussed in the meeting and the comments of the Committee members are obtained for finalizing the EIA report. Then, the Report is finalized based on the comments of the Committee members and the Final Draft EIA report is submitted to the Ministry for the final public disclosure. Accordingly, the Final Draft EIA Report is disclosed by the Ministry and its related Provincial Directorates for 10 calendar days through announcement boards and internet. Any comment received from public in this context is considered by the Ministry in the decision-making process. Depending on the comments received from public, Ministry may request fulfillment of the deficiencies, execution of additional studies or regathering of the Committee. Finally, the Ministry requires the Consultant to submit the Final EIA report with a statement indicating that the report and its annexes are under the commitment of the project owner. Taking the Committee's evaluations and the public views, Ministry gives its "EIA Positive" or "EIA Negative" decision regarding the project. The decision of the Ministry is communicated to public using appropriate means. The procedural flowchart of the full EIA process under national EIA Regulation is presented in Figure 2.1.

APA GES Project is planned to have a capacity of 13.1 MW and due to its capacity it is subject to EIA according to the Turkish EIA Regulation (Annex-1 Project). Therefore, in order to fulfill the requirements of the Turkish EIA Regulation, EIA process for the Project was initiated by submitting the EIA Application File (prepared by ENCON Cevre Danismanlik Ltd. Sti.) to the MoEU on May 16, 2016. Public participation meeting within this scope conducted on June 16, 2016 at a tea house at Apa neighborhood. After submitting the EIA Report to the MoEU for review and evaluation and its acceptance as final report, EIA Positive Decision for the Project was received on April 18, 2017 from the MoEU.

Limited EIA Process (Project Information File for Annex-2 Projects)

If the planned activity is listed under Annex-2 of the EIA Regulation, a Project Information File is prepared by a competent EIA Consultant in accordance with the format given in Annex-4 of the EIA Regulation. The Project Information File is submitted to the Provincial Directorate of Environment and Urbanization for review and evaluation. Provincial Directorate gives its "EIA is Necessary" or "EIA is not necessary" decision regarding the project. The decision of the Provincial Directorate is communicated to public using appropriate means (i.e. announcement boards, internet).

2.2.3. Permitting Requirements

The main licenses and permits that might be required to be obtained throughout the project cycle, other than the "EIA Positive Decision" can be listed as the following, as applicable:

- Electricity Generation License (to be issued by EMRA)
- Renewable Energy Resource Certificate (to be issued by EMRA)
- Transmission License from the EMRA
- Land Use Permit for Pastures from the Provincial Directorate of Agriculture, Food and Husbandry
- Construction Permit
- Workplace Opening and Operation License (to be issued by the relevant Provincial Special Administration or the Municipality)
- Operation Certificate (to be issued by the relevant Provincial Directorate of Ministry of Labor and Social Security)

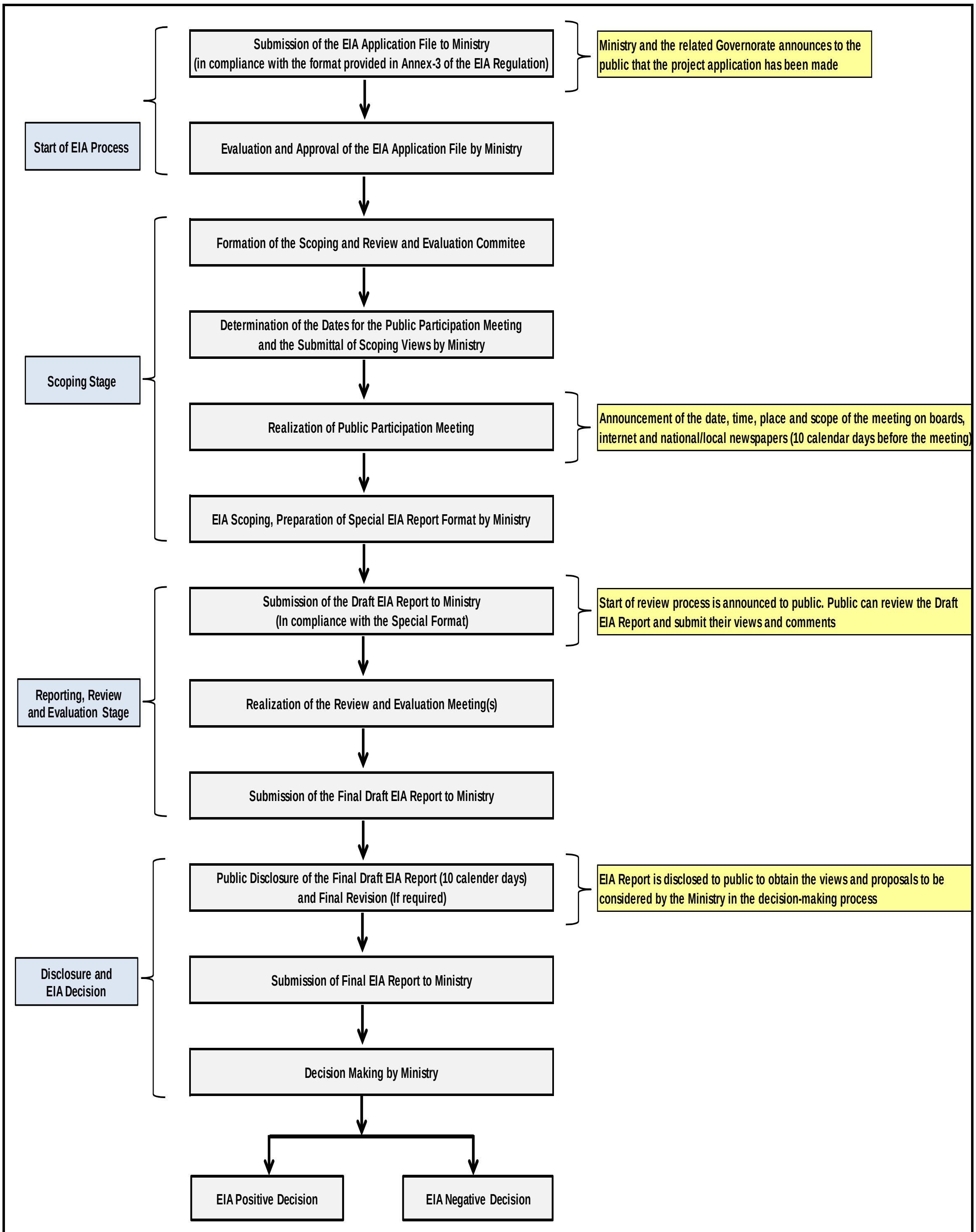


Figure.2.1. Flowchart Showing the Full EIA Process under Turkish EIA Regulation

2.3. International Environmental and Social Regulatory Framework

2.3.1. International Agreements and Conventions

Turkish national policy on protection of environment, cultural heritage and conservation of biological resources has been constituted on the base of relevant international agreements that Turkey has signed or ratified. Relevant environmental international agreements and conventions that have been ratified by Turkey are listed below:

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
- Bern Convention on Protection of Europe's Wild Life and Living Environment
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)
- Convention on Long-range Transboundary Air Pollution
- European Convention on the Protection of the Archaeological Heritage
- European Landscape Convention
- International Convention for the Protection of Birds
- Montreal protocol on Substances that Deplete the Ozone Layer
- Paris Convention on the Protection of the World Cultural and Natural Heritage
- Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat
- Stockholm Convention on Persistent Organic Pollutants
- United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa
- United Nations (UN) Framework Convention on Climate Change (Kyoto Protocol)
- UN (Rio) Convention on Biological Diversity
- Vienna Convention or the Protection of the Ozone Layer

2.3.2. International Financial Institution Standards

The Project will be developed in accordance with the standards and guidelines for financing including the IFC Performance Standards, Equator Principles III and the Organisation for Economic Co-operation and Development (OECD) Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the Common Approaches).

The first stage in the international ESIA process involves 'screening' or categorization of the Project in line with the expected environmental risk (as required by Equator Principle 1 and IFC screening criteria). Projects are assigned a category of A, B, or C, in descending order of environmental and social sensitivity. The Project has been categorized as Category B which is defined by IFC as "Projects with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures". As such an ESIA has been prepared to:

- Identify and assess the potential future environmental and social impacts associated with the proposed Project;
- Identify potential improvement opportunities; and
- Recommend any measures to avoid or where avoidance is not possible, minimize and mitigate adverse impacts.

World Bank and International Finance Performance Standards (2012)

Relevant World Bank and IFC standards and guidelines are as follows:

- IFC Performance Standards, 2012 and supporting guidance;
- IFC General Environmental, Health and Safety Guidelines;
- World Bank Group Guidelines - Pollution Prevention and Abatement Handbook.

International Finance Corporation Environmental, Health and Safety Guidelines - IFC has been preparing comprehensive guidance documents about environmental health and safety. These documents include General Environmental, Health and Safety Guidelines and Sector-specific Environmental Health and Safety Guidelines. These guidelines include administrative and technical requirements and best practices for projects' environmental performance, occupational health and safety, community health and safety, etc. for all phases of the Project (construction, operation and decommissioning). The sector-specific guidelines of IFC have been prepared for addressing the specific needs of the main sectors in which IFC works. In these guidelines, environment, health and safety issues are included and discussed with regard to the specific needs of various sectors. These guidelines are used together with the General Environmental, Health and Safety Principles.

IFC Performance Standards on Social and Environmental Sustainability - The following eight Performance Standards establish the requirements that the Project Owner is required to meet throughout the life of an investment supported by IFC or other relevant financial institutions using these standards:

- PS 1 Assessment and Management of Environmental and Social Risks and Impacts;
- PS 2 Labor and Working Conditions;
- PS 3 Resource Efficiency and Pollution Prevention;
- PS 4 Community Health, Safety and Security;
- PS 5 Land Acquisition and Involuntary Resettlement;
- PS 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- PS 7 Indigenous Peoples; and
- PS 8 Cultural Heritage.

The Equator Principles III (2012)

The Equator Principles Financial Institutions have adopted a set of principles in order to ensure that projects financed, are developed in a manner that is socially responsible and reflect sound environmental management practices. There are ten principles, which are as follows:

- Principle 1: Review and Categorisation;
- Principle 2: Social and Environmental Assessment;
- Principle 3: Applicable Social and Environmental Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;

- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Reporting and Transparency.

The OECD Common Approaches (2012)

In the event that Export Credit Agencies (ECA) from member states of the OECD provide project finance, they would apply the Common Approaches.

The Common Approaches provide guidance to ECAs for screening, classifying and reviewing projects under consideration by ECAs. These reviews benchmark projects against host country standards and one or more of the following international standards:

- The ten World Bank Safeguard Policies;
- The eight IFC Performance Standards;
- Relevant aspects of the standards of Regional Development Banks; and
- Relevant internationally recognized standards.

CHAPTER 3

PROJECT DESCRIPTION

3. PROJECT DESCRIPTON

3.1. Project Site

The Apa GES Project Area is located in APA neighborhood, about 55 km south of Konya city center and 30 km southwest of Cumra district center, within the boundaries of Konya Metropolitan Municipality. The main transportation to the Project Area from the direction of Konya can be achieved through D705 Konya-Hadim Road via the asphalt village road which is departed towards Apa neighborhood at Dineksaray neighborhood. In addition to that, there are other alternative routes that can be used for the transportation in APA neighborhood. The Project Area and the residential areas, transportation networks and power grids that are located in immediate vicinity have been demonstrated in Figure 3.1 on 1/25.000 scaled topographic map.

The Project Area is located in the area that is planned as meadow-pasture within the scope of 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area approved on 16.09.2013 by the MoEU and amended on 16.07.2014. The location of Project Area on 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area is shown in Figure 3.2.

The Project Area is also located in the area that is planned as rural development area, meadow-grassland and pasture within the scope of 1/100,000 scaled Environment Plan of Konya Province approved by the decision of Konya Metropolitan Municipality Council dated 12.12.2014 and numbered 953. The location of Project Area on 1/100,000 scaled Environment Plan of Konya Province is shown in Figure 3.3. The Project Owner has been applied to Konya Metropolitan Municipality, Directorate of Urban Development and Urban Planning on 07.02.2017 with a proposal of a 1/100,000 scaled Environmental Plan Alteration to request registration of the relevant part of the premises, where the Project Area located, in the name of the treasury by changing the allocation purpose and arrangement of the current title deed for the Project Area. Konya Metropolitan Municipality has requested the official opinion of the MoEU, General Directorate of Spatial Planning on the alteration of Environmental Plan. The official opinion of the MoEU states that it is allowed to conduct the business of renewable energy plant without any alteration on Environmental Plan by the positive opinion of relevant authorities and institutions. The process is still continuing in Konya Metropolitan Municipality.

The Project Area lies partly in the region having 1,000 scaled Implementation Development Plan and partly out of planned area, as stated by the Cumra Municipality, Directorate of Real Estate and Expropriation. Currently, preliminary studies for the revision of development plan for the Project continues and application shall be made after the completion of the mentioned studies.

In line with the Environment Plan, current land use status of the Project Area has been identified as pasture according to the Konya Province Land Assets data (1992) of former General Directorate of Rural Services. Land use map of Project Area and its vicinity is given in Figure 3.4.

According to the previous title deed, the Project Area is located on block no 165 and parcel no 2 (165/2) and registered as pasture (poor quality) characterized public property. The parcel no 165/2 had an area of 44.1 hectares where the Project Area covers only 26.17 hectares of it.

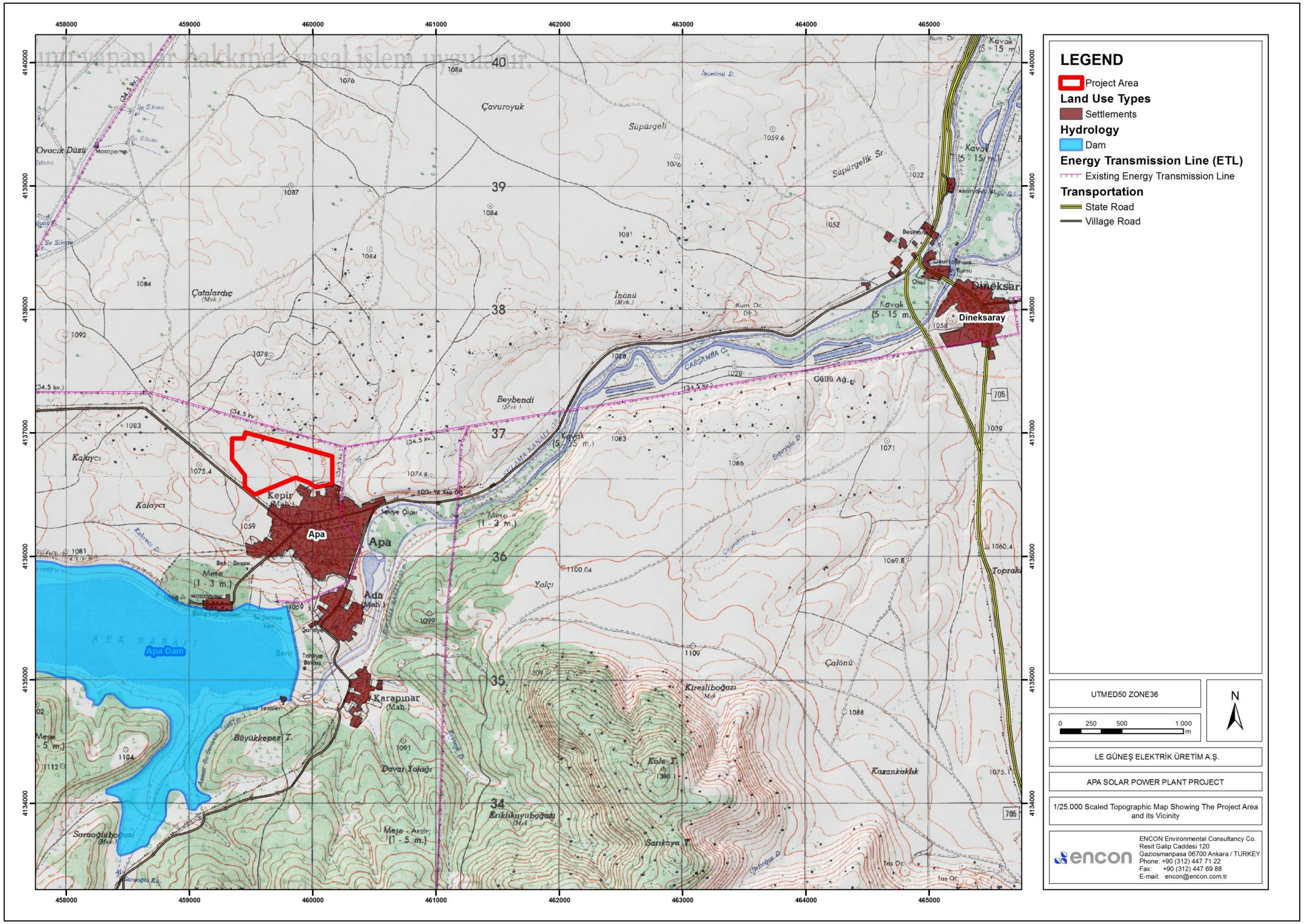


Figure 3.1. 1/25.000 Scaled Topographic Map Showing The Project Area and its Vicinity

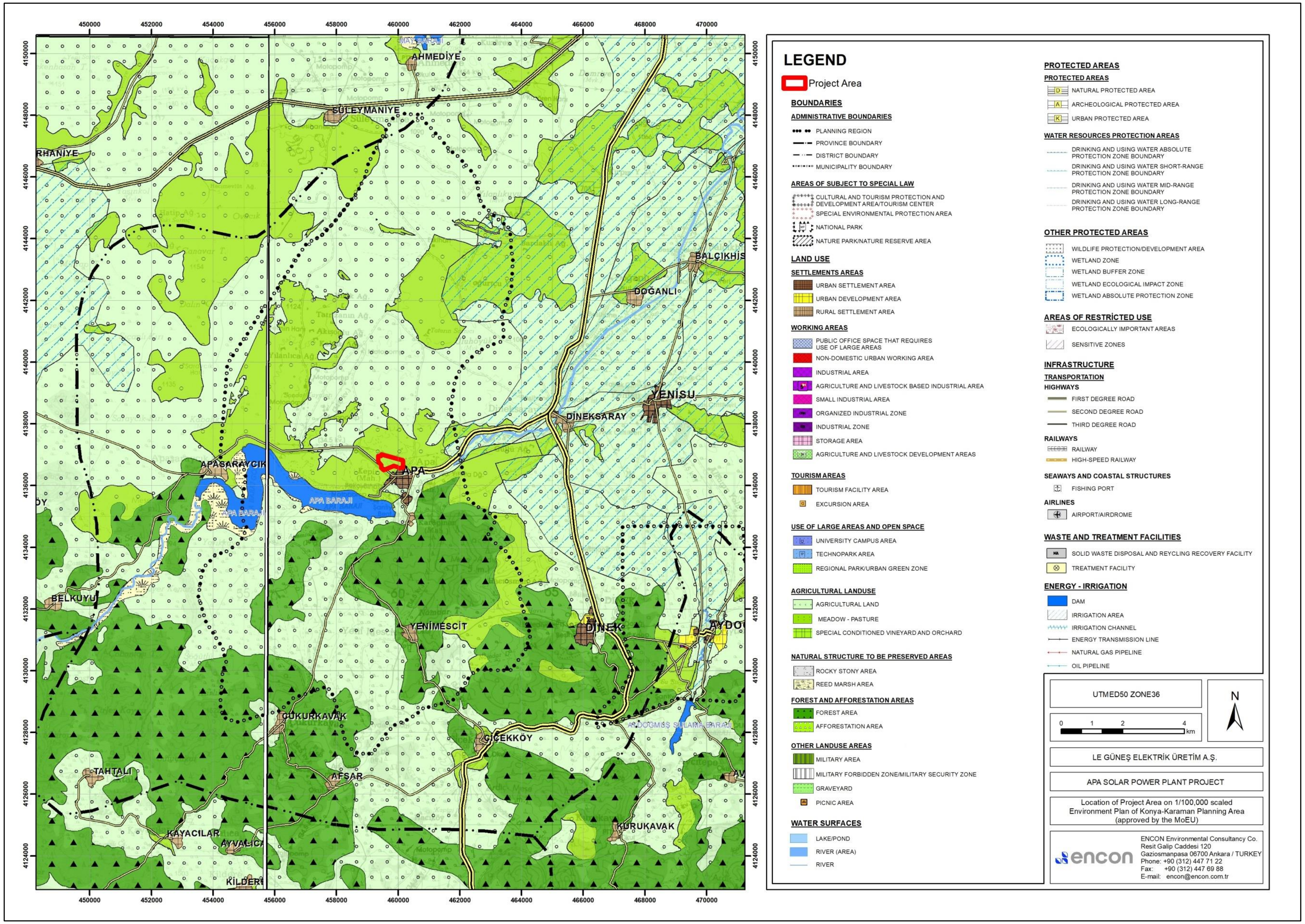


Figure 3.2. Location of Project Area on 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area (approved by the MoEU)

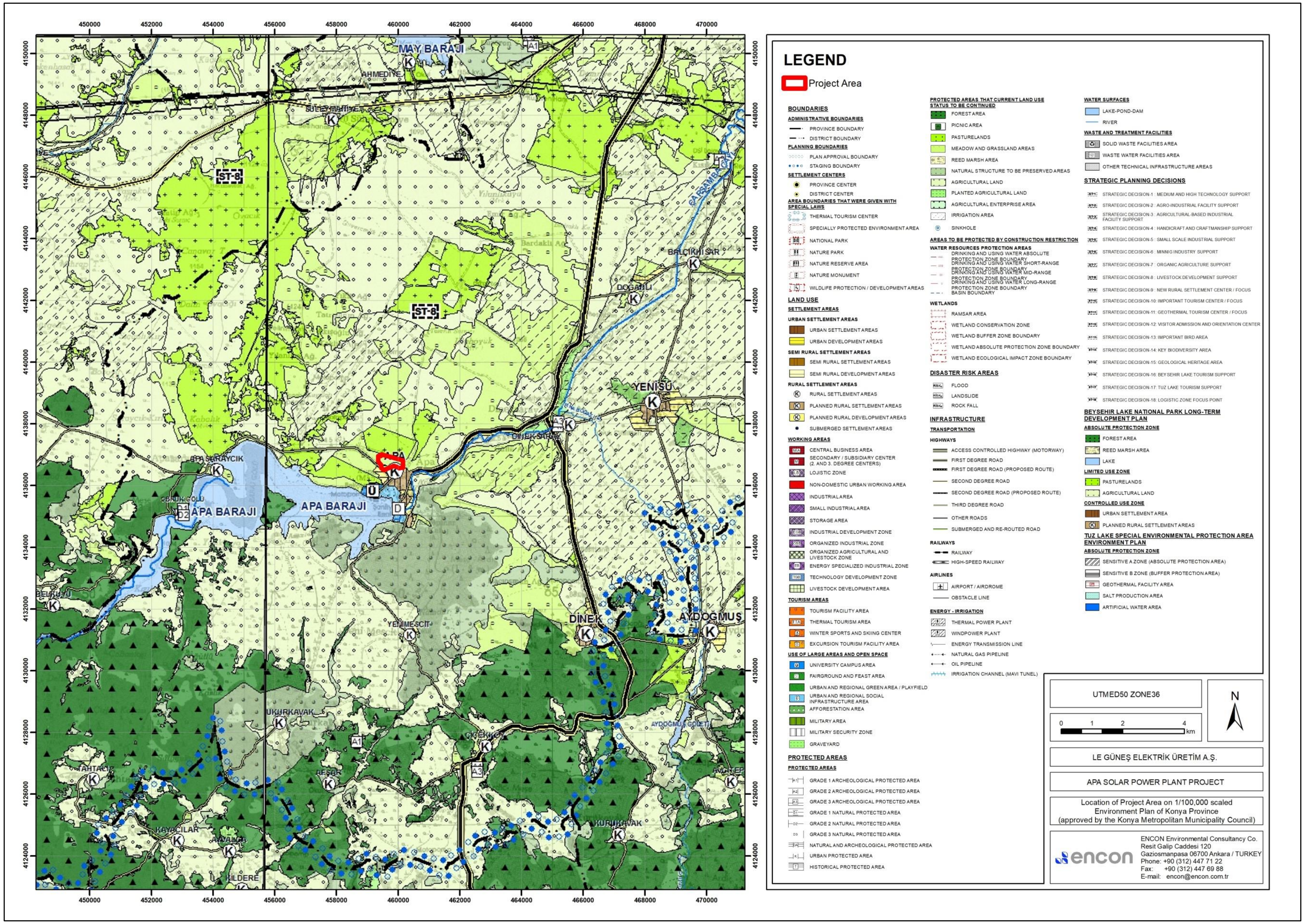


Figure 3.3. Location of Project Area on 1/100,000 scaled Environment Plan of Konya Province (approved by the Konya Metropolitan Municipality Council)

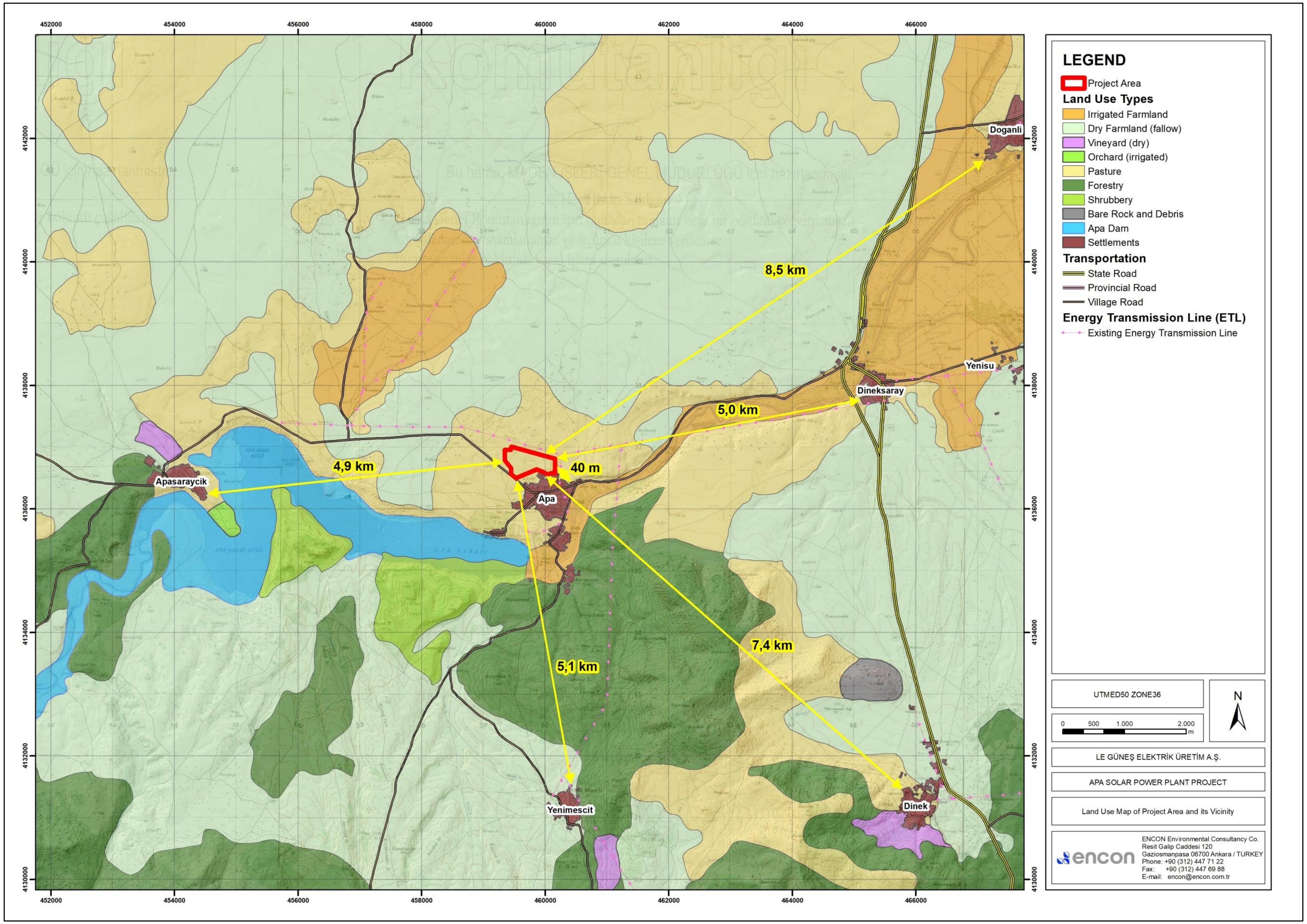


Figure 3.4. Land Use Map of Project Area and its Vicinity

Project Owner applied to Konya Governorship for the registration of the Project Area (only a part of the premises characterized as pasture) to the treasury by requesting allocation purpose change in order to establish Apa GES Project. As a result of the application, new title deed has been arranged for the area with the characterization of Solar Power Plant Area on 31.01.2017 (having a parcel no of 165/45 and an area of 26.19 hectares).

The closest settlement to the Project Area is Apa neighborhood in the south-southeast of the site (see Figure 3.5). The nearest building belonging to the settlement is at a distance of 40 meters to the Project Area, and the nearest panel is at a distance of 130 meters. Apasaraycik neighborhood (at about 5 km west of the site), Dineksaray neighborhood (at about 5 km northeast of the site) and Yenimescit settlement of Apa neighborhood (at about 5 km south of the site) are other settlements around the Project Area.

Figure 3.5. Apa Neighborhood

The altitude of the Project Area is between 1,045 and 1,075 meters above sea level. The area is relatively flat. On the east of the area, stony and locally rocky land and a pit-valley type formation is observed. Photographs of the Project Area showing its current status is given in Figure 3.6 to Figure 3.13.

The nearest dam to the Project Area is the Apa Dam at the south-southwest, which is in operation and used for irrigation purpose. The dam axis is around 1 km to the Project Area and the reservoir is around 900 meters. Carsamba Creek, where Apa Dam constructed on, passes around 400 meters away from the Project Area.

Project Area is not located in any protected area. The nearest protected area is Fosil Ardic Nature Monument that is at around 5.2 km east of the site.

Alibeyhuyugu Transformer Station, which will provide connection of the Project to the grid, is around 18 km north of the site.

Konya Airport and Konya 3rd Jet Military Air Base are around 65 km north of the site. Mersin International Port is around 200 km, Antalya Port is around 180 km and Iskenderun International Port (operated by Limak Group as LimakPort) is around 330 km to the site.

Figure 3.6. Village Road Providing Access to the Project Area from Apa Neighborhood (Looking Towards South-Southeast Direction)

Figure 3.7. West Part of the Project Area (Looking Towards Southeast Direction)

Figure 3.8. Project Area and Apa Neighborhood at the Background (Looking Towards Southeast Direction)

Figure 3.9. East Part of the Project Area and Apa Neighborhood at South (Looking Towards West Direction)

Figure 3.10. Project Area and Existing Energy Transmission Line Passing through North at the Background (Looking Towards North Direction)

Figure 3.11. Apa Neighborhood from East of Project Area (Looking Towards Southwest Direction)

Figure 3.12. Apa Neighborhood from the Village Road Passing Through the East of Project Area (Looking Towards South Direction)

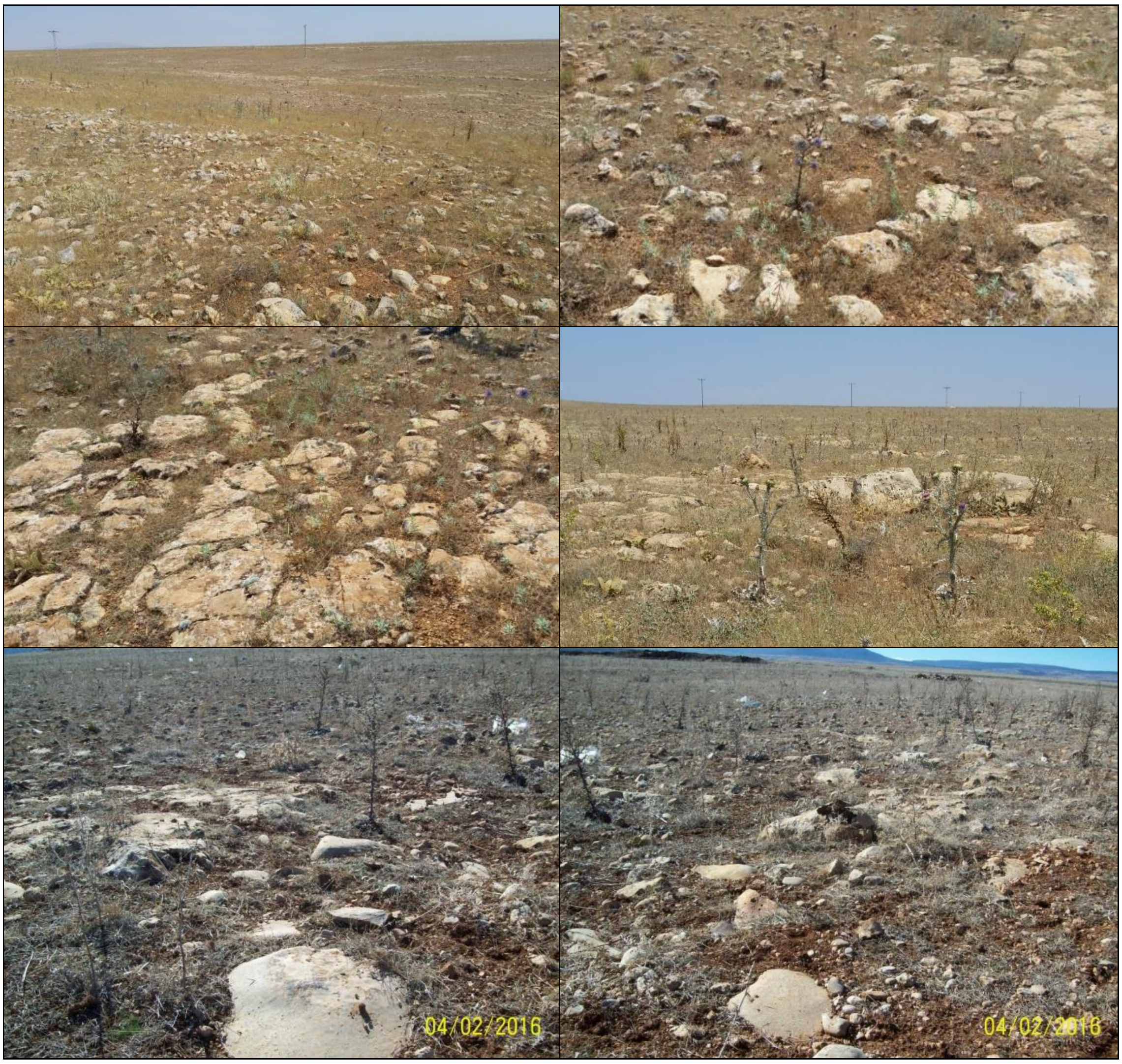


Figure 3.13. Stony and Locally Rocky Land on the East of Project Area

3.2. Basic Project Characteristics

The feasibility studies for the Apa GES Project were completed in 2015 and the basic project characteristics were determined. In accordance with the design made in this context, it is aimed to build and operate a solar power plant with 13.1 MWe installed capacity by using photovoltaic systems. The maximum electricity (annual) to be generated with a solar power plant planned with this installed capacity is anticipated as 26,200,000 kWh/year. An operational life time of 25 years is foreseen for Apa GES Project considering the current technology. The service life of the equipment to be used (solar panels, inverters, etc.) will correspond with the operational life time.

The main features of the project are summarized in Table 3.1 and the operation units to be established within the Project and the activities planned to be carried out are explained in the following sections.

Table 3.1. Main Features of Apa GES Project

Project Features	Information
Technology	Photovoltaic Systems
Total Installed Capacity of the Production Facility	13.1 MWe
Size of the Project Area	26.17 ha
Maximum Annual Power Generation	26,200,000 kWh/year
Foreseen Project Capacity Factor	22.8%
Foreseen Operational Life Time	25 years

3.3. Description of Project Components

The project components/units belonging to the Apa GES Project will include the temporary structures/units to be used in the land preparation and construction phase and the units/equipment that will provide electricity production at the power plant and its connection to the grid.

The temporary structures to be used in the land preparation and construction phase of the project will mainly consist of camp site, stock yards (where construction and installation materials and system equipment will be temporary stored before installation), topsoil storage area and waste storage areas. Workers/staff will not accommodate on site during land preparation and construction phase. However, infrastructure facilities for basic needs of the workers/staff (such as electricity, water, toilet, rest room, dining hall, etc.) will be provided within the camp site. Views of temporary construction structures/sites from similar solar power plant projects are presented in Figure 3.14.

Main and auxiliary units of the solar power plant are listed below:

- Photovoltaic solar panels
- Construction/mounting legs (panel support systems)
- Inverters
- Direct current (DC) cabling system
- Alternative current (AC) cabling system
- Transformer station
- Distribution center
- Administrative building (including office, control room and warehouse)

- Control/monitoring systems (electronic circuits, camera systems, etc.)
- Security cabins
- Toilet cabinet/sealed septic tank
- Temporary waste storage area
- Roads in Project Area
- Drainage channels

The layout of the Apa GES Project is given in Figure 3.15.

Camp Site

Solar Panels Stocked at Site Before Installation

Figure 3.14. Temporary Construction Structures/Sites in Similar Solar Power Plant Projects
(Source: Asian Development Bank, September 2015)

3.3.1. PV Technology

Conversion of solar light to electricity in photovoltaic cells (solar cells) is based on the photovoltaic (PV) effect. The PV effect can be described shortly as follows: The solar light enters a PV cell and increases the energy of electrons. When the electrons have sufficient energy, they are detached from the ions and a built-in-potential barrier in the cell acts on these free electrons to produce a voltage (the so-called photo voltage). This can be used to drive a current through a circuit (*SERI, 1982, Basic photovoltaic principles and methods, Washington DC)*

These systems generate electricity at by making use of semi-conductive materials that are sensitive to light rays (*Cezim, 2013*). When solar light hits this cell, negatively and positively charged electrons are produced in the semiconductors. Negatively charged electrons gather around the N-type semiconductor while positively charged electrons gather around the P-type semiconductor *(ISO, 2005, Workshop on Renewable Energies November 14-25, 2005 Nadi, Republic of the Fiji Islands, Solar Photovoltaic Solar Photovoltaic*). A conducting wire connects the p-type silicone to an electrical load, such as a light or battery, and then back to the n-type silicone, forming a complete circuit. As the free electrons are pushed into the n-type silicone, they repel each other because they are of like charge. The wire provides a path for the electrons to move away from each other. This flow of electrons is an electric current that travels through the circuit from the n-type to the p-type silicon (*University of Oregon, Solar Radiation Laboratory, 2011*). This process is summarized in Figure 3.16.

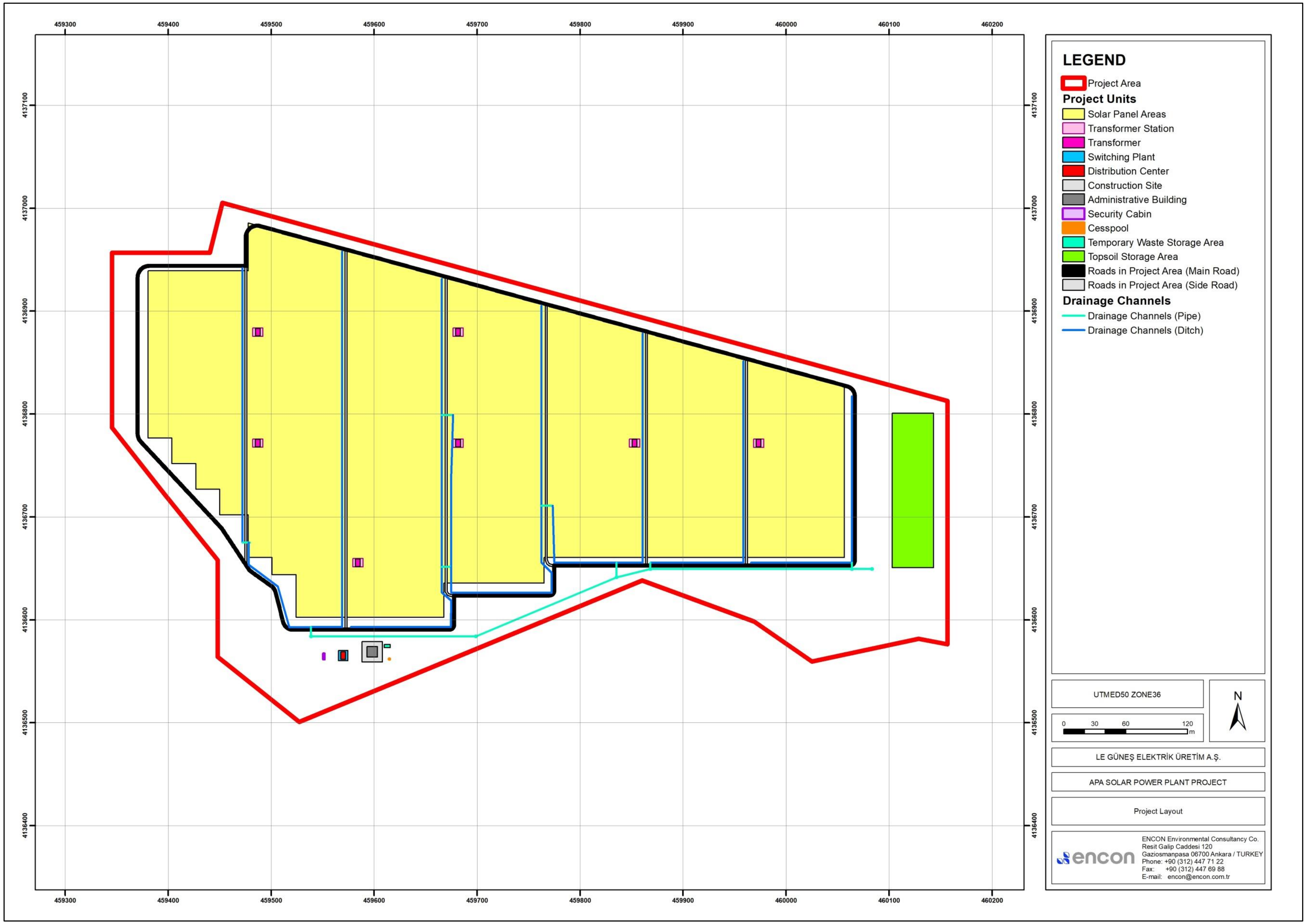


Figure 3.15. Project Layout

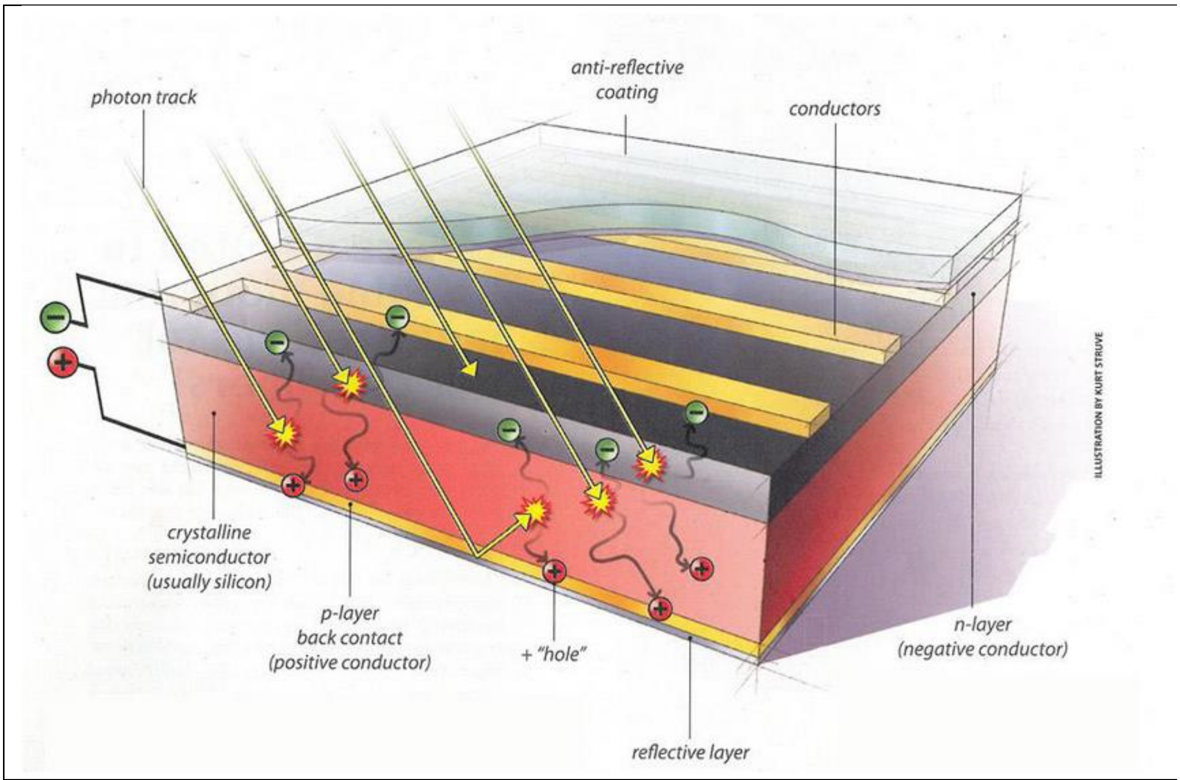


Figure 3.16. Working Principle of a Typical Silicone Photovoltaic Cell
(Source: SEIA web site; www.seia.org)

Several c-Si (crystalline silicone) and thin-film PV technologies have been in large scale commercial use. In addition, several emerging PV technologies may be technically and economically competitive in the future.

It should be noted that, electricity generation with PV system requires only the presence of solar light. These systems can generate electricity even in cloudy meteorological conditions; however, efficiency will decrease in such days. In the same way, as the light intensity increases, efficiency of the plant will also increase.

3.3.2. Panels

Panel technology is improving day by day. 270 W panels are used in similar solar power plants established with the current technology. The feasibility studies for the Apa GES Project are also based on panels with 270 W. In this context, characteristic information about the facilities to be established within the Project is presented in Table 3.2 according to the basic design made for polycrystalline technology, which is considered as the primary alternative under the existing technological conditions. However, based on the geological and geotechnical studies to be carried out on the site, the final design and characteristics of the panels and support system (for example number of legs, dimensions, heights, etc.) will be determined on the basis of a consequence of completed projects and engineering studies considering the latest panel technologies and the latest state of technological developments in the photovoltaic sector. In this context, the number and characteristics of the equipment to be used in Apa GES Project will be the most effective in terms of efficiency and cost of production of the targeted electric energy with an installed power of 13.1 MWe, in accordance with the progress continuously recorded in photovoltaic technology.

Table 3.2. Characteristic Information about the Facilities to be Established in the Project based on Polycrystalline Technology

Panel Characteristics	Unit	Polycrystalline Panel	
		Central Inverter	Serial Inverter
Total installed capacity (DC)	MWp	14.96	14.96
Total installed capacity (AC)	MWe	13.1	13.1
Panel power	Watt	270	270
Total number of panels	number	55,408	55,408
Number of panel per MWe	number	3,704	3,704
Number of inverter	number	13	262
Inverter power	kW	1,000	50
Number of transformers	number	7	13
Transformer Power	kW	3,000	1,250
Annual electricity generation	kWh	26,200,000	26,200,000
Total footprint area of panels	m^2	92,532	92,532
Footprint area of panels per MWe	m^2	6,185	6,185
Footprint area of each panel	m^2	1.67	1.67
Total number of mounts	number	17,952	17,952
Estimated mount size (width x length)	cm	6 x 10	6 x 10
Length of the shorter mount	m	1.8	1.8
Length of longer mount	m	3.3	3.3
Total footprint area of the mount	m^2	564	564
Height of the shorter mount from the ground	cm	100	100
Height of the longer mount from the ground	cm	250	250
Panel inclination	°	20	20

It is planned that the panels will be placed with an inclination of 20 degrees in accordance with the current design for polycrystalline technology based on good practice. Panels will be placed on the short and long mounts that provide support in the front and the back. Sample cross section of panel and panel support system for polycrystalline technology is shown in Figure 3.17. Depending on the ground structure/slope, 3 to 6 meters distance will be kept between the panels.

The inverter type selection will be made as a result of the ongoing alternative evaluation studies. Accordingly, central or serial inverters could be used in the system with the purpose of converting direct current (DC) generated by photovoltaic cells to alternating current (AC).

The solar panels will be installed on the outdoor area on the fixed inclined mounting legs whereas the administrative building, the central inverter station, the transformer building, the distribution center and security cabins will be closed structures. The cables will be placed in the cable channel to be prepared on site.

Solar panels will be assembled on legs using solar panel support systems, which mean that the footprint area of the mounts will be much less than the footprint area of the panels resulting in very limited land coverage.

The service life anticipated for Apa GES, considering the current technology, is 25 years. The nominal life of the panels to be used in the system will be at least 25 years as well. Panels will be supplied from manufacturers complying with ISO 9001 certification and quality management standards.

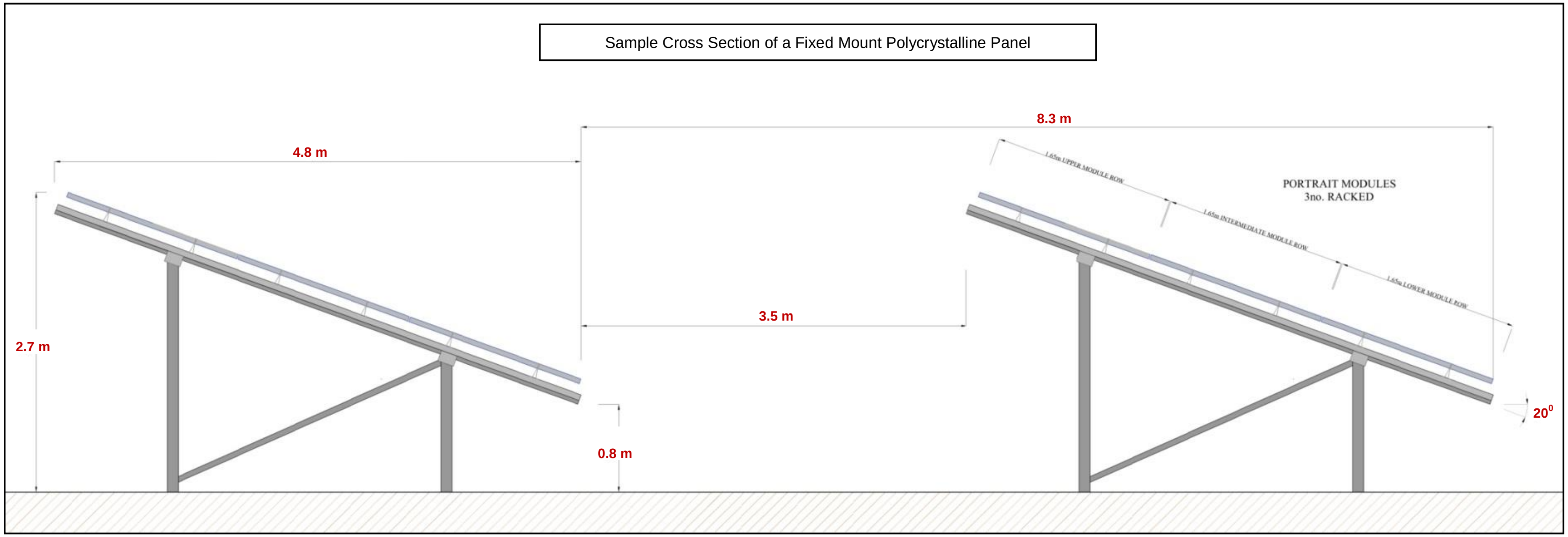


Figure 3.17. Sample Cross Section of Panel and Panel Support System for Polycrystalline Technology

The technical conditions and standards that panels and other equipment (inverters, construction) will comply within the scope of the procurement contracts to be made are listed below and these could be optimized according to current available technology and standards, if necessary:

- The product warranty of the modules will be at least 10 years.
- Panels will be guaranteed with linear energy. Information and documents will be included in the technical documents and shall be accompanied by a certificate of guarantee that the expected yield reduction at the end of the first year after the beginning of operation and the subsequent years, and the conditions specified for the nominal power to be given at the end of the 10th and 25th years.
- The panel will have a positive initial power tolerance. Panels will be classified according to the positive tolerance they have, and the plus tolerance provided by the panel manufacturer will be used.
- The panel will be constructed (in accordance with IEC 61215) to withstand the wind and snow loads to be determined. It will be documented that the load values to be determined are provided.
- Panel connection box and connectors will provide water resistance standard of IP65 and IP67 respectively.
- Solar panels will be "Potential Induced Degradation (PID) free".
- Panels will be tested by EN IEC 61730 - TUV (Fire Test and Cam, Eva, Junction Box, etc.).
- Panel tests such as Sand Test, Salt Mist Corrosion and Ammonia as well as CE tests will be carried out by accredited laboratories.
- Inverters' product warranty will be 10 years.
- Inverters will provide IP65 water resistance standard according to IEC 605329 certification.
- The construction to be prepared for the photovoltaic modules, as a whole (together with the modules on it), shall be designed to meet the criteria such as snow load, wind load, ice load, earthquake load considering the relevant region as specified in TS 498.
- The construction of the carrier structure, which is planned to be done by the method of piling on the ground or by using the concrete method, will be designed according to the life span of 30 years. If a concrete based system is preferred against corrosion, all structure will be aluminum and/or galvanized steel, if piling system is preferred, frames and legs will be made of aluminum and/or galvanized steel.

- The aluminum products to be used in the carrier structure will be in accordance with EN AW 6063 T5 and TS EN 12020 (2010) standards, and steel products will be in ST 37 (S235JR) quality and galvanized.

- The static calculation of the construction to be installed will be done taking into consideration the soil properties.

- The constructions, modules will be designed and constructed in such a way that they will not be able to shade each other for 12 months of the year (except for the projected amount of shadows).

- Even there will be screw holes that could be assembled with the fixing elements which are suitable for modular supporting structure, assembly with screw is strictly forbidden. The fixing elements will strictly be stainless steel.

- Appropriate distances will be kept between the stands to reduce the wind resistance.

- All the products, including the connection equipment in the support structure, will be guaranteed for at least 10 (ten) years.

- Relevant tests for construction will be performed in accordance with the standards of ISO 1460 and TS EN ISO 1461.

3.3.3. Transmission Line

The connection of Apa GES to the national grid will be through Alibeyhuyugu Transformer Station, that is belonging to Turkish Electricity Transmission Company (TEIAS) and located approximately 18 km north (air distance) of Project Area (see Figure 3.18). For this purpose, a medium voltage (31.5 kV) energy transmission line will be established between the Distribution Center to be constructed within the scope of APA GES Project in the Project Area and Alibeyhuyugu Transformer Station under the responsibility of related electricity distribution company (Konya Meram Electricity Distribution Company-MEDAS) as a separate project.

Figure 3.18. Alibeyhuyugu Transformer Station

3.4. Description of Planned Activities

After the completion of preliminary license and other permit processes relevant to the Project, related system equipment will be supplied and land preparation, construction and installation/assembly activities will be carried out. Following this, start-up of the system will be performed and electric energy production activities will be started. A general workflow diagram for photovoltaic solar power plants is presented in Figure 3.19. Details of the activities to be carried out during land preparation and construction phase and operation phase are discussed in the following sections.

3.4.1. Land Preparation and Construction Activities

Since the project site is mainly flat, there will be no major excavation or filling work and therefore leveling works will be limited. Top soil will be stripped with proper methods and temporarily stored within the site (east of Project Area) in order to be used for future rehabilitation and landscape activities.

Following the stripping of top soil and leveling works, camp site (which will be comprised of prefabricated and/or container type structures) will be established and delivery and storage of equipment and material required for the construction activities will be performed in parallel. After the completion of land preparation and mobilization works, roads in the Project Area will be constructed by considering operation and maintenance requirements, and water supply infrastructure for construction and operation phases will be provided. Subsequently, structures and facilities such as administrative building, central inverter station, transformer station, distribution center and security cabins will be constructed and bases for panel installation will be prepared. Some of the surface structures (for example administrative building, security cabins, inverter cabins) is planned to be prefabricated and others (for example transformer station, distribution center) to be reinforced concrete.

In the next stage, the installation/assembly of the power plant and related facilities will be realized. In this context, firstly the detail design of foot systems, wiring system and earthing and lightning protection systems will be made and assembly/installation of control/monitoring room, solar panels, inverters and other system equipment will be performed together with the installation and system connection of transformer station/switchyard. Energy and fuel (diesel) will be used to operate the machinery, equipment and vehicles to be used during the land preparation and construction works to be carried out within the scope of Apa GES Project. Since the land preparation and construction works will be completed in a relatively short period of time and a limited number of equipment and vehicles will be used intermittently in certain works, the energy and fuel consumption of the Project will be relatively low (compared to the projects having longer construction period and require more equipment and vehicle).

Foundation options for ground-mounted PV systems include:

- Driven piles: If geotechnical survey proves suitable, a beam or pipe driven into the ground can result in low-cost, large scale installations that can be quickly implemented. Specialist skills and pile driving machinery are required; these may not always be available.

- Concrete piers cast in-situ: These are most suited to small systems and have good tolerance to uneven and sloping terrain. They do not have large economies of scale.

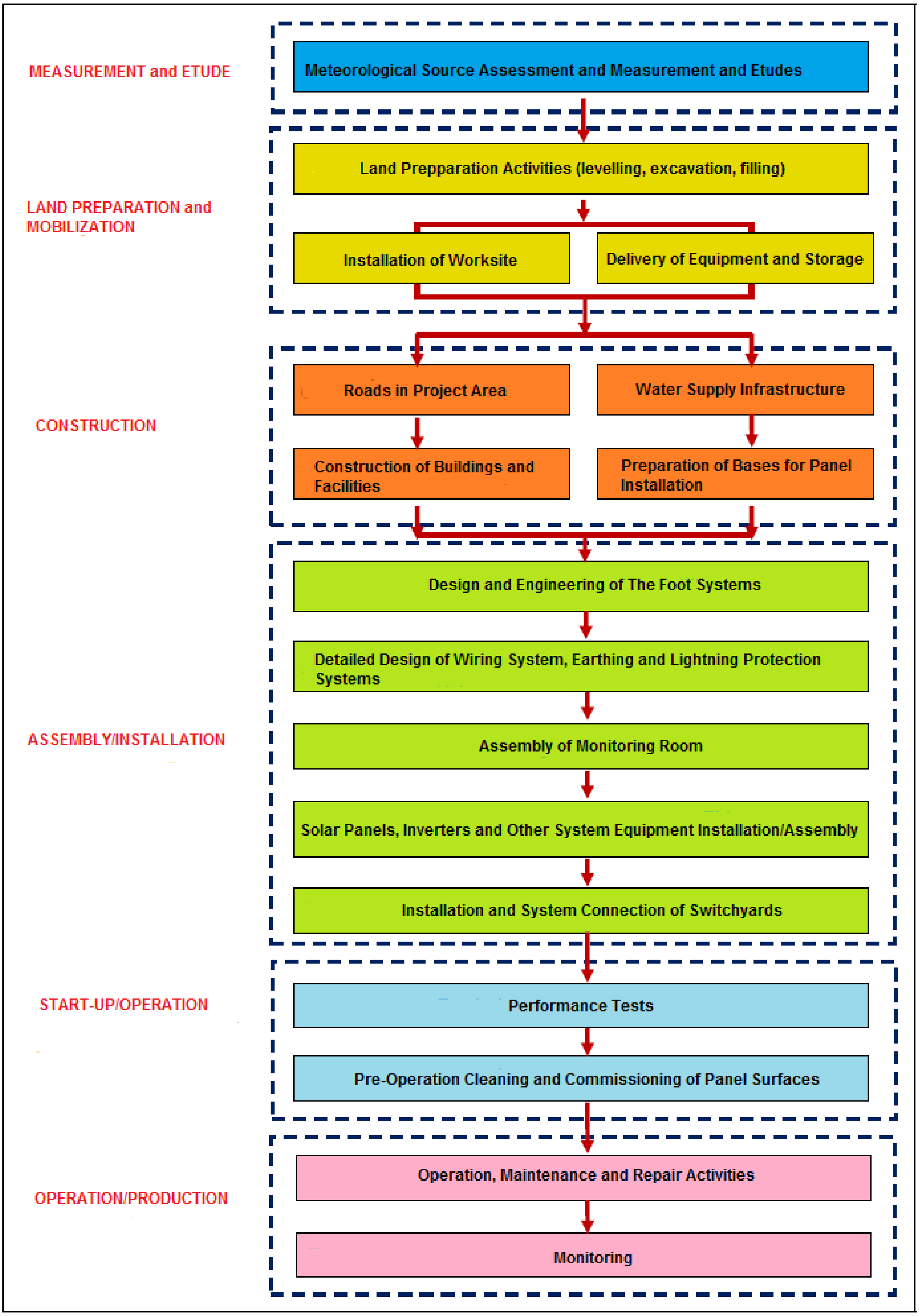


Figure 3.19. General Workflow Diagram for Photovoltaic Solar Power Plants
(Source: Asian Development Bank, September 2015)

- Pre-cast concrete ballasts: This is a common choice for manufacturers having large economies of scale. It is suitable even at places where the ground is difficult to penetrate due to rocky outcrops or subsurface obstacles. This option has low tolerance to uneven or sloping terrain but requires no specialist skills for installation. Consideration must be given to the risk of soil movement or erosion.

- Earth screw: Helical earth screws typically made of steel have good economics for large scale installations and are tolerant to uneven or sloping terrain. These require specialist skills and machinery to install. (*IFC, February 2012*).

Ground properties of the Apa GES Project Area will be determined on the basis of the geological and geotechnical surveys to be performed on the site, but it has been observed during the preliminary field surveys that the site has dirt surface in general while at certain locations there are also stony and rocky zones. Based on the assessments made considering the results of preliminary field surveys, it seems possible to use special pressurized pile driving machinery in the installation/assembly of the majority of the foot system while it might be possible to use concrete applications in the stony and rocky zones.

Other construction pieces will be assembled to the foot system to be installed in the ground with the appropriate method (pile driving or concreting), and finally the panels will be assembled on this construction (panel support system). Based on the available assessments, it is foreseen that the mounts/legs will be driven 1.5 meter to the ground where pile driving method is suitable, and will be strengthen with reinforced concrete structures placed in 80 cm depth, where necessary. Sample photos showing assembling phases of solar panels are given in Figure 3.20.

After the installation of solar panels, the system connection of the plant will be carried out. Afterwards, performance tests will be done and the plant will be put in operation after the cleaning of the panel surfaces. During the performance tests, power will also be needed and this power will be supplied from the photovoltaic panels or from the grid.

3.4.2. Operation Activities

In the scope of the Project, electricity will be generated in the solar power plant using photovoltaic technology and the produced energy will be connected to the national grid using necessary system equipment. A flow diagram representing the process that will take place in the plant during the operation phase is given in Figure 3.21.

Conversion of solar light to electricity in photovoltaic cells is based on the photovoltaic effect and this process is described in Section 3.3.1 (PV Technology). Photovoltaic solar panels produce direct current (DC). The DC current should be converted to Alternating Current (AC) for grid connection and this is done by the help of inverters. Inverters used in the solar power plants are separated into two; central and serial inverters. The inverter type selection for the Project will be made as a result of the ongoing alternative evaluation studies. Sample inverter photos are given in Figure 3.22.

Alternating Current obtained from inverters should be elevated to the proper level of voltage in the transformer station before national grid connection. For this purpose, a transformer station and a distribution center will be installed in the Project. Sample transformer station (step up) and switchyard photos are given in Figure 3.23.

The power for lightning, security systems and other equipment to be used in operation phase will be supplied from the power generated in the solar power plant.

Figure 3.20. Sample Photos Showing Assembling Phases of Solar Panels
(Source: Asia Development Bank, September 2015; IFC, February 2012)

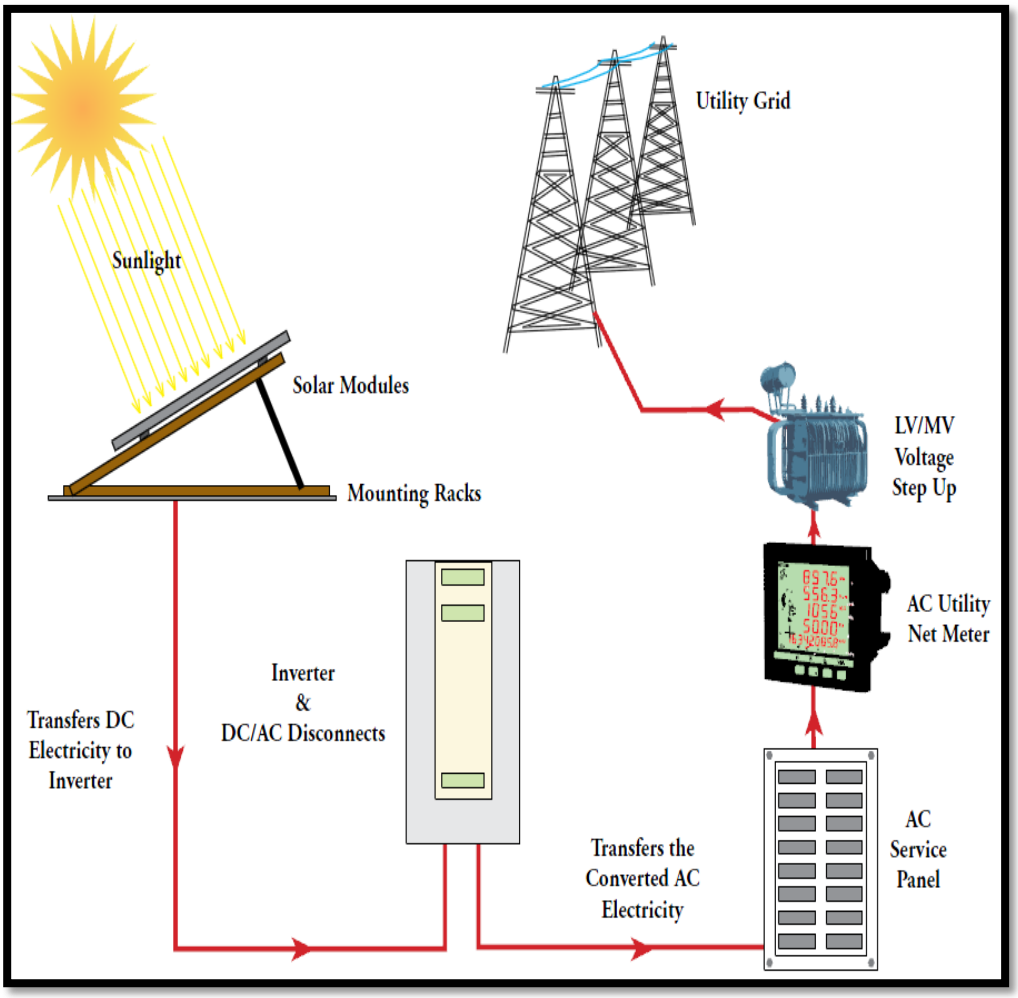


Figure 3.21. Generic Process Flow Diagram of Photovoltaic Solar Power Plants
(Source: IFC, February 2012)

Figure 3.22. Sample Inverters Photos
(Source: www.solarprofessional.com)

Figure 3.23. Sample Transformer Station (Step-up) and Switchyard Photos
(Source: Asia Development Bank, September 2015)

3.5. Project Schedule

License application to the EMRA for the Apa GES Project was made on June 13, 2013 and a preliminary license has been granted to the Project Owner for the Project for 30 months starting from April 21, 2016.

Environmental baseline and EIA studies were started in January 2016 and official EIA process was initiated by submitting the EIA Application File to the MoEU on May 16, 2016. A public participation meeting within the scope of EIA process conducted on June 16, 2016 at Apa neighborhood. EIA Positive Decision was received on April 18, 2017 from the MoEU.

Project Owner applied to Konya Governorship for the registration of the Project Area to the treasury by requesting allocation purpose change in order to establish Apa GES Project. As a result of the application, Konya Governorship decided that the allocation purpose change is acceptable in October 2016. All permitting procedures and engineering studies will be completed before the start of construction works.

The service life for photovoltaic solar power plants is usually around 25-30 years. Apa GES is also expected to have a 25 year service life, considering the current technology. However, service life might be extended, if required and related requirements are completed, with possible system modifications based on possible technological developments within the service life of the Project and the license period granted by EMRA for electricity production.

Main phases of the Project are; (i) Permitting and License, (ii) Design and Engineering, (iii) Manufacturing, Transportation, Construction and Assembly, (iv) Start-up, and (v) Operation/Production with License. The project schedule based on these phases is given in Table 3.3.

Table 3.3. Project Schedule

ISSUE	MONTHS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. PERMITTING AND LICENSE PHASE																				
1.1. Preliminary License																				
1.2. Turkish EIA Process																				
1.3. Land Use Permits (allocation purpose change and registration to treasury, lease)																				
1.4. Geological and Geotechnical Studies																				
1.5. Implementation Development Plan and its Approval																				
1.6. Other Local Permits																				
1.7. Energy Transmission Line Feasibility, Routing and Design Studies																				
1.8. License																				
2. DESIGN AND ENGINEERING PHASE																				
2.1. Preparation of EPC Package and Contracts																				
2.2. Finance Meetings and Agreements																				
3. MANUFACTURING, TRANSPORTATION, CONSTRUCTION AND ASSEMBLY PHASE																				
3.1. Preparation of Camp Site (Electricity, Mobilization, Water Supply, Access Roads)																				
3.2. Excavation/Leveling Works, Concreting and Construction Works																				
3.3. Provision of Plant Equipment and Installation/Assembly																				
3.4. Manufacturing, Transport and Assembly of Transformer Station and Switchyard Equipment																				
3.5. Construction and Assembly of Main and Auxiliary Units																				
4**. START-UP PHASE**																				
4.1. Completion of the Plant, Performance Tests and Start-up																				
4.2. Temporary Acceptance and Commencement of Commercial Operation																				
5. OPERATION/PRODUCTION WITH LICENSE																				

3.6. Workforce Requirements

There will be a need for the workforce during land preparation, construction and operation phases of the Project. Land preparation and construction phase is planned to be completed in 4 months with 8 hours single shifts depending on the worksite conditions. In line with this target, it is predicted that approximately 25 staff will be working within the EPC contractor. During the operation phase of the plant, it is planned to have 7 security guards since the operation will be performed remotely. In this scope, the workforce required and personnel compositions have been given in Table.3.4. Periodic maintenance and repair activities will be outsourced.

Table 3.4. Foreseen Workforce Requirement and Estimated Personnel

Personnel Type	Number
Construction Phase	
Site Manager	1
Topographer	1
Construction Supervisor	1
Assembly technician/personnel for Support System	5
Assembly technician/personnel for Panels	5
Personnel for Cabling and Establishment of Control Units	7
Electrical Supervisor	1
Environment, Occupational Health and Safety Expert	1
Security Guard	3
Total (Construction Phase)	**25**
Operation Phase	
Security Guard	7
Total (Operation Phase)	**7**

In addition to the personnel mentioned above, the provision of maintenance and repair services or other services, which can be found in Turkey, of system equipment (cables, electrical equipment) and other construction materials that are produced in Turkey, will provide additional indirect employment opportunities and economic benefit.

Panels, carrier systems and other electrical equipment that are power plant equipment will be provided from Turkey since their production is available in the country. Hence, during design, manufacturing and delivery phases, employment will be supported by the Project indirectly. Moreover, cleaning, maintenance and security services that will be benefitted from during operation phase will be rewarding in terms of economic activities and employment.

Within the scope of the Project, labor will be provided locally (in the vicinity of Project Area) as much as possible. Hence there will be no need for accommodation on site for the workers. On the other hand, food, water, safety equipment and other social means that personnel might need will be provided together with transportation service in case needed.

3.7. Machinery and Equipment Requirement

Equipment and machinery that will be used in top soil stripping and excavation/leveling works, road arrangements, construction and concrete works, construction of buildings and facilities, plant assembly, electrical works and other activities during land preparation and construction phase are listed in Table 3.5.

Table 3.5. Machinery and Equipment that will be used in Land Preparation and Construction Activities

Machinery and Equipment	Number
Pile Driving Machine (Pressurized)	4
Earth Digger	2
Mini Loader (Bobcat)	2
Truck	2
Excavator	1
Dozer	1
Wheel Loader	1
Crane	1
Tractor	1
Concrete Batching Mixer	1
Concrete Pump	1
Water Truck	1
Trencher	1

Since it is planned to outsource maintenance and repair services by Operation and Maintenance Agreement to a contractor firm, it is not foreseen that there will be requirement for machinery or equipment during operation phase. It is planned to operate the plant by remote control system.

CHAPTER 4

ANALYSIS OF ALTERNATIVES

4. ANALYSIS OF ALTERNATIVES

Apa GES Project will be constructed in the vicinity of Apa neighborhood of Cumra District in Konya Province. The Project Area covers a land of 26.17 hectares. Within the scope of the project, it is planned to produce electricity by using photovoltaic solar energy technology. In the following sections, factors considered in the site and technology selection will be described and evaluation of alternatives will be presented.

4.1. Site Alternatives

The most important factor affecting site selection for solar energy plants is the potential of solar energy in the area. Studies to determine solar energy potential of Turkey was carried out using the sunshine duration and radiation intensity data measured from 1966 to 1982 belonging to the General Directorate of State Meteorological Services (DMI) (today the General Directorate of Meteorology) by the former Survey Authority of Electricity Affairs (EIE). In this context, studies have been carried out to determine the solar energy potential of Turkey, Esri Solar Radiation Model, an international accepted model, has been run in Turkey at a resolution of 500x500 meters and mapped using Geographical Information System (GIS) techniques. These maps were calibrated using measurements taken from former EİE and DMI stations and the average monthly solar radiation and sunshine times were calculated for 81 provinces. As a result of this work, Solar Energy Potential Atlas of Turkey was published in 2010. The studies have revealed that Turkey has a significant solar energy potential thanks to its geographical location.

With the Solar Energy Potential Atlas of Turkey, it was determined where the best areas were in terms of solar energy applications in Turkey and it was aimed to determine the production possibility of electricity or heat energy based on solar energy in these areas. In this direction, maps published for Turkey and Konya province are shown in Figure 4.1 and Figure 4.2 respectively. According to this study, depending on solar radiation values, the Mediterranean has the highest solar energy potential region in Turkey. Especially the southern part of the Konya province, where the Project Area is located, is located very close to the Mediterranean Region and has a high solar energy potential.

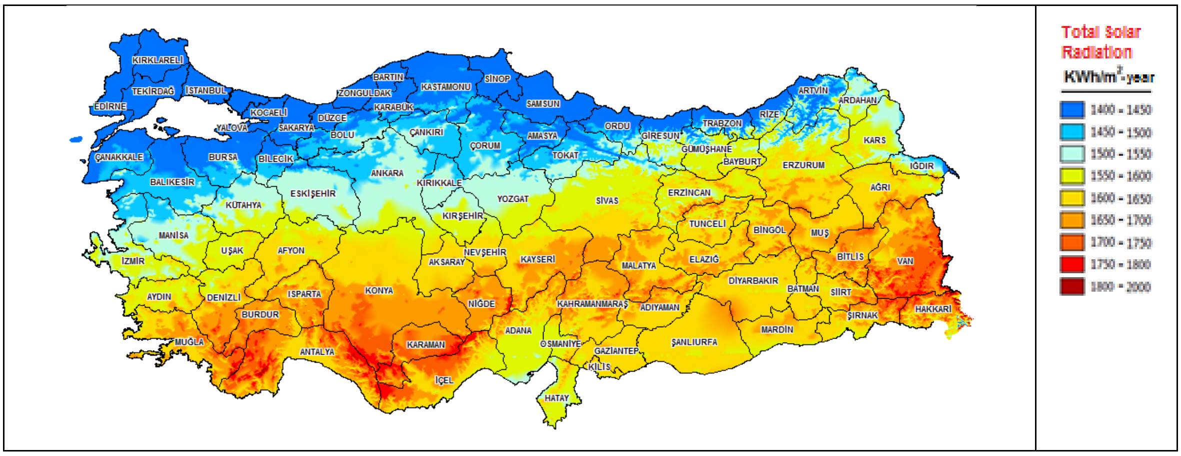


Figure.4.1. Total Solar Radiation of Turkey
(*Source: http://www.eie.gov.tr*)

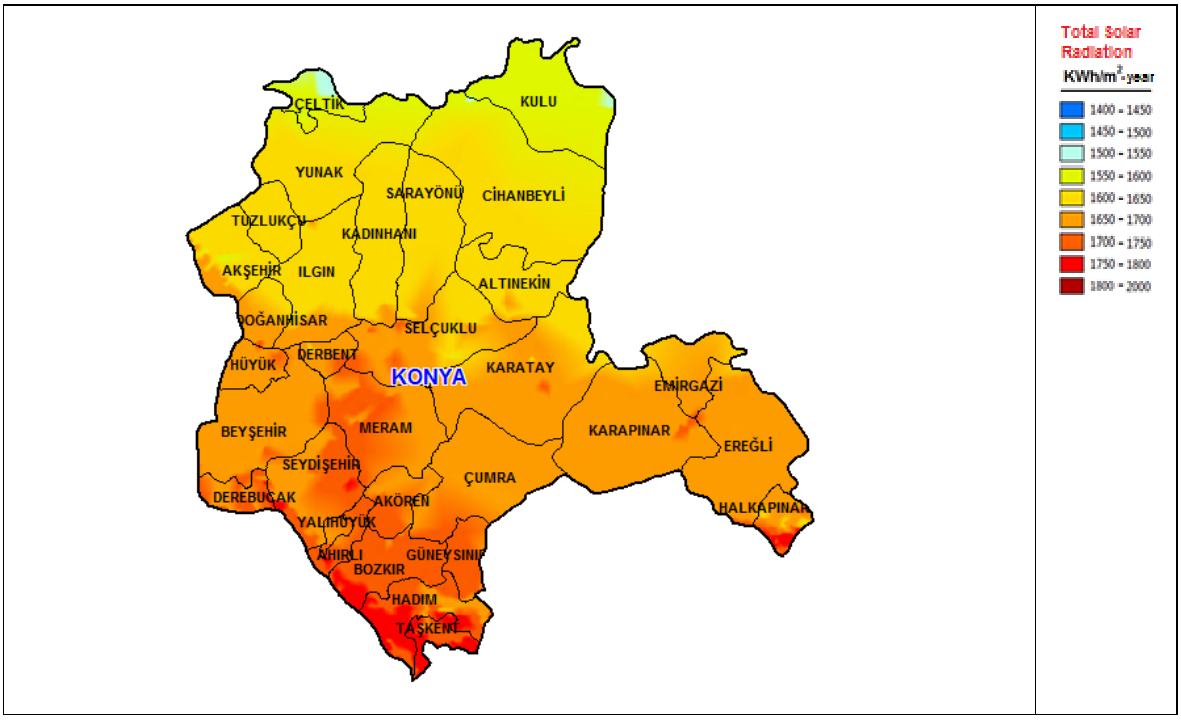
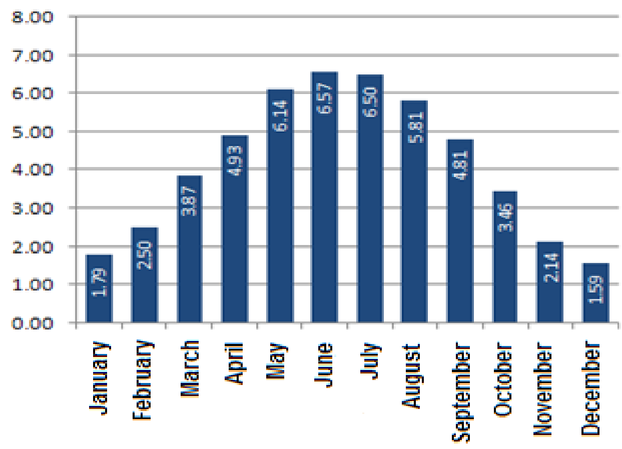


Figure.4.2. Total Solar Radiation of Konya Province
(*Source: http://www.eie.gov.tr*)

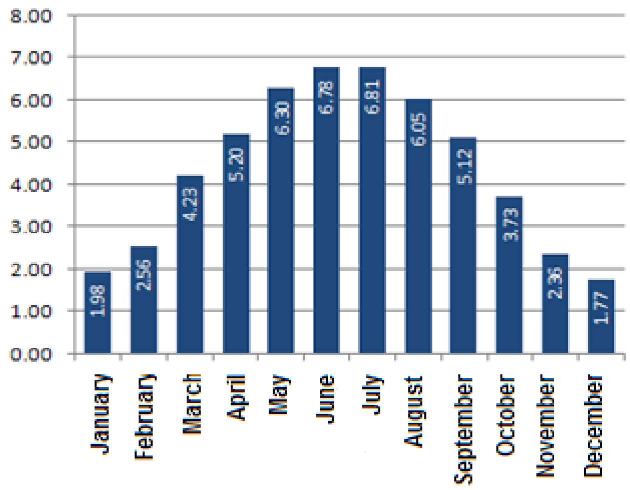
Global radiation values, sunshine periods (hours) and photovoltaic (PV) panel type-area-energy generation quantities in the Turkey, Konya Province and Cumra District are shown comparatively in the graphs given in Figure 4.3, Figure 4.4 and Figure 4.5 respectively. According to the graphs presented in Figure 4.3, the monthly average global radiation values in Konya Province are above the monthly average values in Turkey for all months and the monthly average global radiation values in Cumra District are above the monthly average values in Konya Province for all months. A similar relationship seems to be valid for the sunshine periods presented in Figure 4.4. According to different photovoltaic technologies, the amount of energy that could be produced per square meter (kWh/year) is higher in Konya Province than in Turkey and also energy production in Cumra District is higher than Konya Province. In the light of this data, it is seen that Konya Province and Cumra District are very suitable for solar power generation in Turkey.

In the following process, a site in the vicinity of Apa neighborhood was determined in Cumra District of Konya Province, which has sufficient characteristics in terms of solar potential, and more detailed solar source evaluations were made for this area. In this context, the energy yield of the site was estimated using the PV-GIS SAF meteorological data (Satellite data covering solar radiation temperature, wind speed and barometric pressure parameters covering a period of 11 years) obtained from the online database of European Union Research Center (JRC) and PVsyst software (Version 6.10).

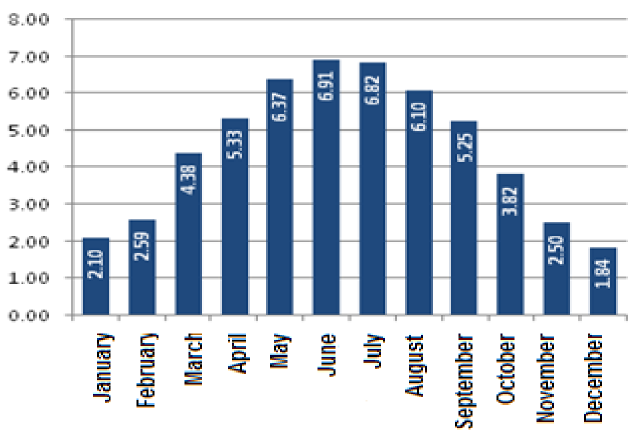
In a region where the solar source is sufficient, the choice of a site to minimize costs while maximizing production efficiency is great importance for the feasibility of the project. In addition to the source of solar energy, factors that are effective on subscale in the site selection of solar power plants are given in Table.4.1 (*IFC, February 2012*).



(a) Turkey



(b) Konya Province



(c) Cumra District

Figure.4.3. Total Solar Radiation (Hour) of (a) Turkey, (b) Konya Province and Cumra District (*Source: http://www.eie.gov.tr*)

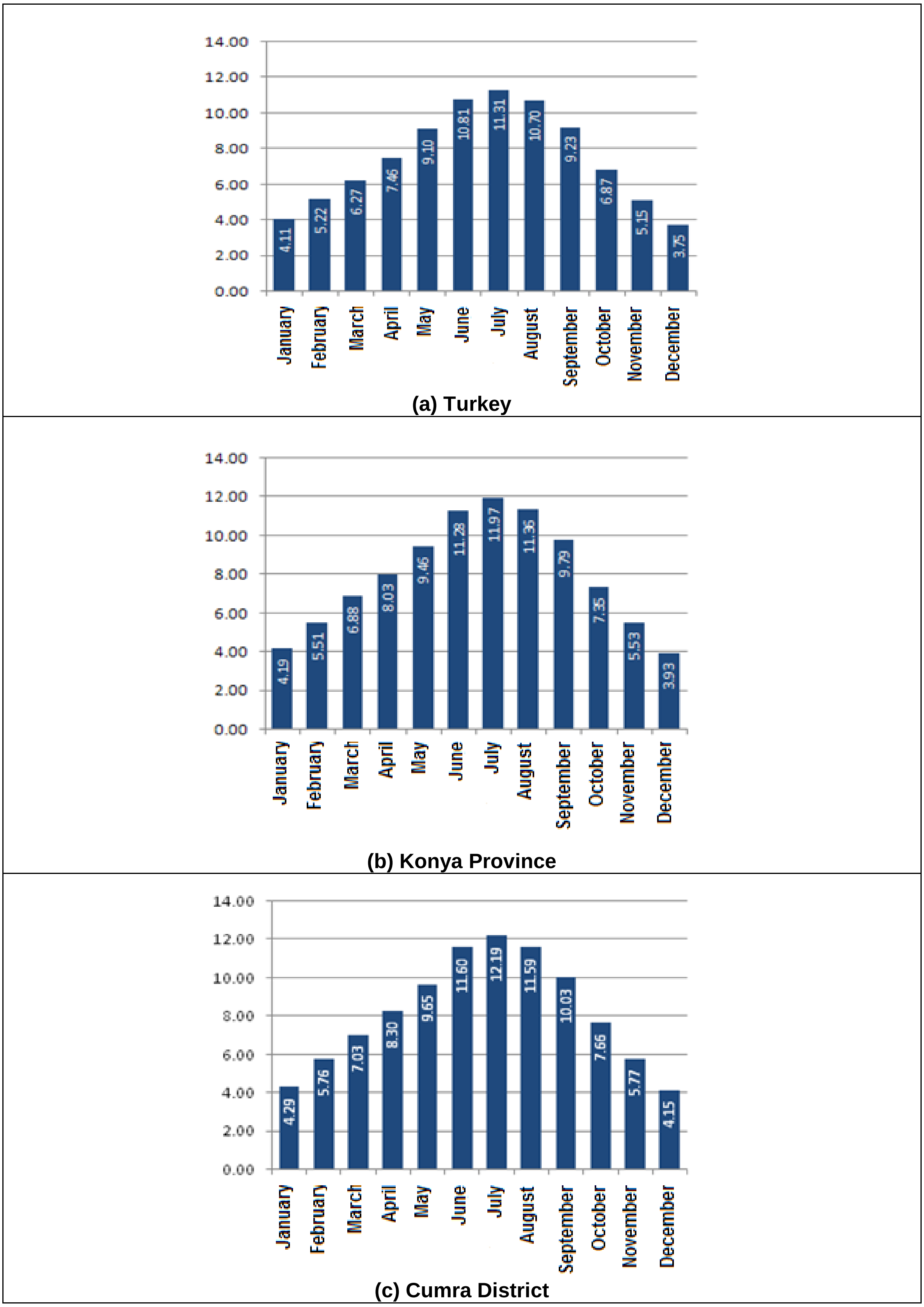
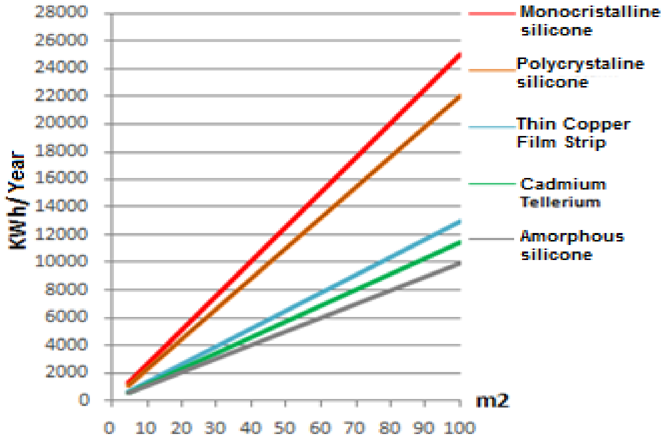
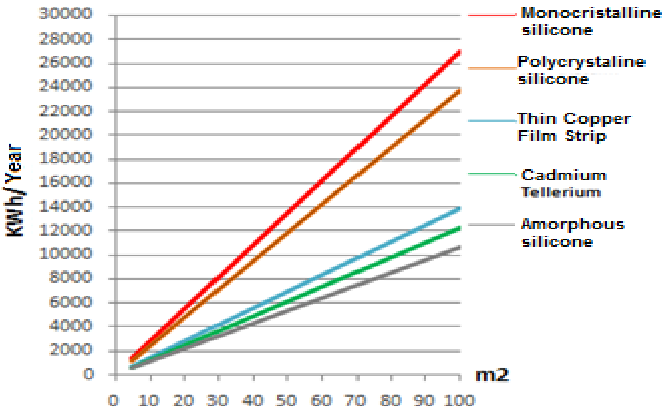


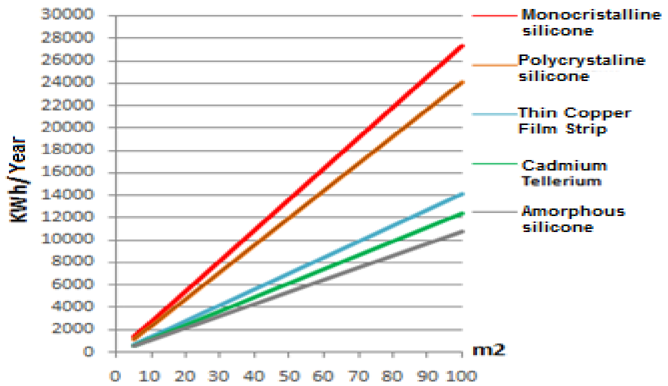
Figure.4.4. Total Hours of Sunshine of (a) Turkey, (b) Konya Province and Cumra District (*Source: http://www.eie.gov.tr*)



(a) Turkey



(b) Konya Province



(c) Cumra District

Figure.4.5. PV Type Area Energy to be Produced (kWh/year) in (a) Turkey, (b) Konya Province and (c) Cumra District

(*Source: http://www.eie.gov.tr*)

Table.4.1. Factors Effecting Site Selection for Solar Power Plants

Factor	Issues/Criteria to be Considered
Local climate conditions	Flood condition, wind condition, snow or extreme temperature values
Available area	Providing area for different module technologies, transportation conditions, shading factor
Land use features	Environmental sensitivities and permit requirements, land use costs, impacts on other users of land
Topography	Slope of the site; if there is a slope direction, it is preferred that planned project in the northern hemisphere is slightly sloping to the south
Geotechnical conditions	Condition of groundwater, resistance, load carrying characteristics, pH level of soil, seismic risk
Geopolitical conditions	Distance to sensitive military areas
Access to the site	Distance to existence roads, new road construction necessity
Grid connection	The distance to the existing transformer station, the capacity of the transformer station, the cost and time dimensions
Contamination risk of modules	Pollutants resulting from local climate, environment, human and natural life
Financial incentives	Incentives, tariffs

Source: IFC, February 2012.

In case of more than one application for the same site and/or to the same connection point and/or same connection region in the preliminary license applications for the establishment of wind or solar power plants in Turkey, the one/ones to be connected to the grid is determined as a result of a competition made by TEIAS in accordance with the "Competition Regulation Regarding Preliminary License Application to Establish Wind and Solar Power Plants". In this context, initially an area of 64.5 hectares within the parcel numbered 165/2 having a pasture status (the parcel that the allocation purpose change was made in 2016) has been selected for the Apa GES Project and application to EMRA was made on June 2013 for the planned project with a capacity of 38.18 MW. Following this, LE Solar Power Generation A.S. won the connection right for an installed capacity of 13.1 MW on the basis of the evaluation made within the scope of the competition made by TEIAS. Within this scope, EMRA informed the Project Owner that the power plant site should be revised in accordance with the installed capacity of 13.1 MW allocated by TEIAS based on the conditions stipulated in the relevant legislation, with the condition that the revised project area should be within the power plant area applied to EMRA. In this respect, the Project Owner narrowed the Project Area according to the "Regulation on Technical Evaluation of License Applications for Solar Energy" and obtained the current area of 26.17 hectares. The first power plant area (old power plant area of 64.5 hectares) and the final power plant area (current Project Area of 26.17 hectares) evaluated in this content are shown together in Figure 4.6.

Within the framework of EMRA and TEIAS criteria to determine the specific conditions of the selected site and to design the Project according to these conditions, a solar energy measurement station was established by renting a land that is nearby (west of Project Area) parcel numbered 165/2 where Apa GES has planned to be constructed. In this station, measurement of parameters such as wind speed, wind direction, temperature, humidity, solar radiation were made during a 6 months period between November 2012 and May 2013 with respect to related legislation and the total (global) solar irradiance and the duration of sunshine on the horizontal surface were determined. Solar measurement station installation and conclusion reports were approved by the General Directorate of Meteorology (MGM). The data obtained from the meteorological station evaluated together with PV-GIS SAF data and modeling studies using PVsyst software and it has been confirmed that the site provides sufficient potential for solar power plant operation.

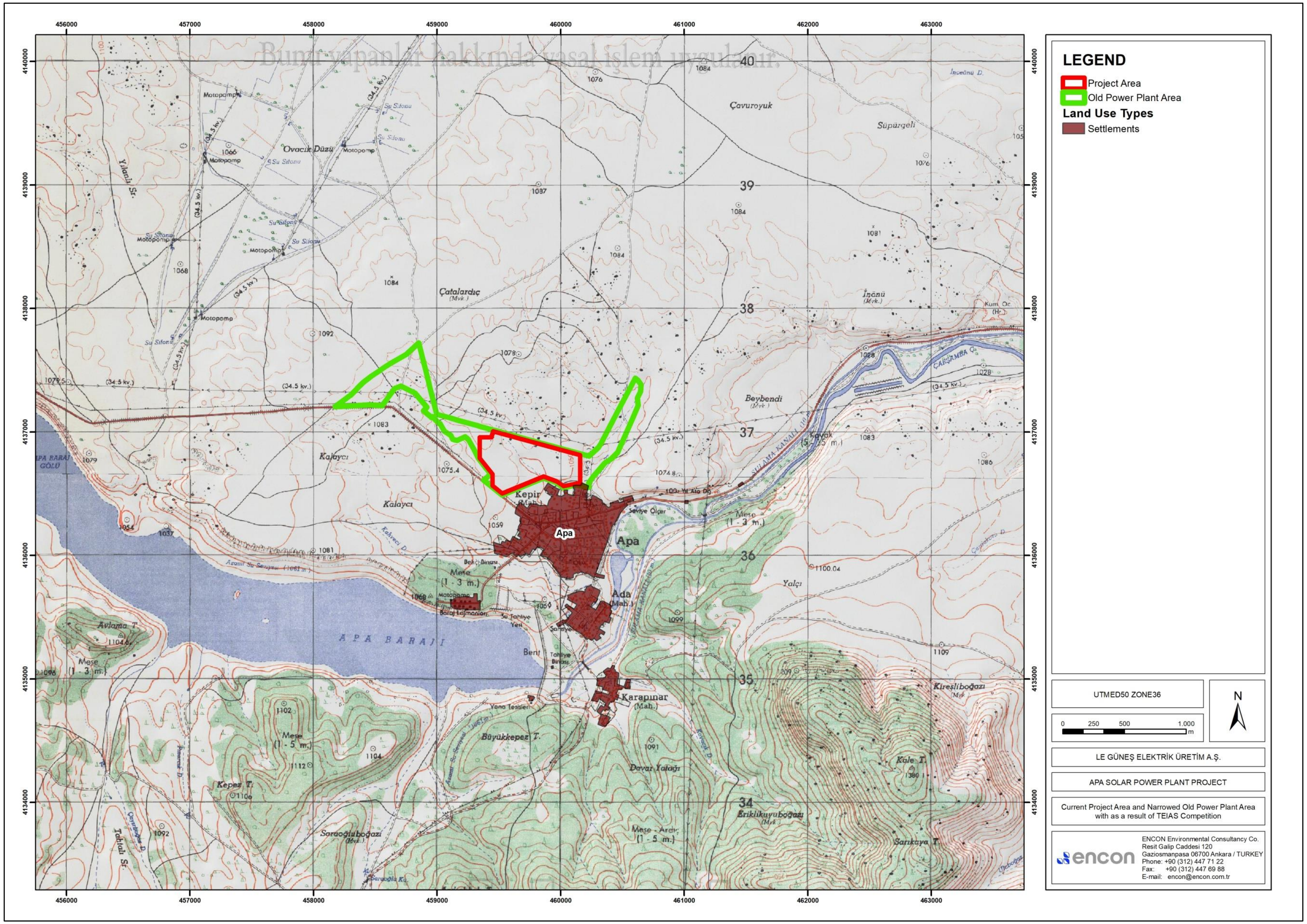


Figure.4.6. Current Project Area and Narrowed Old Power Plant Area with as a result of TEIAS Competition

When the Project Area is evaluated within the framework of the general factors presented in Table 4.1, it is concluded that the Project Area is suitable or very suitable for a large majority of the criteria considered. Information on the evaluation of selected site for Apa GES Project is presented in Table 4.2.

Table.4.2. Evaluation of Selected Site for APA GES Project

Factor	Current Situation/Evaluation	Compliance Status		
		Very Suitable	Suitable	Not Suitable
Local climate conditions	A six-month solar survey/measurements conducted with the aim of determining the meteorological and climatic conditions specific to the site. In this context, wind speed, wind direction, temperature, humidity, solar radiation parameters were determined. Measurement results and model studies indicated that the site would be suitable in terms of solar source and other parameters and necessary feasibility studies were carried out accordingly.			
Available area	The Project Area is located on a pasture land that the allocation purpose change was made and is capable of providing the space needed for different module technologies. Currently, there are no high trees or structures around the site that might cause shadowing.			
Land use features	Project Area is not located in any legally protected area. There is no defined protected area (e.g. archeological site) in the vicinity of the Project Area in the approved 1/100,000 scaled Environment Plan of Konya-Karaman Region. The nearest protected area is at around 5 km east of the site. The Project Area is located on a pasture land that the allocation purpose change was made. There is no forest in the area. The size of the pasture land to be used within the scope of the project corresponds to 11.19% of the total pasture land within the impact area having 1 km radius around the Apa neighborhood and there are alternative pasture land available within the impact area. While it will be necessary to obtain the necessary permits and pay the fees according to the relevant legislation for the pasture land, it is not expected that the related process and costs will pose a risk to the viability of the project.			
Topography	The majority of the Project Area is flat terrain that is suitable for the establishment of solar power plant. The elevation of the site ranges between 1,045 and 1,075 meters above sea level. There is pit-valley type morphology only in the eastern part of the site and this does not pose a significant risk for the establishment of the plant.			
Geotechnical conditions	There are existing ground water wells used by the Apa neighborhood in the vicinity of the Project Area. According to the Earthquake Zones Map of Turkey, the project area is located in the 5th degree earthquake zone, which represents the lowest risk level, and seismic risk is not foreseen. There are no slip/dislocation, earth flow and creep movements and landslide risk in and around the Project Area. The necessary precautions for ground conditions will be applied taking into account the results of geological and geotechnical survey studies.			
Geopolitical conditions	Konya Airport (civil) and Konya 3rd Jet Military Air Base are around 65 km north of the site.			
Access to the site	The main transportation to the Project Area can be achieved through D705 Konya-Hadim Road via the asphalt village road which departs towards the Apa neighborhood at Dineksaray neighborhood. In addition, there are alternative routes to the Apa neighborhood, where the Project Area is located, to provide transportation from different routes. In this sense, the site is very convenient in terms of accessibility by road.			
Grid connection	The connection of the Apa GES to the national grid will be through Alibeyhuyugu Transformer Station located approximately 18 km north (air distance) of the Project Area and determined by TEIAS. For this purpose, a medium voltage (31.5 kV) energy transmission line will be established between the Distribution Center to be constructed within the scope of APA GES Project in the Project Area and Alibeyhuyugu Transformer Station under the responsibility of related electricity distribution company (Konya Meram Electricity Distribution Company-MEDAS) as a separate project. Opinion on the connection conditions and suitability were taken from TEIAS and related Meram Electricity Distribution Company. The temporal and technical aspects (e.g.			

Factor	Current Situation/Evaluation	Compliance Status		
		Very Suitable	Suitable	Not Suitable
	transmission losses) of the connection point resulting from the distance to the plant site and costs (e.g. land acquisition, construction, etc.) are possible to deal with appropriate design and management strategies and it is not expected to pose a risk to the viability of the Project. In addition, the route between the Project Area and the transformer station passes through relatively flat terrain so that the construction difficulties are not foreseen.			
Contamination risk of modules	There is a risk of contamination of modules due to pollutants resulting from local climate, environment, human and natural life as in the case of a typical solar power plant project. Within the context of baseline studies, no condition has been identified in the field that would create an inconvenience in terms of contamination risk of modules. Panel cleaning will be done twice a year during operation phase.			
Financial incentives	Law on Use of Renewable Energy Sources for the Purpose of Producing Electricity Energy guarantees the price to be applied for a ten years period for the production plant types based on renewable energy sources including solar power plants with the aim of disseminating the use of renewable energy sources for electricity generation purposes. It also defines the addition of additives to be applied for domestic manufactured goods for a period of five years.			

4.2. Technology Alternatives

In the following section solar energy technologies are compared with other energy technologies in general, then the reason for selection of the photovoltaic power system to be used for Apa GES Project are explained and general features of the sub technologies that could be used in this system are described.

Comparison of Solar Based Energy Production Systems with Other Energy Resources Based Energy Production Systems

Today, the major resources used to meet the energy demand of the World are fossil fuels such as coal, oil and natural gas, those contain hydrocarbons, and nuclear resources together with renewable resources based on hydraulic, wind, solar, geothermal and biomass, which are getting more and more popular day by day.

The possible environmental impacts of different energy sources have been compared with a general approach in the Energy Report (2006) published by the Union of Turkish Engineers and Architects (TMMOB). Although the scale and characteristics of the production system based on each energy source may vary specific to the activity, and there might be differences specific to the activity in the importance of the potential impact, its management and residual impacts depending on the technologies to be used, the comparison matrix presented in Table 4.3 gives a general idea for the management of possible environmental impacts for different energy production systems.

Besides the environmental components and parameters considered in the subject matrix, it is likely that projects based on different energy sources will have impacts having different levels of significance to be managed on existing land use, flora and fauna elements, landscape, protected areas and socio-economic environment. Activities based on each energy source might have project-level impacts on environmental and social components and if these activities are carried out together in a particular geographical area and have an impact on the same environmental and/or social components, cumulative impacts might also be a concern.

Table.4.3. Comparison of Possible Environmental Impacts required to be managed in Power Generation Systems Based on Different Energy Sources

Energy Sources	Water Pollution	Soil Pollution	Climate Change	Noise	Acid Rain	Radiation
Oil	X	X	X	X	X	-
Coal	X	X	X	X	X	X
Natural Gas	X	-	X	X	X	-
Nuclear	X	X	-	-	-	X
Hydro	-	-	X	-	-	-
Wind	-	-	-	X	-	-
Solar	-	-	-	-	-	-
Geothermal	X	X	-	-	-	-

Source: TMMOB Energy Report, 2006

The evaluation presented in Table 4.3 does not indicate an important environmental impact that must be managed for solar based power generation facilities. On the other hand, general implementations in solar power plant projects demonstrate the necessity of assessing and managing the temporary construction impacts (e.g. noise, vibration, traffic, waste generation, etc.) and impacts on land use, landscape and socio-economic environment in the long term (*Tsoutsos et.al., 20*05). Taking into consideration the parameters involved in this assessment, it is seen that the possible environmental impacts required to be managed in the power generation systems based on other renewable energy sources (hydraulic, wind and geothermal) are also limited to certain parameters (for example; only noise impact in wind power plants). Power generation systems based on fossil fuels and nuclear power plants are likely to have impacts on different environmental components and the measures to be taken for the management of these impacts might need to be much more comprehensive (technical, economic and administrative aspects) in this respect.

Another important parameter in comparing different power/energy generation systems is their contribution to greenhouse gas emissions and consequently to climate change. Inventories of total greenhouse gas emissions in Turkey are prepared by the Turkish Statistical Institute (TurkStat). Emissions of greenhouse gases are expressed in terms of CO_2 as carbon dioxide (CO_2) equivalent. Global warming potentials (contribution to global warming) of greenhouse gases are taken as a basis in the emission calculations. When the global warming potential of CO_2 is accepted to be 1, this value is 21 for methane (CH_4) and 310 for nitrous oxide (N_2O) (*World Energy Council Turkish National Committee, 2012)*. As can be seen in Figure 4.7, where the change in greenhouse gas emission quantities in Turkey from 1990 to 2013 is presented, the total greenhouse gas emission of Turkey have risen between 1990 and 2013 from 218.2 million tons of CO_2 equivalent to 459.1 million tons of CO_2 equivalent.

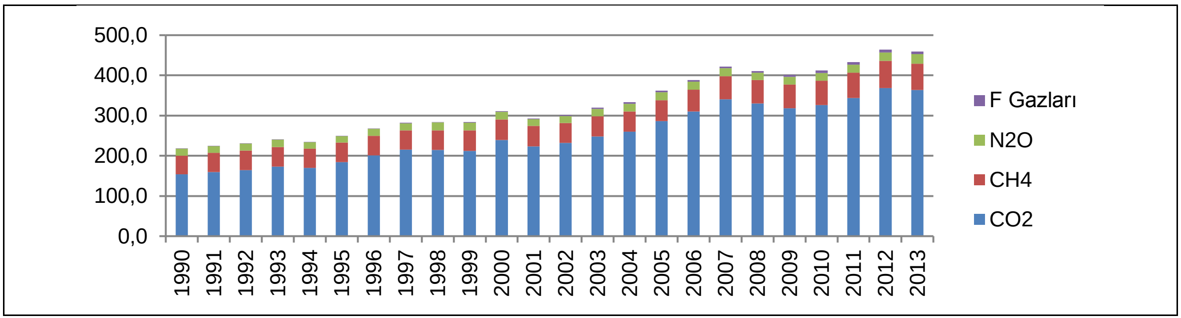


Figure.4.7. Changes in the Amount of Greenhouse Gas Emissions during 1990-2013 in Turkey
(Source: TurkStat, 2016)

A very large amount of CO_2 gas, the component that makes the greatest contribution to global warming, comes from energy systems based on the burning of fossil fuels. The amount of CO_2 generation per unit energy production in solid fuels such as coal and lignite is higher than other fossil fuels (e.g. liquid fuels). Natural gas is the fossil fuel having the lowest amount of CO_2. Renewable energy sources are regarded as clean energy in terms of greenhouse gas emissions (*World Energy Council Turkish National Committee, December 2012)*. Since solar energy systems based on photovoltaic technology do not use fuel or have any combustion process, there is no greenhouse gas emission in solar power plants operating with this technology that contribute to global warming. Therefore, significant saving on CO_2 emission could be achieved when electricity production is done with solar energy systems instead of fossil fuels. This is regarded as an environmental advantage for renewable energy systems. Average carbon sales revenue of 48,850 EURO per year is expected in the Apa GES Project based on carbon reduction.

Electric energy production with technologies based on renewable energy resources are also regarded as more acceptable alternatives from the social point of view. According to the results of the research conducted by the Ipsos Institute of Social Research for the evaluation of the global population's view to world energy policies, solar and wind energy (with 97% and 93% positive opinion respectively) are among the most widely accepted sources of energy production by the public *(Ipsos, 2012).*However, although the environmental impacts are limited compared to other alternatives, proper site selection and design and proper execution of stakeholder relations are determined to be critical factors in solar power plant projects.

Constantly developing photovoltaic technology is becoming more and more economical every day with the occurred and predicted reductions in system costs (*World Energy Council, 2013; World Energy Council Turkish National Committee, December 2012)*. The average cost of solar panels, which have the most important share in system costs, were 76.7 US dollars/watt in 1977 and decreased to less than one percent of it over the past 35 years and dropped to 0.6 US dollars/watt in 2014 (*http://cleantechnica.com*). Thus, electrical generation cost with photovoltaic technology, which was several times higher than fossil fuel technologies only a few years ago, have started to come down to lower levels than the electricity cost offered to the public through distribution system, which are generated by oil and natural gas based technologies especially in developed markets. In addition, photovoltaic technologies also offer higher reliability in terms of not being affected by the change in fossil fuel prices (*IRENA, 2012; http://cleantechnica.com*).

The International Energy Agency (IEA) publishes Energy Technology Perspectives (ETP) analysis annually. According to 2014 ETP analysis, CO_2 emissions in energy sector are projected to increase by 61% between 2011 and 2050 if new policies for low carbon emissions (and high carbon capture) are not implemented, (*IEA, 2014*). In the analysis, various scenarios are proposed that stabilize the global temperature increase at 2°C by combining the energy efficiency, increasing the share of renewable energy, increasing the share of nuclear energy and bringing the zero emissions with developing fossil fuels system to reduce this carbon release. The graph showing both the future expected photovoltaic module prices, based on the scenario which takes the share of renewable energy sources as a primary target (hi-REN scenario) and the scenario where all options are combined at the lowest cost (2DS), and the past known photovoltaic module prices is given in Figure 4.8. In Figure 4.8, the left side of the elliptical form corresponds to the expected modules prices in case of 2DS scenario and right side to hi-REN scenario. According to the forecast in this graph, the cost of photovoltaic modules, which are already rapidly dropping, is expected to decrease by half in the next 20 years (*IEA, 2014*).

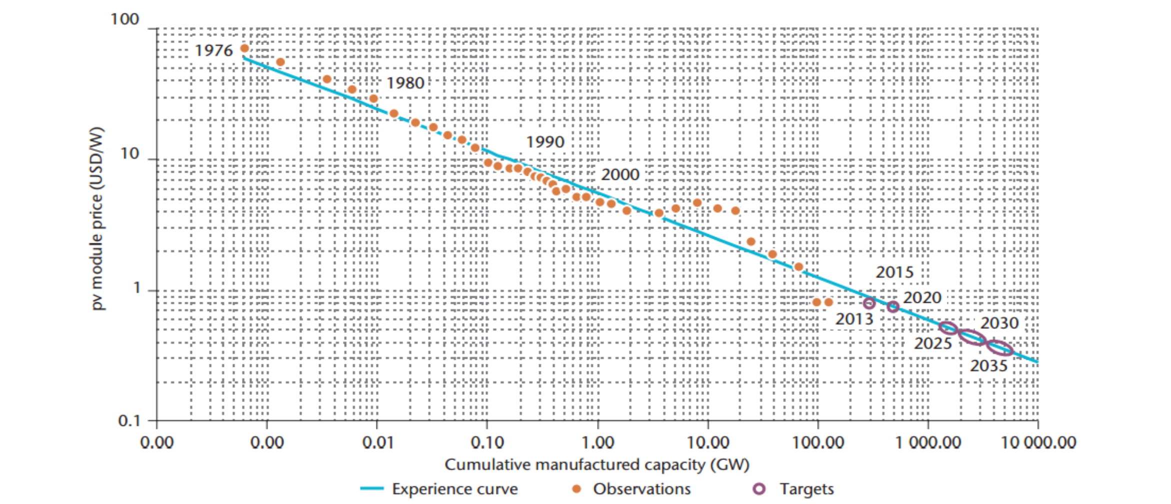


Figure.4.8. Past Prices for Photovoltaic (PV) Modules and Projection to 2035 (*IEA, 2014*)

Selection of Solar Energy Converter Technology

The sun both acts as a direct source of energy via radiation and indirectly feeds wind, biomass, hydro and other renewable energy sources (*World Energy Council, 2013; National Renewable Energy Laboratory, September 2010*). There are different alternatives that can be used to make energy in the form of heat and light reaching the world from the sun in everyday life, which can vary widely in terms of method, material and technology (*ETKB web site, 2016*). Within these, “photovoltaic power systems” (solar batteries or PV) and “focused solar thermal power systems” (concentrated solar thermal power plants or CSP) are the most widely used and most advanced technologies (*World Energy Council Turkish National Committee, 2014; Europe Photovoltaic Industry Association, 2014*). Conversion technology, general application area and significant disadvantages and/or advantages on which both systems are based are presented comparatively in Table 4.4 and the photographs showing the examples of the application of these systems in the world are given in Figure 4.9. Apart from these two systems, there are also “Solar Collector Systems” which are not based on electricity generation but are based on the principle that high heat adsorption and transfer to the moving fluids. This system used widely in our country with the aim of obtaining hot water.

In concentrated solar thermal power plants (CSP) where the Focusing Solar Thermal Power Systems are used, the thermal method (which allows the thermal utilization of solar energy) is used to generate electricity from solar energy. For this reason, these systems are suitable for places where the temperature is too high (e.g. desert). In this method, a fluid is heated to a high degree in a concentrating collector (e.g. parabolic mirror, capsule or heliostat systems-solar tower) by solar radiation and this heat is evaporated by transferring to another fluid (water), as in the case of a nuclear or coal-fired power plants. With the stream power obtained by this method, electricity is produced by operating the turbine (*Cezim, 2013*). In CSP technology, an alternating current is generated and this current can be directly connected to the network. The use of these systems dates back to the 1800s.

Table.4.4. Comparison of Basic Solar Energy Conversion Technologies

System/Characteristic	Photovoltaic Power Systems (Solar Batteries or PV)	Focusing Solar Thermal Power Systems (Concentrated Solar Thermal Power Plants or CSP)
Cycle/Conversion Technology	Direct conversion of sunlight into electrical energy by means of semi-conductor technology-based systems	The focus of the sunlight and the conversion of the generated heat to electricity by means of turbines
General Application Area	As well as small-scale systems such as roof or agricultural applications, large scale systems with 50-100 MWe capacity, which feed intercity networks, are also widely used in the world	It is mostly used in high-radiation geographies like desert (South America, Africa).
Key Advantages/ Disadvantages	– While manufacturing requires advanced technology, it can generate electricity for 20 to 30 years with a very low operating/ maintenance cost compared to other power plants depending on the location after construction – Modular systems make it easy to move and install – Presence of the sunlight is sufficient for electricity generation – There is no emission to the environment – Water usage at the operation stage is very low	– Small scale construction is not possible since they are quite large systems – It is only effective where the air temperature is too high – With the transition from wet cooling systems to dry cooling technology, the use of water at the operating stage tends to decline

Source: Word Energy Council Turkish National Committee, 2012; USA Sandia National Laboratories, 2013.

Roof Application (Germany)

Power Plant Application (France)

Photovoltaic Systems

Focusing System

Power Plant Application (Spain)

Focusing Solar Thermal Power Systems (CSP)

Figure.4.9. Examples of Application of Basic Solar Energy Conversion Technologies in the World

While the photovoltaic effect based on the principle of conversion of light to electricity in photovoltaic cells was first observed by Becquerel in 1839, the main development in photovoltaic cell technology has been achieved by the production of high-grade pure crystalline silicon through a process developed in the 1950s (*US Department of Energy, Solar Energy Research Institute, 1982*). Thus, electricity is produced by using light rather than solar heat in systems operating with photovoltaic technology emerging as an advanced technology product after 1950s. For this reason, photovoltaic systems can work wherever the sun is (*Cezim, 2013*). In these systems, the electrical energy generated at the cellular level via solar sensitive semiconductor materials is converted into a power plant by serial/parallel coupling of a large number of photovoltaic cells. Grain photons, which are carries and spreaders of solar energy, are converted to electric energy similar to the principle of photosynthesis process performed by plants when they fall on these photovoltaic cells (*TMMOB, Chambers of Electrical Engineers, Cezim, C., 2013*). In this system, direct current is produced by photovoltaic effect and the direct current is connected to the grid by converting it to the alternating current through the help of suitable device.

The research and application efficiency of photovoltaic solar panels can vary depending on design, material structure and manufacturing conditions. Nowadays, electric energy can be produced between 5% and 30% efficiency with PV technologies that use different solar cell types (e.g. amorphous silicon, monocrystalline, polycrystalline, etc.) (*ETKB web site, 2016*). The use of photovoltaic modules is increasing day by day due to constantly falling costs thanks to private and public funded research, increasing yields and based on the sun, which is a clean energy source in electricity generation. In addition, thanks to significant policy incentives (such as tax deduction) solar energy-based electricity generation systems are now one of the fastest growing renewable energy technologies.

Power plants based on photovoltaic systems are expected to play an important role in future global energy production (*IRENA, 2012*).While in 2000, the total installed power capacity of photovoltaic solar energy systems in the world was around 1.5 GW, as of 2014, the installed power capacity reached to 178 GW. Only in 2014, increase of installed power is at 40 GW, in other words 28% of the total installed power of the previous year. Over the next 5 years it seems possible to reach 540 GW of installed power in the world and 80% growth in Europe (*Solar Power Europe, 2015*). The installed capacity of CSP also tended to increase rapidly with policies to reduce CO_2 emissions. The installed CSP power in the world has increased from 1.2 GW in 2010 to 2 GW in 2012. In addition, there is a significant CSP capacity, especially in the US and Spain, which is under construction or development stage. In light of this information, it can be said that the usage of photovoltaic technologies in electricity generation based on solar energy in the world is much more widespread and has a potential to become more and more widespread.

In addition to decrease of manufacturing costs to very reasonable levels, having no moving parts, a life span of 25-30 years with minimal maintenance, use of water only for cleaning purposes in very low quantities and having no emissions to the environment during electricity generation are the advantages of PV technology. Taking into consideration the described properties and advantages of photovoltaic power systems (technological characteristics, place in the market, widespread usage, the tendency of the costs to decrease continuously, having relatively limited environmental impacts, ease of installation and operation, etc.) together with the characteristics of the selected site for APA GES Project (Apa neighborhood of Cumra District in Konya Province), it is considered as an appropriate alternative to performed electricity generation based on photovoltaic technology within the Project.

Alternative Photovoltaic Technologies

PV cells are typically named with the name of the semiconducting material of which they are made of. These cells have certain characteristics that vary depending on the area of use and the materials they contain in order to obtain solar energy. For example, while some cells are designed to use the sunlight reaching the Earth's surface, some cells are designed to generate energy in space. Nowadays, PV cells are categorized as "first generation cells", "second generation cells" and "third generation cells" (*Bagher v.d., 2015*). This classification method is based primarily on the level of commercial maturity reached and the main material used (*IRENA, 2012*). In the present case, photovoltaic technology is divided into two main groups: crystal silicon solar cells (monocrystalline and multi/polycrystalline) and thin film solar cells, and research is continuing for alternative cell types.

A comparison of the general characteristics of different solar cell technologies is presented in Table 4.5, and additional information on advantages and disadvantages are given in the following section.

Table.4.5. Comparison Different Solar Cell Technologies

Generation	Technology/Cell Type	Best Research Efficiency (%)	Current Highest Commercial Yield (%)	Area Requirement (m^2/kW)	Approximate Module Cost (USD/W) (2014)
First	Monocrystalline silicon (c-Si)	25.0	20.4	7	0.75-1
	Multi/ polycrystalline silicon (mc-Si)	20.4	16.0	8	0.75-1
Second	Amorphous silicon (a-Si)	13.4	6-8	12-15	0.5-0.75
	Cadmium Telluride (CdTe)	21.0	17.0	10	0.75<
	Copper Indium Gallium Diselenide (CIS/CIGS)	21.7	13.8	10	0.75<

Source: National Renewable Energy Laboratory (NREL), 2014. World Energy Council Turkish National Committee, 2012; IRENA 2013; www.energyinformative.org (January 2015); http://community.irena.org (January- 2015).

First Generation PV Technologies (Crystal Silicon Solar Cells)

Mono crystalline (c-Si) or multiple (multi/poly) crystalline (cs-Si) silicon is used in first generation PV Technologies, which are commonly used and have reached full maturity in commercially speaking. Silicon, a suitable semiconductor for PV applications, is one of the most commonly found elements in nature. In current situation, the most widely used material in the PV industry is silicon, and is the predominant material in both manufactured and installed PV modules (*IRENA, 2012*). Monocrystalline panels, which are one of the crystalline silicon solar cell types, are made of large silicon crystals. Monocrystalline panels are highly efficient in converting sunlight into electricity, but their manufacturing is expensive and they are fragile. Polycrystalline (multicrystalline) are less effective than monocrystalline panels, but their manufacturing are cheaper. Polycrystalline panels consist of smaller and numerous silicon crystals and they look like broken glass (*EPA, April 2011).*Crystalline silicon solar cells do not contain dangerous components such as cadmium, copper, gallium, and indium.

Second Generation PV Technologies (Thin Film Solar Cells)

These cells, known as thin-film solar cells, consist of 1-4 μm thickness thin solar cell layers applied on a cheap material such as glass or metal. Commonly manufactured are amorphous silicon, Cadmium Tellurium (CdTe), Cadmium Sulfide (CdS), Cadmium Indium Selenide (CLS) and Copper Indium Gallium Diselenide (CIGS) type cells. Manufacturing costs are lower because they can receive the same amount of sunlight with up to 99% less material. Thanks to these low manufacturing costs, the productivity ratios of the thin film cells, which offer the potential to provide lower energy production costs compared to the crystalline solar cells, have come close to the crystalline cells as a result of various research and development studies that have taken 20 years. Today, it is not yet very common in commercially speaking though it has begun to be manufactured in high amounts (*IRENA, 2012; Bagher v.d., 2015*).

The most common metal component used in thin film technology is cadmium. In the case of thin film solar cells, no risk is expected due to the metal components forming the panels under normal operating conditions. However, it is necessary to take additional measures into account for and prevent events that may cause damage to solar cells (e.g. fires, damages during closure) in the operation and closure phases of large scale installations, where metal encapsulation is a matter of concern that can reach significant quantities (*US Department of Interior, Land Management Bureau, July 2012*).

Third Generation PV Technologies

PV Technologies are already one of the most researched energy technologies. Third generation PV technologies include technologies that are under investigation, those that have not yet been commercially used and that have fundamental differences from existing technologies. Condenser PV, organic PV and sensitized paint PV technologies are the most prominent of third generation PV technologies.

Photovoltaic Technologies Evaluated for Apa GES Project

Alternative evaluation studies are continuing on the selection of photovoltaic technology and other system components to be used for the Apa GES Project. Experts within the scope of feasibility studies have focused on polycrystalline cells from crystal silicon solar cell variants, and alternatively monocrystalline cells and thin film cells have also been analyzed. Within the scope of the evaluation of technology alternatives, fixed structure systems and solar tracker systems for support structure and central and serial/array inverter alternatives have also been taken into consideration. Ten different technology alternatives evaluated in this context are listed in Table 4.6.

Table.4.6. Evaluated Alternative Technologies within the scope of Apa GES Project

Alternatives	Cell Type	Support Structure	Inverter Type
1A	Polycrystalline	Fixed	Serial Inverter
1B	Polycrystalline	Fixed	Central Inverter
2A	Monocrystalline	Fixed	Serial Inverter
2B	Monocrystalline	Fixed	Central Inverter
3A	Thin Film	Fixed	Serial Inverter
3B	Thin Film	Fixed	Central Inverter
4A	Polycrystalline	Sun Tracker (single axle)	Serial Inverter
4B	Polycrystalline	Sun Tracker (single axle)	Central Inverter
5A	Monocrystalline	Sun Tracker (single axle)	Serial Inverter
5B	Monocrystalline	Sun Tracker (single axle)	Central Inverter

Source: Parsons Brinckerhoff, October 2015.

The results of the present evaluations are summarized in Table 4.7. As can be seen from the reviews presented in the table, Polycrystalline systems have relatively low investment costs when the investment cost and energy production criteria are taken into consideration and it offers higher energy production values under project conditions. For these reasons, it has been considered as a suitable alternative for the Apa GES Project. On the other hand, the high temperature values recorded in the field specific measurements have also made thin film technology, which offers good performance under high temperature values, a considerable alternative to the Project. More comprehensive assessments of the suitability/applicability of such technologies within the scope of the Project are currently going on and technology selection will be finalized taking into account the technical and economic circumstances in the pre-construction period. After the technology selection, one of the Tier-1 panel brands will be selected and the panels with the highest nominal power available according to the existing technology will be used.

When the systems using central and serial inverters are compared, it is taken into account that central inverters offer a better financial option and that serial inverters could provide higher performance in terms of operation in case of failure (especially considering the Project Area's relatively distant location from the center). Similarly, when fixed and solar tracking support systems under polycrystalline and monocrystalline technologies are compared, it has been considered that solar tracking systems might cause operational difficulties due to their moving parts.

When the evaluations related to serial and central inverters are elaborated in detail, it is possible to replace the failed inverter shortly without a significant loss of the system's total generation capacity (less than about 0.5%) in the event of failure of the systems in which the serial inverters are used. In the event of a failure in the central inverter systems, a greater loss of the system's total generation capacity (reaching to 7-8%) can be seen. The solar energy sector in Turkey is still in its early stages of development and this may also cause the extension of the time needed to intervene the system in case of a failure.

As can be seen in the evaluations presented above, different technology alternatives have various advantages and disadvantages of technical, economic, environmental and operational aspects. While polycrystalline alternative is more prominent under the current technological conditions, the most appropriate technology and system alternative for Apa GES Project will be selected with taking into account further alternative analyzes to be carried out in the future that will be based on a detailed consideration of all factors with the technological developments in the photovoltaic sector.

Table.4.7. Summary of Apa GES Project Technology Alternative Evaluation

Alternative	Technology	Support System Type	Inverter Type	Advantages	Disadvantages
1A	Polycrystalline	Fixed	Serial	– It is one of the best options in financial terms. – It requires relatively low land use. – Investment cost is one of the lowest options. – It is one of the choices with the highest energy generation values. – The use of serial inverters allows the fixing of the faults more easily.	– The energy generation values are lower than the polycrystalline systems used by central inverters. – Heat-induced losses are relatively high.

Alternative	Technology	Support System Type	Inverter Type	Advantages	Disadvantages
1B	Polycrystalline	Fixed	Central	– It is the best option in financial terms. – It requires relatively low land use. – Investment cost is the lowest option. – Energy generation values are the highest option. – Central inverters allow capturing higher energy generation values.	– In case of a central inverter failure, more generation loss occurs. – Experienced personnel are needed for maintenance/repair of central inverters.
2A/2B	Monocrystalline	Fixed	Serial/ Central	– There is less space required depending on high yield.	– Due to high manufacturing costs of Monocrystalline cells, it is more costly. – High temperature values do not provide additional energy generation.
3A/3B	Thin Film	Fixed	Serial/ Central	– Perform better on warmer conditions. – Though requiring further analysis, it is still considered feasible for the Project.	– More land use (at least 20%) is required for the same energy generation values. – Costs of construction and mechanical works are more.
4A/4B/ 5A/5B	Polycrystalline/ Monocrystalline	Solar/ Sun Tracker (single axle)	Serial/ Central	– It is one of the best options in financial terms. – It has the highest energy generation value per installed MW.	– It is the option with the highest investment cost per installed MW. – Operation costs are higher.

Source: Parsons Brinckerhoff, October 2015.

According to the basic design for thin film technology, which was evaluated as an alternative to polycrystalline technology under existing technological conditions within the scope of Apa GES Project, the characteristic information about the facilities to be installed in the Project is presented in Table 4.8. Sample cross section of panel and panel support system for thin film technology is shown in Figure 4.10.

Table.4.8. Characteristic Information on Facilities to be Established in the Project for Thin Film Technology Evaluated as an Alternatives

Panel Characteristics	Unit	Thin Film	
		Central Inverter	Serial Inverter
Total number of panels	number	124,668	124,668
Numbers of panels per MWe	number	8,333	8,333
Panel power	Watt	120	120
Number of inverter	number	13	262
Inverter power	kW	1,000	50
Number of transformers	number	7	13
Transformer power	kW	3,000	1,250
Total installed capacity (DC)	MWp	14.96	14.96
Total installed capacity (AC)	MWe	13.1	13.1
Annual electricity generation	kWh	26,962,505	26,891,700
Total footprint area of panels	m^2	89,761	89,761
Footprint area of panels per MWe	m^2	6,000	6,000
Footprint area of each panel	m^2	0.72	0.72
Total number of mounts	number	20,944	20,944
Estimated mount size (width x length)	cm	5 x 10	5 x 10
Length of the shorter mount	m	1.75	1.75
Length of longer mount	m	2.5	2.5
Total footprint area of the mount	m^2	658	658
Height of the shorter mount from the ground	cm	95	95
Height of the longer mount from the ground	cm	170	170
Panel inclination	°	20	20

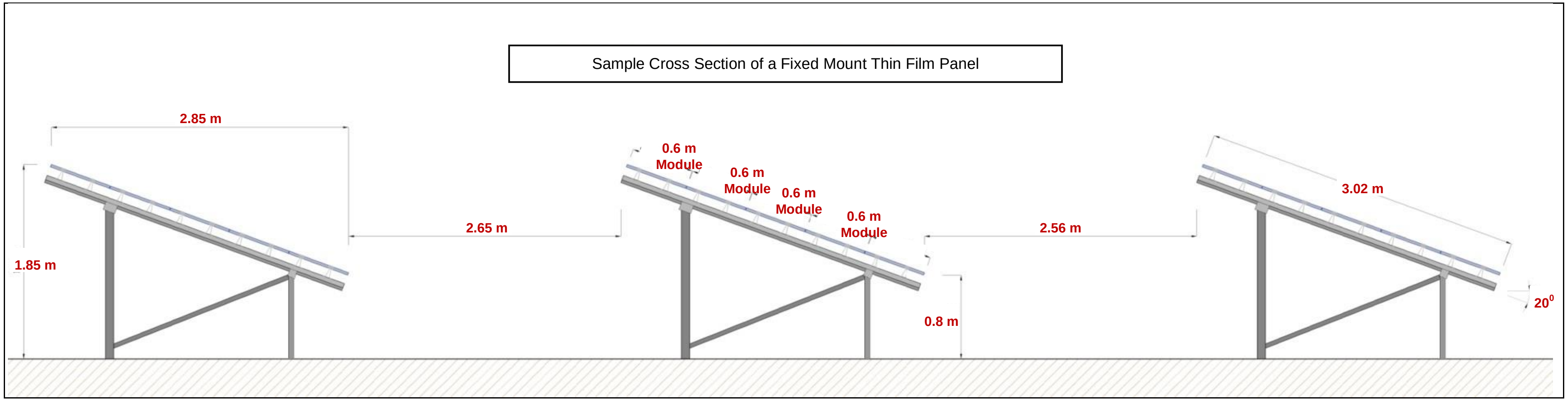


Figure.4.10. Sample Cross Section of Panel and Panel Support System for Thin Film Technology

4.3. No Action Alternative

The no action alternative represents the condition in which the planned Project is not being carried out. In the no project alternative, the current land use (pasture) and landscape characteristics in the Project Area will remain the same, the limited amount of employment foreseen within the scope the Project will not be created and the Project would not have had any possible negative impacts on the environment that would be minimized with the mitigation measures developed under this EIA report.

On the other hand, if the Project is not realized, an annual average electricity of 26,200,000 kilowatt-hours that will be produced in a solar power plant based on photovoltaic technology having 13.1 MWe installed capacity will not be generated and it would be possible that this energy demand will be supplied with a different production method. If the alternative method to be used in this context is going to be production of electricity based on fossil fuels, then carbon dioxide emissions that are not occurring during the electricity production in solar power plants would occur. In this case it should also be noted that an average of 18,000 tons of $CO_{2,}$ which could be prevented from being released annually with the Apa GES Project, may be released into the atmosphere.

If the energy production is done by alternative conventional methods (natural gas, coal, hydropower, etc.) besides solar energy, then the management of the impacts, which are based on the use of water and fuel, will become important. However, the advantage of these alternative conventional plants/facilities would be their relatively low land requirements and creation of more employment opportunities.

When the properties/characteristics of the selected site (near the Apa neighborhood of Cumra District in Konya Province) for the Project, the solar energy potential of the province, environmental aspects of the electricity generation based on solar energy and economical benefits of the Project are considered, electricity generation with a solar power plant to be installed in the described Project Area is evaluated as a better alternative than the no action alternative. The benefits of the project/activity will be maximized through the realization of the Project with the effective management of environmental impacts by taking mitigation measures developed within the scope of this report.

CHAPTER 5

GEOLOGY, NATURAL HAZARDS, SOIL CHARACTERISTICS AND LAND USE

5. GEOLOGY, NATURAL HAZARDS, SOIL CHARACTERISTICS AND LAND USE

This Chapter identifies existing geological conditions, natural hazard potential, soil characteristics and land use in the Project Area and assesses potential impacts of the Project on soil environment. Measures proposed for the mitigation of the potential impacts and the residual impacts are also described in this Chapter for the following impact issues:

- Agricultural suitability;
- Grazing suitability;
- Erosion risk;
- Topsoil loss.

5.1. Geology

The information provided in this section is based on a detailed literature review of the Project Area and its vicinity. Baseline descriptions are provided under the following subtopics:

- Regional Geology
  - Geological Setting and Tectonic Evolution
  - Stratigraphy
- Project Area Geology
  - Geotechnical Characteristics
  - Seismicity and Structural Geology

5.1.1. Regional Geology

Geological Setting and Tectonic Evolution

Turkey's geology, in general, is highly complex and although studied in the extent of a multitude of studies by several researchers, its main features and their relations with each other are yet to be understood clearly. On the largest scale, Turkey is separated into three main tectonic units, the Pontides, the Anatolides-Taurides and the Arabian Platform (*Ketin, 1966; from Okay, 2008*). Formerly surrounded by oceans, these tectonic units are currently separated by suture zones which mark the closing regions of these oceans. A map presenting the main tectonic units of Turkey is presented in Figure 5.1.

The Pontides presents similarities to the continent Laurasia and corresponds to the tectonic units in the Balkans, the Caucasus and central Europe. All of these units represent the northern branch of Neo-Tethys Ocean. This ocean completely disappeared during Miocene, by collision of Anatolia - Taurus Platform with Pontide Island Arc and subsequently, the Izmir-Ankara Erzincan suture zone was formed where the ocean closed (*Okay, 2008; Pourteau, 2011*).

The Anatolides-Taurides present similarities to the continent Gondwana, however, were separated from the main mass of this continent by the southern branch of Neo-Tethys Ocean. This ocean, which lies on an approximately E-W direction, at the north of African-Arabian Plates, also closed approximately during Miocene by continental collision of Anatolian Platform and Arabian Plate. Current eastern section of the Mediterranean is a remnant of this ocean. The ocean closing process is still ongoing and the active subduction zone in the Aegean Region is one of the current indicators of this condition (*Okay, 2008*).

The southeast Anatolia forms the northernmost extension of the Arabian Platform. The Arabian Platform has a Pan-African crystalline basement overlain by a Paleozoic to Tertiary sedimentary sequence. In most areas of the southeast Anatolia only the Cretaceous and younger deposits crop out on the surface. The lower parts of the sequence are exposed in anticlines (*Rigo de Righi & Cortesini 1964; from Okay, 2008).* During the Late Cretaceous and Tertiary ophiolites, ophiolitic melanges and thrust sheet were emplaced over the Arabian Platform and form the Lower Nappe. The continental collision with the Anatolides – Taurides occurred later during the Miocene, when a second set of allochthonous units including the Bitlis Massif and the underlying melange units were emplaced over the Arabian Platform (*Okay, 2008).*

At the end of Middle Miocene, Southern Tethys Ocean closed due to the continental collision that occurred along Bitlis-Zagros Suture Zone and also around the same time, towards south of this suture zone, the Red Sea - Aden gulf was formed, pushing the Arabian Plate towards north-northeast. These two large scale tectonic events caused the formation of North Anatolian Fault Zone (NAFZ) and East Anatolian Fault Zone (EAFZ). On the southwestern boundary of Anatolian-Aegean Plate, Aegean Region tectonic structures were also formed (due to N-S stresses) by north-northeast bound movement of the African Plate. Formation of these fault zones and tectonic structures is considered to be the beginning of Neo-tectonic period in Turkey and corresponds approximately to Late Miocene – Early Pliocene (*Okay, 2008*).

Project Area is located at the north of the Taurides from these three main tectonic units. Geyikdagi and Bozkir sub tectonic units formed in Paleotectonic era and Neo-autochthonous Unit rocks formed in neo-tectonic era is located in the Project Area and its wide vicinity (*Ozgul, 1976; Turan, 2010*). Rocks in the region have gained folded, fractured and faulted structures due to tectonic movements. Stratigraphic evaluation of these formation shows that early-middle Alpine and neo-tectonic movements are influential in the region (*Ozkan and Turan, 2007*).

Three discontinuities among different geological units exists in the region which are angular unconformity between autochthonous and allochthonous units related to the end of Middle Alpine orogenesis phases and Dilekci Group units, unconformity related to the end of Middle Alpine movements between Dilekci Formation and Topraklı Formation and lastly unconformity between alluviums and older units. As a result of orogenic action which has been active since the Late Cretaceous, the Mesozoic sequences are folded and deformed in the region. Other structural elements in the region are the thrust and gravity faults observed along the Geyikdagi Unit, Bozkir Unit and neo-autochthonous units. The strikes of these faults indicate that the region is subjected to significant N – S compression stresses in general (*Ozkan and Turan, 2007; Turan, 2010*).

Stratigraphy

The Taurides, which are extensions of the Alpine – Himalayan orogenic belt, consist of the units deposited/settled in the Cambrian – Tertiary and represent different basin conditions. These units are defined and named by *Ozgul (1976)* as Bolkardagi Unit, Aladag Unit, Geyikdagi Unit, Alanya Unit, Bozkir Unit and Antalya Unit (*Turgay, 2011).* In the area near to Konya Basin belongs to Taurides, units are observed as three units which are Geyikdagi Units (autochthonous unit), Bozkir Unit (allochthonous unit) and young continental and volcanic units (neo-autochthonous unit) from bottom to top (*Turan, 2010*). Generalized stratigraphic section of the region is presented in Figure 5.2.

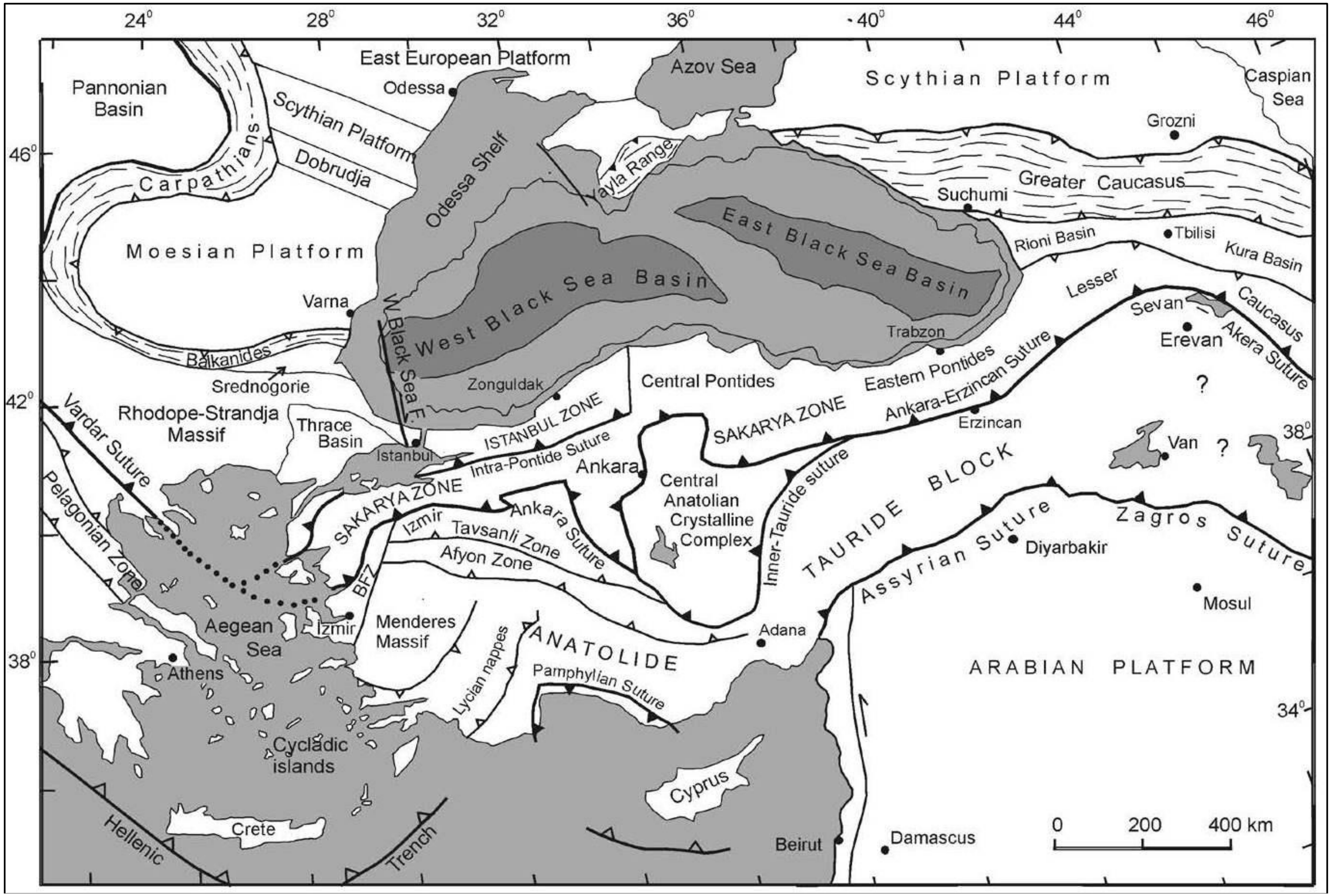
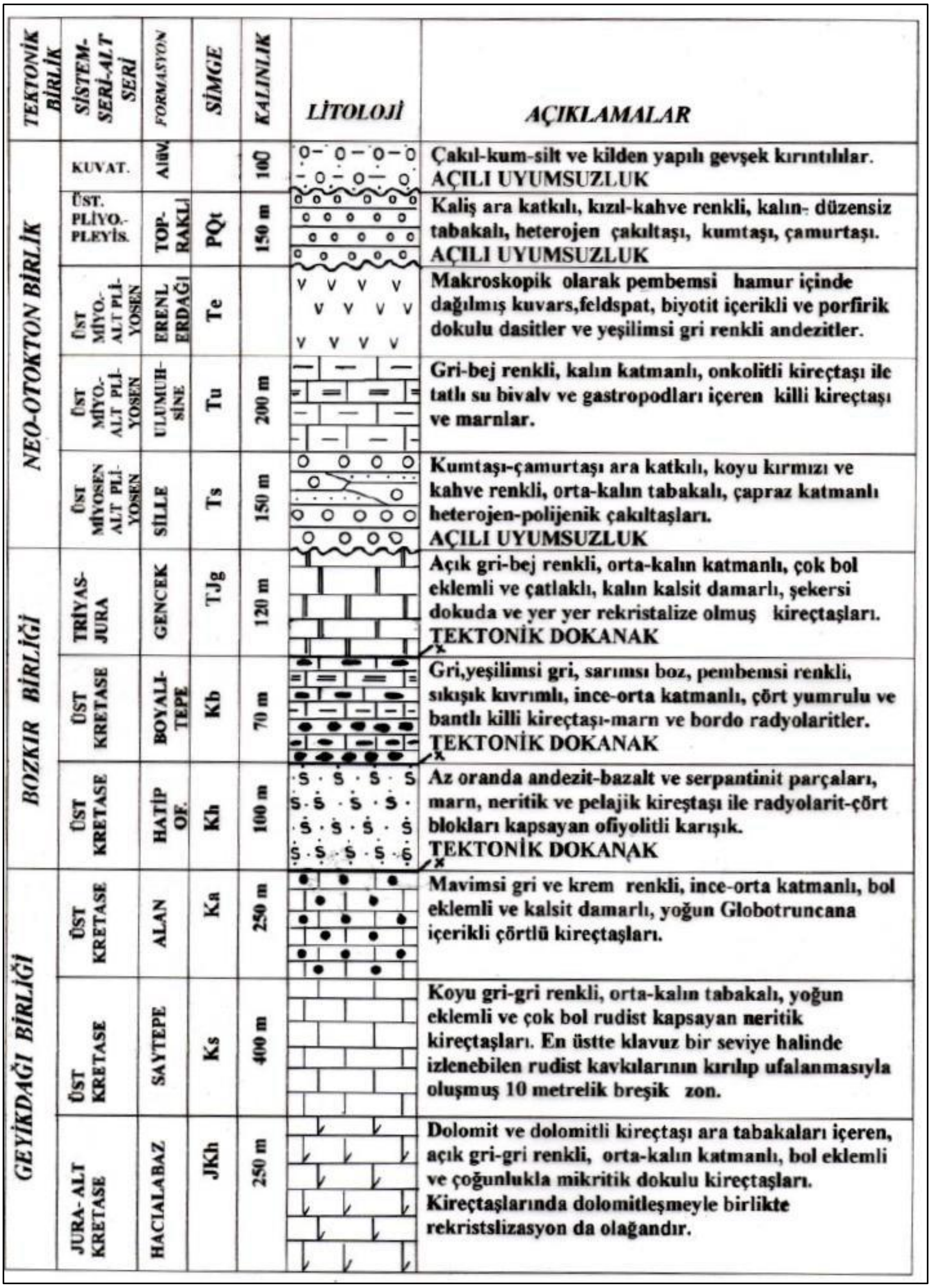


Figure 5.1. Tectonic Map of Turkey and the Region (*Okay, 2008*)



TEKTONİK BİRLİK	SİSTEM-SERİ-ALT SERİ	FORMASYON	SİMGE	KALINLIK	LİTOLOJİ	AÇIKLAMALAR
NEO-OTOKTON BİRLİK	KUVAT.	Alüv.		100		Çakıl-kum-silt ve kilden yapılı gevşek kırıntılılar. AÇILI UYUMSUZLUK
	ÜST. PLİYO.-PLEYİS.	TOP-RAKLI	PQt	150 m		Kaliş ara katkılı, kızıl-kahve renkli, kalın- düzensiz tabakalı, heterojen çakıltaşı, kumtaşı, çamurtaşı. AÇILI UYUMSUZLUK
	ÜST MİYO.-ALT PLİ-YOSEN	ERENL ERDAĞI	Te			Makroskopik olarak pembemsi hamur içinde dağılmış kuvars,feldspat, biyotit içerikli ve porfirik dokulu dasitler ve yeşilimsi gri renkli andezitler.
	ÜST MİYO.-ALT PLİ-YOSEN	ULUMUH-SİNE	Tu	200 m		Gri-bej renkli, kalın katmanlı, onkolitli kireçtaşı ile tatlı su bivalv ve gastropodları içeren killi kireçtaşı ve marnlar.
	ÜST MİYOSEN ALT PLİ-YOSEN	SİLLE	Ts	150 m		Kumtaşı-çamurtaşı ara katkılı, koyu kırmızı ve kahve renkli, orta-kalın tabakalı, çapraz katmanlı heterojen-polijenik çakıltaşları. AÇILI UYUMSUZLUK
BOZKIR BİRLİĞİ	TRİYAS-JURA	GENCEK	TJg	120 m		Açık gri-bej renkli, orta-kalın katmanlı, çok bol eklemli ve çatlaklı, kalın kalsit damarlı, şekersi dokuda ve yer yer rekristalize olmuş kireçtaşları. TEKTONİK DOKANAK
	ÜST KRETASE	BOYALI-TEPE	Kb	70 m		Gri,yeşilimsi gri, sarımsı boz, pembemsi renkli, sıkışık kıvrımlı, ince-orta katmanlı, çört yumrulu ve bantlı killi kireçtaşı-marn ve bordo radyolaritler. TEKTONİK DOKANAK
	ÜST KRETASE	HATİP OF.	Kh	100 m		Az oranda andezit-bazalt ve serpantinit parçaları, marn, neritik ve pelajik kireştaşı ile radyolarit-çört blokları kapsayan ofiyolitli karışık. TEKTONİK DOKANAK
GEYİKDAĞI BİRLİĞİ	ÜST KRETASE	ALAN	Ka	250 m		Mavimsi gri ve krem renkli, ince-orta katmanlı, bol eklemli ve kalsit damarlı, yoğun Globotruncana içerikli çörtlü kireçtaşları.
	ÜST KRETASE	SAYTEPE	Ks	400 m		Koyu gri-gri renkli, orta-kalın tabakalı, yoğun eklemli ve çok bol rudist kapsayan neritik kireçtaşları. En üstte klavuz bir seviye halinde izlenebilen rudist kavkılarının kırılıp ufalanmasıyla oluşmuş 10 metrelik breşik zon.
	JURA-ALT KRETASE	HACIALABAZ	JKh	250 m		Dolomit ve dolomitli kireçtaşı ara tabakaları içeren, açık gri-gri renkli, orta-kalın katmanlı, bol eklemli ve çoğunlukla mikritik dokulu kireçtaşları. Kireçtaşlarında dolomitleşmeyle birlikte rekristslizasyon da olağandır.

Figure 5.2. Generalized Stratigraphic Section of the Region (*Turan, 2010*)

Geyikdagi Unit

The unit, which is named after Geyik Mountain which is one of the highest mountains of the Central Taurus and consists of rock units belonging to this group that are shelf type carbonate rocks and detritic rocks generally deposited at Cambrian-Tertiary (*Özgül,1997*). The unit includes almost all units that deposited at Cambrian-Tertiary. The oldest member of the unit whose age can be determined consists of multicolored, nodular limestones and there is no fossil content in dolomitic limestone and underlying schist unit which are conformable (*Dean and Monod; Ozgul and Gedik, 1973; from Ozgul 1976).*

Shelf type carbonate and detritic rocks which are aged as Cambrian-Paleocene are represented by Lower Eocene/Lutetian aged flysch and Upper Lutetian-Upper Eocene aged rocks which belong to olistostrome facies. The epirogenic movements affecting the unit are active from the Cambrian and there is unconformity at the base of Maastrichtian-Lutetian aged rocks and Silurian, Permian, Triassic, Liassic, Dogger marls. In Sultandaglari, Seydisehir, Hadim region that is forming the northern part of the zone a large hiatus covering Upper Triassic and partly Triassic exist. In the southern part the deposit is more compact. Rock units, including the oldest rocks, have not metamorphosed (*Ozgul, 1976).*

The unit is overlying the all other units is relatively autochthonous. The Project Area is represented by Jurassic aged Hacialabaz Limestone, Upper Cretaceous aged Saytepe Formation consisting neritic limestone and Upper Cretaceous aged Alan formation consists cherty limestones from bottom to the top (*Turan, 2010)*;

- Hacialabaz Limestone: Defined and named by *Demirkol (1981)* then it is defined as Belkuyu Formation, including Upper Cretaceous neritic and pelagic facies units, Saytepe which is underlying Hacialabaz Limestone and Alan formation that is overlying Saytepe Formation. It consist of micritic levels, crystallized, gray, mid-thick bedded dolomitic limestones; gray, pinkish levels, mid-thick bedded limestone; dolomitized levels, gray-light gray limestone from bottom to top. The unit overlying the Middle Triassic aged Sarpyardere Formation(in Seydisehir region) and Late Cambrian-Ordovician aged Seydisehir Formation (in Hadim region) with angular unconformity and conformably overlain by Late Cretaceous aged Saytepe formation.

- Saytepe Formation: The formation consists of mid-thick bedded, gray colored neritic limestones. At lower levels it includes abundant rudist and less foraminifera and algae fossils, gray, mid-thick bedded limestones. Above these limestones gray-white, abundant in rudist, mid layered limestones and these levels is overlain by gray, including abundant rudist content, detritic limestones. The formation overlays Hacialabaz Limestone conformably and overlain conformably by Alan Formation.

- Alan Formation: The formation is start with gray-bluish, with chert nodules, mid layered limestones from bottom and continue with gray, chert noduled clayey limestone and then light pink pelagic clayey and cherty carbonate rock alternation. Dilekci Group is overlain the formation with angular unconformity and Hatip Ophiolitic Melange Rocks belonging to Bozkir Unit is overlain the formation with tectonic contact.

Bozkir Unit

The age of this unit is in between Triassic-Cretaceous and this unit consist of a melange that include pelagic and neritic limestone, radiolarite, volcanite, tuff, diabase, serpentinite and these rock types present in different sizes of blocks and also this unit is allocthonous.

Some parts of the units are in the same age but, represent different environmental conditions. The unit has quite complex stratigraphy that includes, various units such as red colored, pelagic limestone, radiolarite, ophiolitic blocks in different sizes, tuff, submarine volcanics and allochthonous units which belong to Bolkardagi Unit. All the units that are included in Bozkir unit represent deep sea marine environment and are aged as Jurassic-Upper Cretaceous (*Ozgul, 1997).*

The units those are included in Bozkir Unit which are Hatip Ophiolitic Melange, Boyalitepe Unit and Gencek Unit show spreading around Project Area and its wide vicinity (*Turan, 2010*):

- Hatip Ophiolitic Melange: consist of red colored, mudstone and birght green-dirty green colored serpentinite with quartz vein, dispered chert, radiolarite and small sized limestone blocks in a matrix that is exposed to the excess shearing. Small amount of basalt, andesite, diabase and gabbro fragments also observed partly in the melange. It has tectonical contact with underlying Alan Formation (part of Geyikdagi Unit) and Boyalitepe Group(part of Bozkir Unit) overlays this melange tectonically.

- Boyalitepe Group: starts with maroon-red colored, thin-middle layered radiolarites and locally gray, limestone intercalations with chert lumps. In this level, the ratio of gray-greenish, dark yellow-pinkish colored clayey-marly limestone which is alternating with radiolarites is increasing towards the top of the deposit. In addition to that, chert containing, intensely jointed limestones, brown-maroon pelagic carbonate levels and greenish-beige, dark pinkish clayey limestone and marl levels also exist. The upper part of this group is formed by detritic limestone, sandstone, shale, marl and thin bedded cherty limestone and represented by mixed sedimentary deposit. It has tectonic contact with Late Cretaceous aged Hatip Ophiolitic Melange at the bottom and Triassic-Jurassic aged Gencek Group at the top.

- Gencek Group: consists of gray-beige colored, intensely jointed, mid-thick layered, neritic Triassic-Jurassic aged carbonate rocks. It has tectonic contact with Boyalitepe Group at the bottom and it is overlain by Sille or Ulumuhsine formation (part of Neo-autochthonous Unit) with angular unconformity.

Neo-Autochthonous Unit

Late Miocene-Early Pliocene aged Dilekci Group that covers underlying unit with angular unconformity, forming the base of the neo-autochthonous unit. In the region, Sille Formation (continental sedimentary deposit with continental conglomerate, sandstone, and mudstone lithologies), Ulumuhsine Formation (rocks that deposited in lacustrine environment such as lacustrine limestone, clayey limestone and marl) and Erenlerdagi Volcanics (Andesitic and dacitic lava flow on Ulumuhsine Formation) are observed. Unconsolidated sandstone, mudstone lithologies of Toprakli Formation which is Upper Pliocene aged is overlying Dilekci Group with unconformity.

When consider the morphology and lithological characteristics of this formation, it is considered that the alluvial fan is observed in the form of mud and debris flows and the debris that is formed by intermittent rivers in the plains that is the complex alluvial sediments. Youngest sediments in the region are 30-40 cm thick alluvium consist coarse pebble, coarse and fine sand and silt-clay sized material.

5.1.2. Project Area Geology

Geotechnical Characteristics

Project Area is corresponds to 5th grade earthquake zone according to Earthquake Zones Map of Turkey. In this context, there is no significant earthquake risk exist in the area. Furthermore, Cumra District where Project Area is located is a region where no landslide is observed. According to 1/500,000 scaled landslide inventory map published by MTA, there are no slip, flow and creep incidents in the Project Area and there is no risk for landslide (see also section 5.2. Natural Hazard Potential). According to Earthquake Zones Map of Turkey, operation units will be designed to be sensitive under a maximum ground acceleration of 0.1 g. In order to ensure the safety of the foundation, panel stands to be installed by piling will be placed deep enough to provide stability and concrete applications will be made in stony zones. Construction works within the scope of the Project will be in accordance with Regulation on Buildings to be made in Disaster Areas and Regulation on Buildings to be made in Earthquake Areas. All suggestions and measures to be mentioned in the Plan-based Geological-Geotechnical Study Report to be surveyed in the Project Area will be adopted in project applications.

Seismicity and Structural Geology

According to Earthquake Zones Map of Turkey, all of the 5 earthquake levels are observed in the Konya Province, where the Project Area is located. The Project Area corresponds to the 5th grade earthquake zone, that is, the lowest earthquake risk level. Earthquake zone map of Konya Province is given in Figure 5.3.

Konya Basin; is a basin that is bounded by Konya fault zone in the west, Karaomerler fault in the north and Divanlar and Gocu faults in the east (*Eren, 2011*). These faults are generally oblique and faults that is in N-S and E-W directions are dominant and in some places faults with NE-SW and NW-SE directions are also observed. With these faults while Konya Basin was collapsing relatively, near vicinity rise. Konya fault zone, which constitutes the most important fault system, consists of dominantly normal faults dipping E, SE.

The active fault map of the Project Area and its surroundings is presented in Figure 5.4. As can be seen from this map, the faults located closest to the Project Area are respectively Alacadag fault zone at 40.5 km northwest of the Project Area and Hotamis fault zone at 49 km northeast of the Project Area.

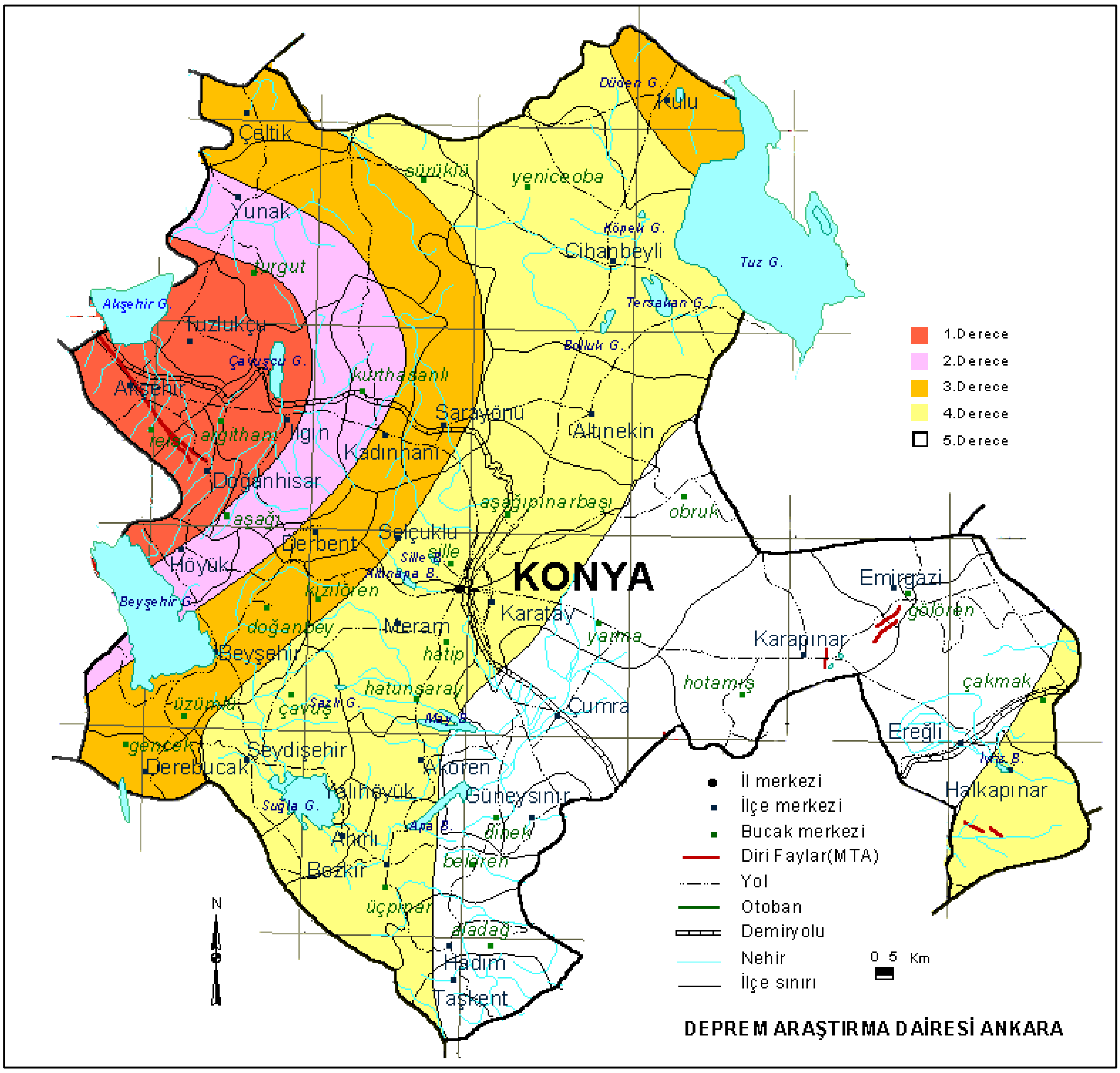


Figure 5.3. Earthquake Zones Map of Konya Province

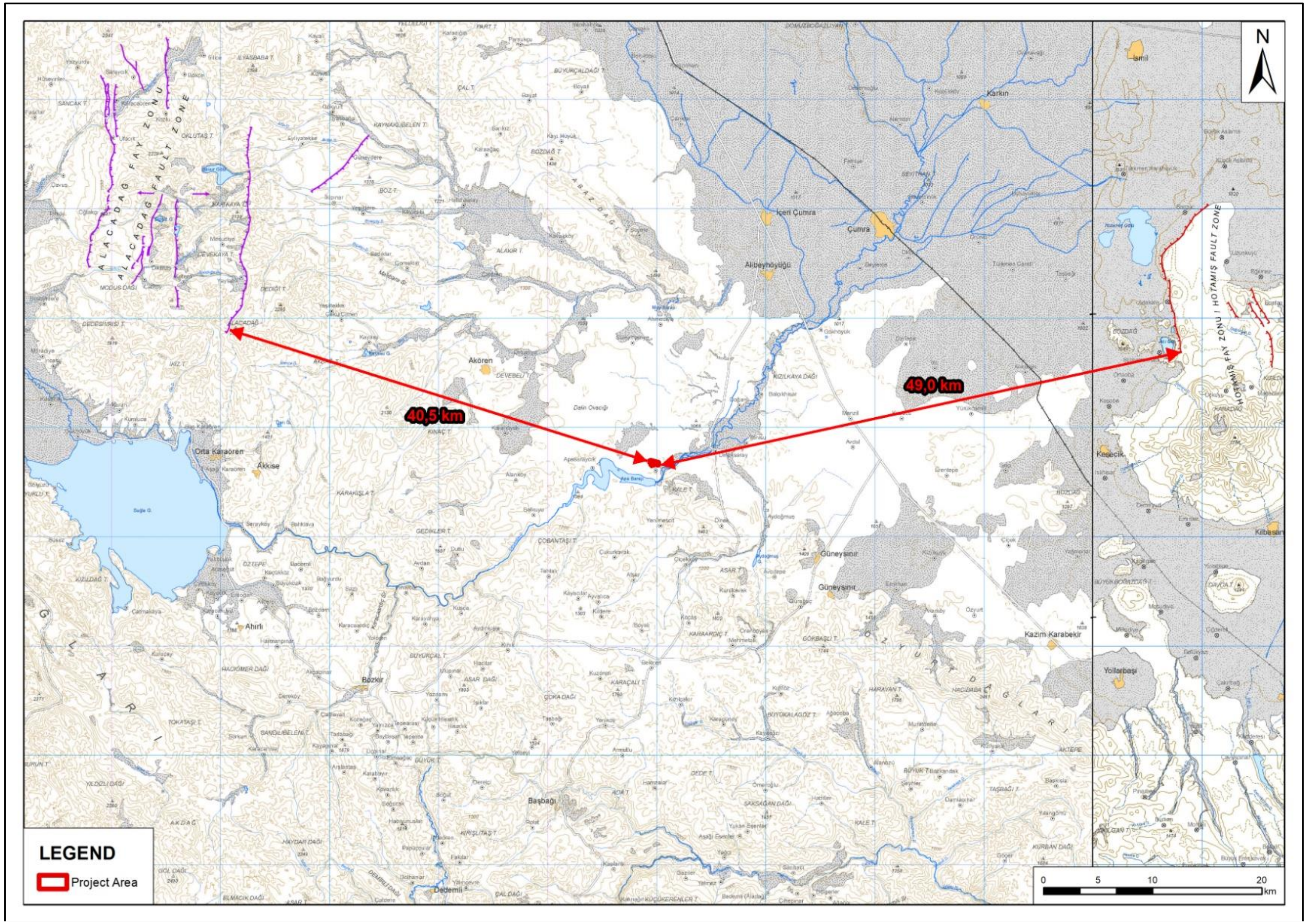


Figure 5.4. Active Fault Map of the Project Area and Its Vicinity (*official website of MTA*)

5.2. Natural Hazard Potential

The information provided in this section covers the potential natural hazards that could be observed within the region where Konya Province and Project Area is located. As there is no snowslide hazard risk in the province, this hazard has not been taken into consideration.

5.2.1. Mass Movements

Landslide

Natural factors affecting the formation of landslide can be listed as climate, precipitation, geological structure, topography and vegetation cover. In addition to them, factors such as unplanned settlement and unplanned road cuts increase the severity and frequency of landslides. Landslide disaster in Turkey is observed in all Black Sea Region and Central and Eastern Anatolia regions, especially in Eastern Black Sea Region, in accordance with these triggering factors (*JICA, 2004)*. Between 1950 and 2008, most landslide incidents occurred in Trabzon with 1,123 events, Rize with 1,049 events, Kastamonu with 613 events, Erzurum with 573 events and Artvin with 471 events (*Gokce v.d., 2008*). Konya Province is not located in the list of 15 provinces that are exposed to landslide and rockfall threats according to the number of incidents.

The distribution of landslides between 1950 and 2008 according to provinces and districts are given in Figure 5.5 and Figure 5.6 respectively. According to these maps, Konya Province is categorized as low risk area in terms of landslide incidence. Landslides are not observed in the Cumra district where the Project Area is located according to these maps. Similarly, when the 1/500,000 scaled landslide inventory map that is presented in Figure 5.7 is examined, it is seen that slip, flow and creep movements are not observed in the Project Area and its vicinity.

A quite flat topography is observed in the Project Area and its vicinity and it is assessed that there is no risk in terms of landslide in this area when the landslide, slip, flow and creep phenomena are not observed in the Cumra district and Project Area as mentioned above and the precipitation characteristics of the region is taken into account.

Rockfall

Rockfall events are concentrated in Eastern Anatolia and certain parts of Central Anatolia. Kayseri, Erzurum and Erzincan are the most frequently encountered provinces of this disaster, while Konya Province is not located in the top 40 provinces where rockfall events occur most frequently (*Gokce, 2008*). When Figure 5.8 showing distribution of rockfall events by provinces and Figure 5.9 showing distribution of landslide events by districts are examined, it is seen that Cumra district is corresponds to second lowest category (1-10 event frequency). There is no high ground exist in the Project Area, so the Project Area does not have rockfall risk.

5.2.2. Flood

Flood events are defined as due to excess rain receive of the basin and/or melting of existing snow cover in the basin, rapid increase in the amount of water in a riverbed, and the damage to living things, properties, lands around the river beds.

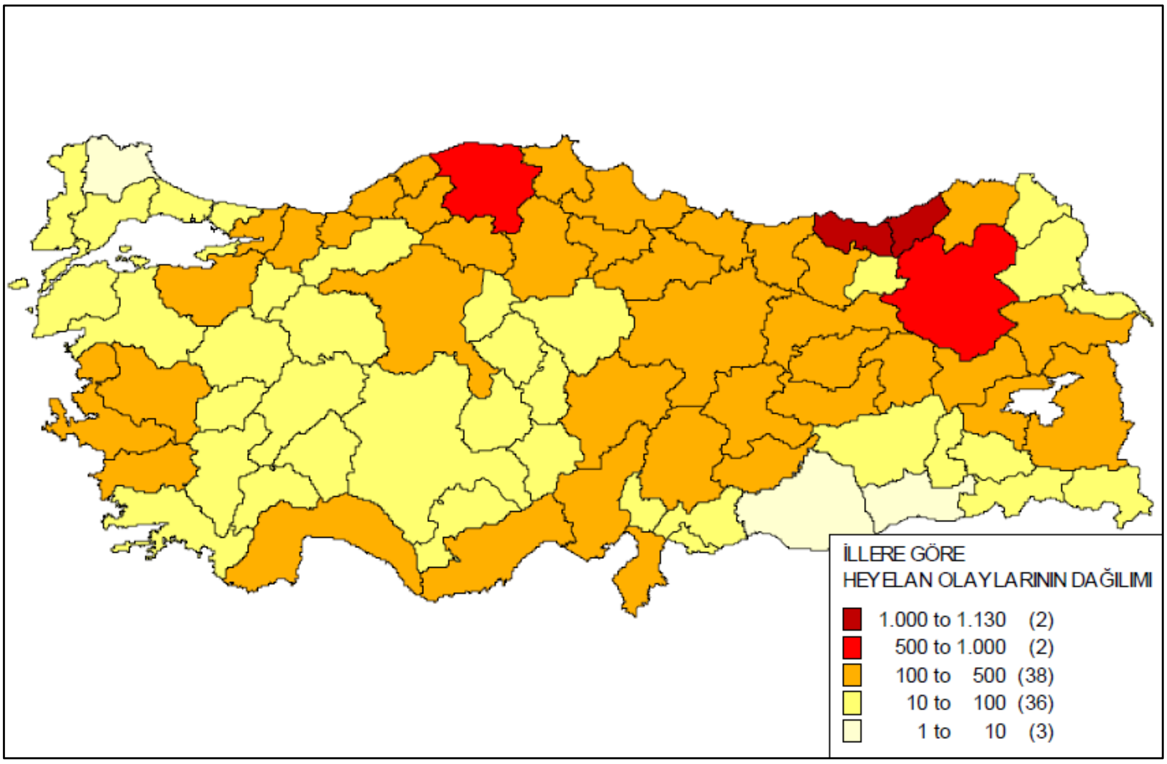


Figure 5.5. Distribution of Landslide Events in Turkey by Provinces (*Gokce et. al, 2008*)

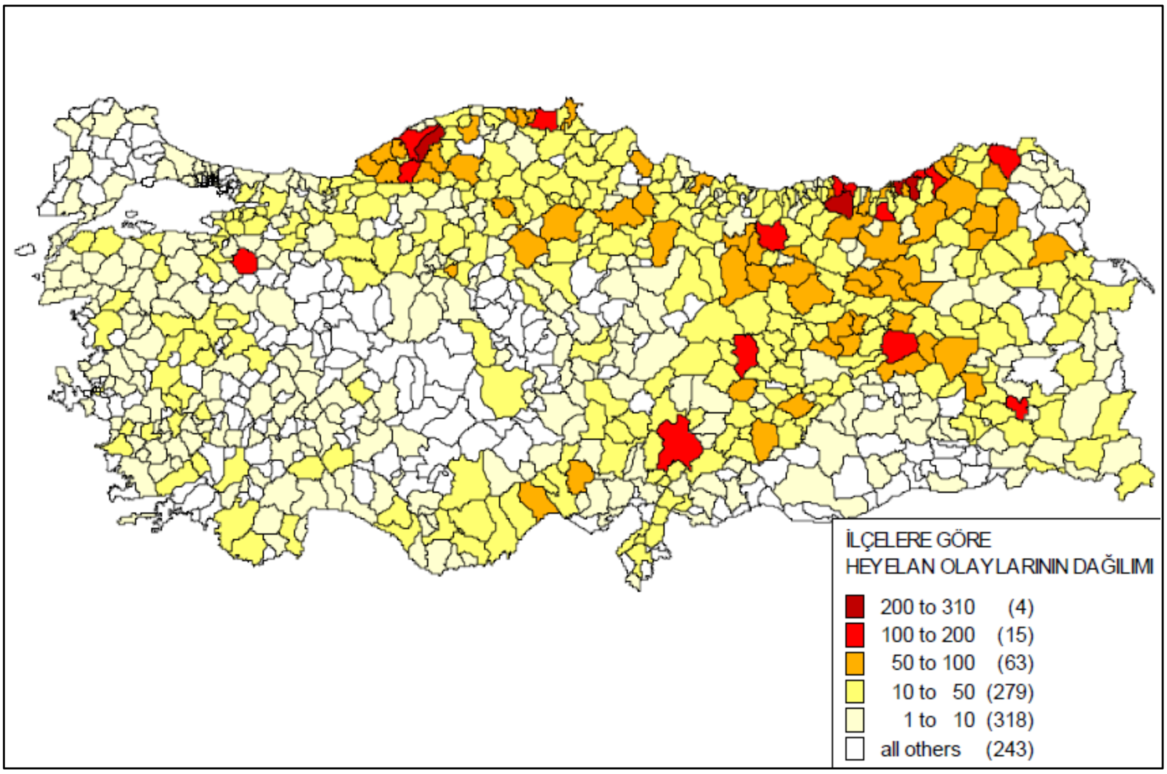


Figure 5.6. Distribution of Landslide Events in Turkey by Districts (*Gokce et. al., 2008*)

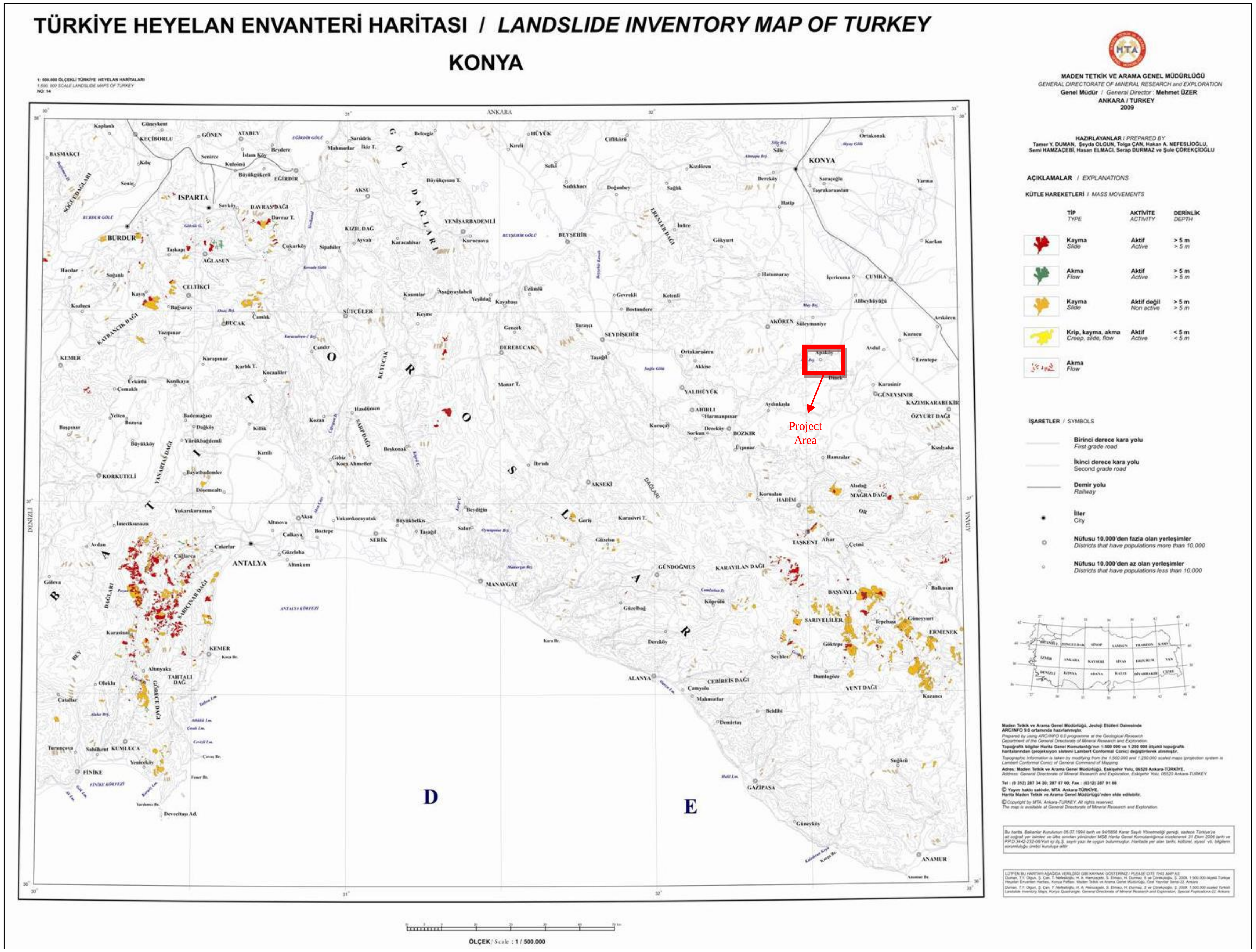


Figure 5.7. Landslide Inventory Map of Turkey (*MTA web site*)

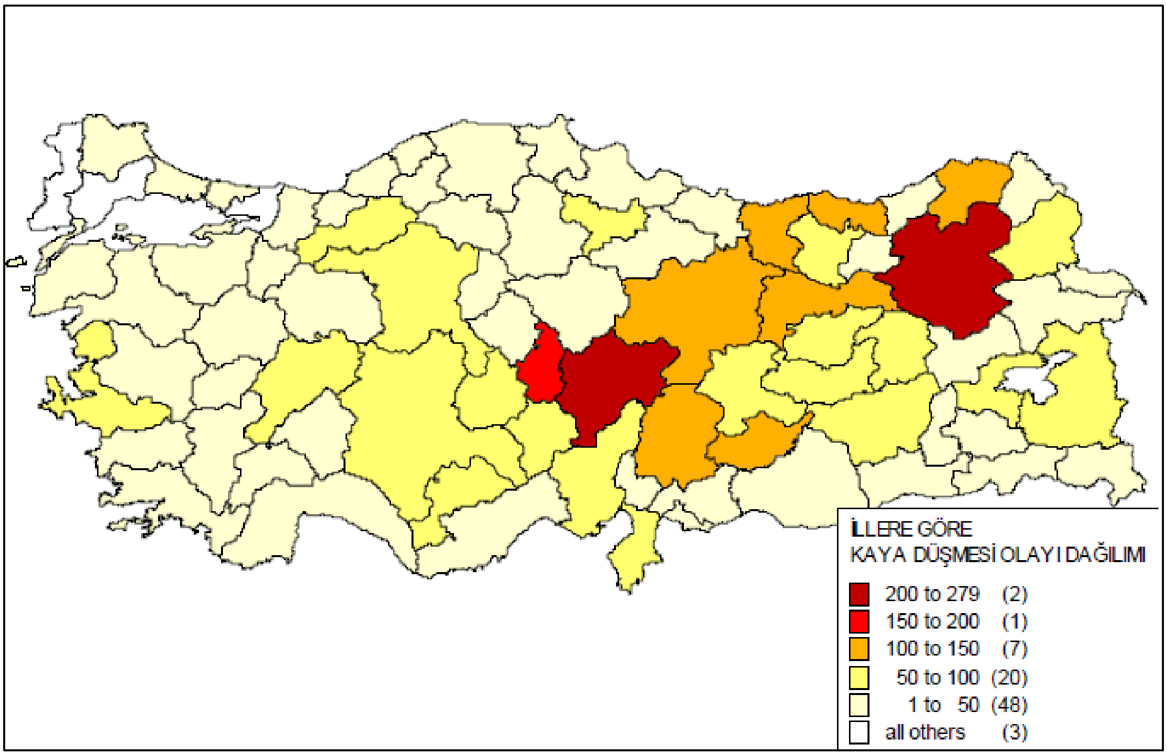


Figure 5.8. Distribution of Rockfall Events in Turkey by Provinces (*Gokce et. al., 2008*)

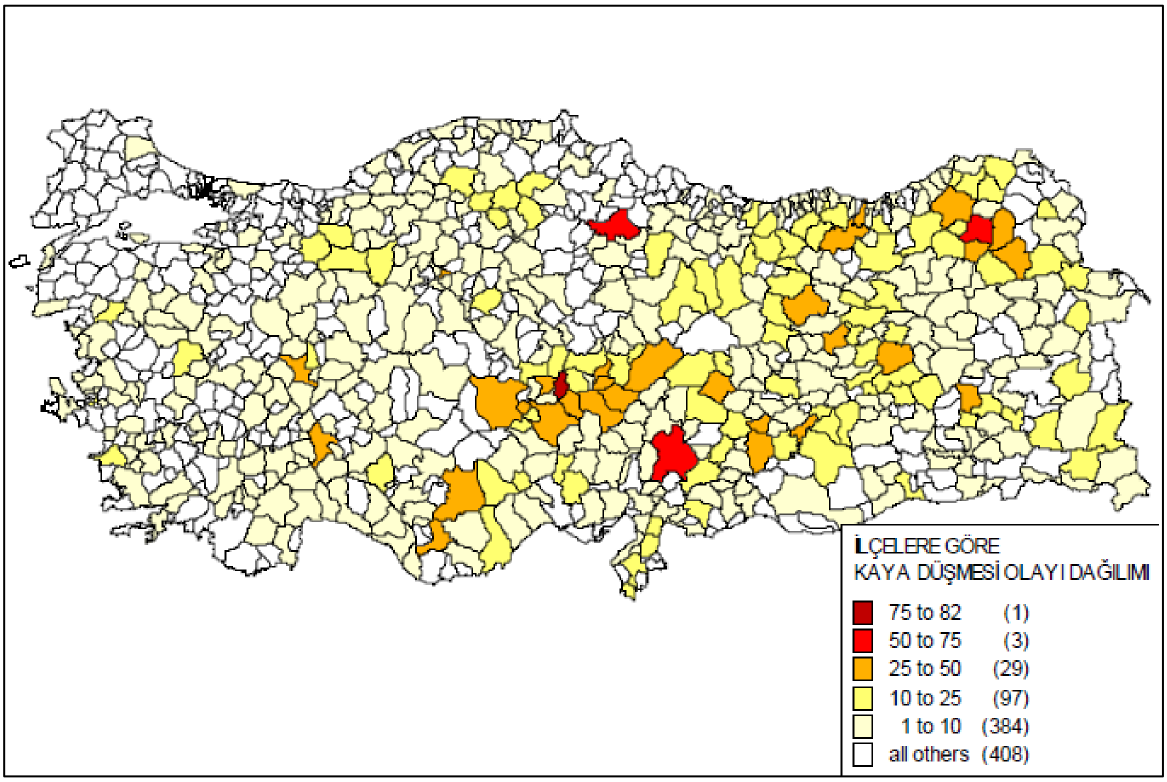


Figure 5.9. Distribution of Rockfall Events in Turkey by Districts *(Gokce et. al., 2008)*

The main factors affecting the floods are the regional precipitation character, geology and geomorphological features (elevations, valleys, slopes, drainage structure etc.), erosion processes, land use and factors that unbalance hydrogeology (deforestation, uncontrolled/improper settlements, improper creek rehabilitation etc.).

When flood disasters are evaluated in Turkey, Konya Province does not exist in the first 15 provinces (*JICA,* 2004). According to list in *Ergunay (2007)*; according to annual frequency of flood disasters, the provinces listed as Izmir with 3,484 events/year, Rize 1,841 events/year and Kahramanmaras with 1,608 events/year. Figure 5.10 shows the geographical distribution map of flood disasters according to the number of floods takes place according to the DSI data between 1940-2010. According to the map, number of flood observations in Konya Province is generally decreasing from the center to the outside of the province. This shows that flood events are more common in regions with intense urbanization.

Land use is one of the important factors affecting the storage of rainfall in the soil and its flow as surface flow. In the areas that structures do not exist such as forests and agricultural lands, rainfall is absorbed by vegetation and soil. When the retention capacity is exceeded, the surface flow occurs slowly beneath the surface. In the areas where urbanization is intense, surface flow both increases and become faster due to the increase in impermeable surfaces (*Konrad, 2003*). When the land use status in Project Area and its vicinity is evaluated, it is seen that pasture lands are dominant and the probability of flooding that can be formed at the outside of the Project Area is low. When Figure 5.11 where the distribution of flood disasters in Turkey by district is given, it is seen that Cumra district where the Project Area is located has a risk one step higher than the lowest level with 1-10 event and it is seen that there is no risk of flooding in the Project Area.

5.2.3. Drought

Drought, which is the most comprehensive disaster in meteorological characteristics, is a consequence of significant decrease of recorded normal levels, resulting in adverse effects on land and water resources and spoil on hydrological balance (*Kapluhan, 2013*). The effects of El-nino in the Mediterranean countries are not clearly visible. However, due to long standing dry seasons the danger of drought has become increasingly important. In the spring of 1999 and 2000, there was a drought that was effective in Turkey, especially in the southern regions, resulting in an average loss of agricultural production of 30% in the region.

In Turkey, there is no area that can be counted as arid only due to rainfall, significant part of Central Anatolia and Eastern Anatolia are located in the semi-arid region. Whole Central Anatolia, Eastern Mediterranean and Southeastern Anatolia regions have some arid features and they are characterized by desert and very dry characteristics in some locations (*Kapluhan, 2013*).

General Directorate of Meteorology presents Turkey’s drought analysis maps for specific time periods. A 12-month drought assessment map that is prepared according to maps prepared by Standardized Rainfall Index (SPI) method, which is obtained as using the equation of precipitation minus average over standard deviation within the determined time periods, is presented in Figure 5.12. As can be seen from this map, the Project Area corresponds to the mid-drought interval and the region has the potential to become a problematic region in the future in terms of drought disaster.

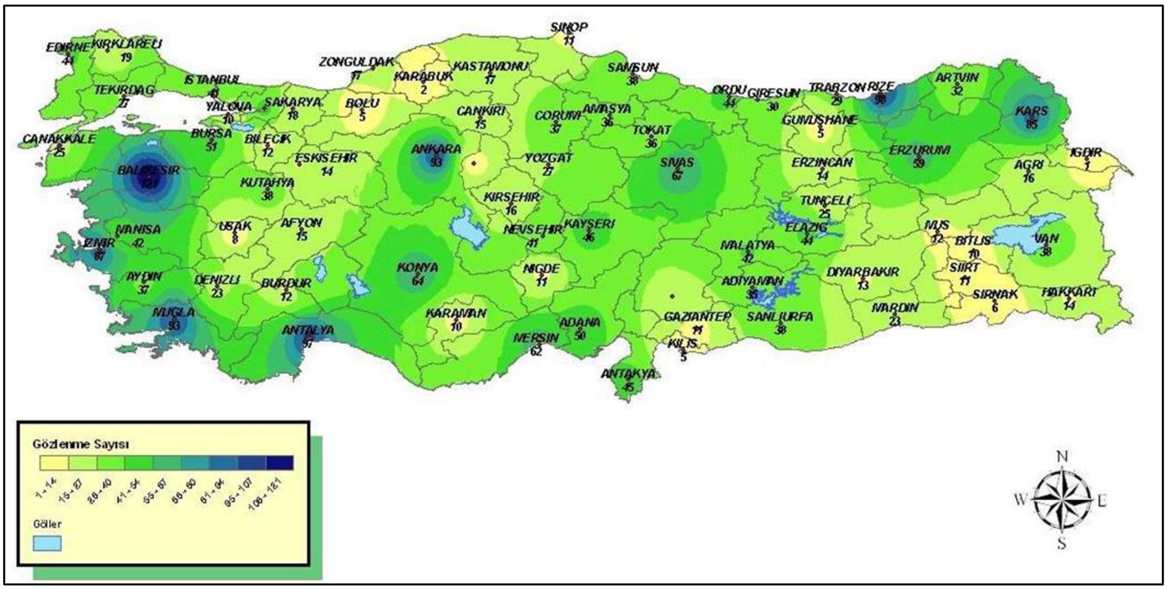


Figure 5.10. Flood-Heavy Rainfall Disasters, Number of Observations between 1940 and 2010 (*official website of General Directorate of Meteorology*)

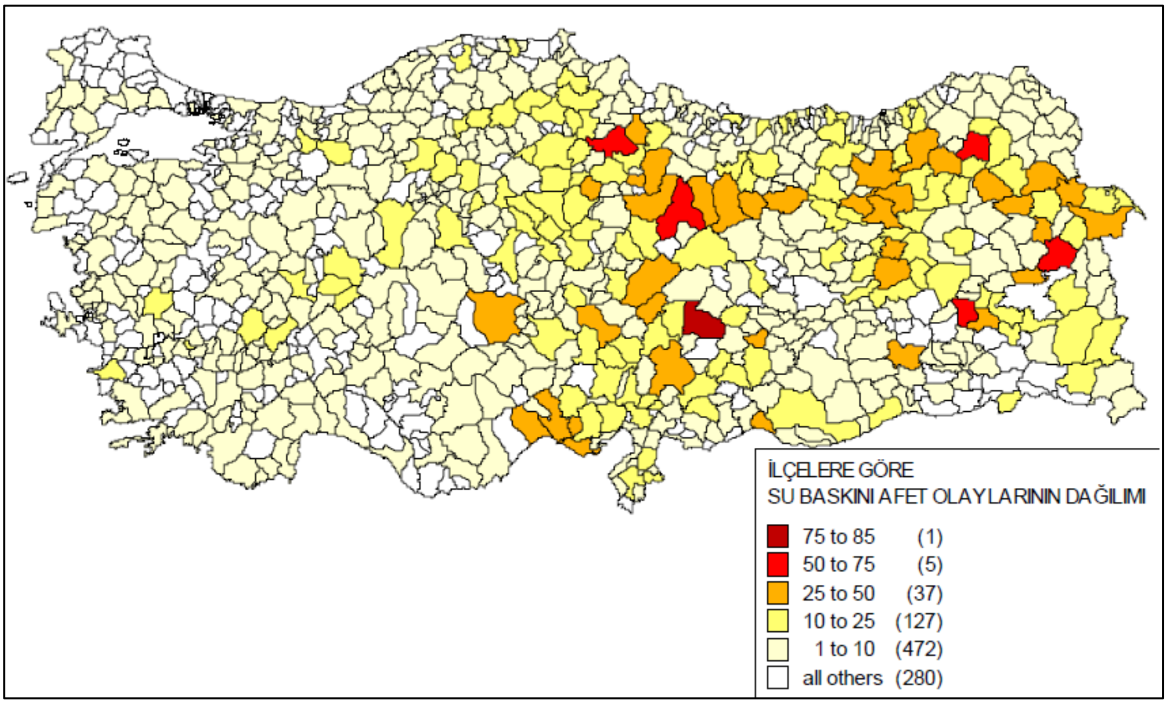


Figure 5.11. Distribution of Flood Events in Turkey by Districts (*Gokce et. al., 2008*)

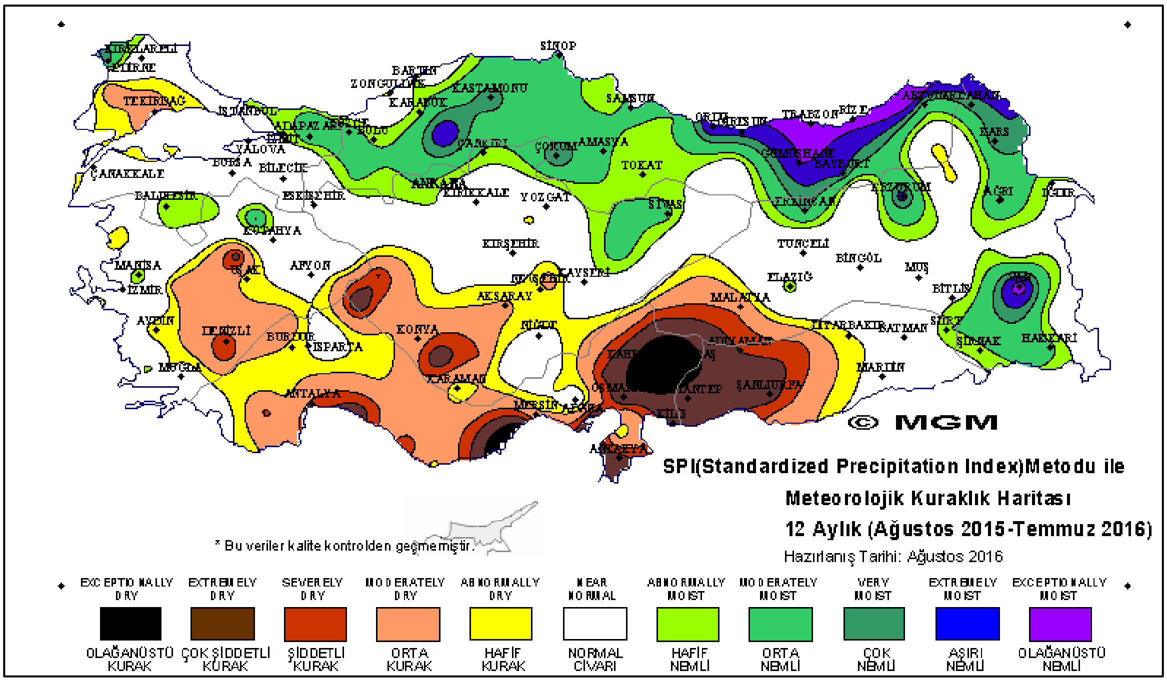


Figure 5.12. Turkey's 12 Month Drought Map (*official website of General Directorate of Meteorology*)

5.3. Soil Characteristics and Land Use

5.3.1. Topographical Conditions

The most important topographical feature in Konya Province is Konya Basin (*TUBITAK MAM, 2010*). Since Konya Basin is surrounded by mountains and ridges, surface waters cannot reach the sea, however several rivers enter the basin from south and west directions (*de Meester,* 1970). The central part of the basin, that was former lake, consists of a number of plains which are separated by ridges. Konya Plain, Hotamis Plain, Karapinar Plain, Eregli Plain, and Karaman Plain are the plains can be considered important (*de Meester, 1970*). Within these plains, Tuz Lake, which has high salinity content in the downstream section and Beysehir Lake which is a freshwater lake in the upstream section, are located (*Gokmen, 2013*).

The highest mountain formation in the province is Bolkar Mountains with 3,240 m height and other relatively high mountains are Sultan Mountains with height of 2,610 m, Geyik Mountain with height of 2,467 m and Loras Mountain with 2,050 m height. Therefore, the province is surrounded by the extensions of Taurus Mountains in the south and southwest *(Konya Provincial Directorate of Environmental and Urban Planning, 2011)*.

The slope in the Project Area ranges from minimum of 0% to a maximum of 40% and the average slope in the field is around 5%. The Project Area is located on a relatively flat surface and presents a slope in the west-east and northwest-southeast directions. A pit-valley type formation, which exists in rocky places towards the eastern border of the area, is observed.

5.3.2. Soil Characteristics and Land Use

Project Area is within the area planned as meadow-pasture within the scope of 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area which is approved by the MoEU on 16.09.2013 and amended on 16.07.2014. The Project Area is also located in the area that is planned as rural development area, meadow-grassland and pasture within the scope of 1/100,000 scaled Environment Plan of Konya Province approved by the decision of Konya Metropolitan Municipality Council dated 12.12.2014 and numbered 953. Similarly according to the Konya Province Land Assets data (1992) of former General Directorate of Rural Services (GDRS), Project Area is covered by pasture. Land use map of Project Area and its vicinity, prepared according to database of former GDRS, is presented in Figure 5.13.

According to previous title deed belonging to the area which the Project Area is located (parcel no 165/2), the mentioned area is pasture. Within the scope of the application for the establishment of the Apa GES facility at the Project Area where the pasture qualified immovable part located, the allocation purpose change of the area was accepted by the authorities of the Governorship as dated 26.10.2016 and numbered 11076-57921. Therefore, a new title deed has been arranged for the Project Area on behalf of State Treasury.

According to Konya Province Land Assets data of former GDRS, in the whole land that Project Area is located, reddish brown soils exist. Also, the entire Project Area is classified as Class VII. Map showing the soil properties and land classification of Project Area and its vicinity is given in Figure 5.14.

Characteristics of reddish brown soils together with brown soils (having similar soil properties with reddish brown soils) are as follows:

- Reddish brown soils: Apart from color, nearly all features of them are same or similar with brown soils. Therefore they are found in arid and semi-arid climates. Natural vegetation of them consists of weeds and shrubs. Their natural drainage is well. Biological activity and natural productivity in these kinds of soils are low.

- Brown soils: Such kinds of soils are found in arid and semi-arid climates. Natural vegetation of them consists of weeds and shrubs. Calcium is abundant in their profiles. They are rich in plant nutrients. Their natural drainage is well. Their color is brown as their name implies. Their organic matter content is mediocre. Below the subsoil lime accumulation layer, which is hardened mostly and below this layer it may be gypsum accumulation layer exist. These soils remain dry for long periods in summer. The temperature is low in winter and early spring when most of the rain falls. For this reason, chemical and biological activities in the soil are slow, except for short periods in the spring and autumn.

GDRS database defines the land use capabilities in 8 different classes. Class I-II-III-IV is defined as “lands suitable for agricultural soil cultivation”, Class V-VI-VII as “lands not suitable for soil cultivation” and Class VIII as “Non-arable lands”. According to this classification, the entire Project Area is classified as Class VII. Class VII lands have high slope, are stony and have been subject to violent erosion. Exposed soils, dry and/or some unfavorable conditions and swamps can be classified as Class VII soil. These can be used as forest or meadow without showing due care. If the vegetation on these soils diminishes, erosion can get quite violent.

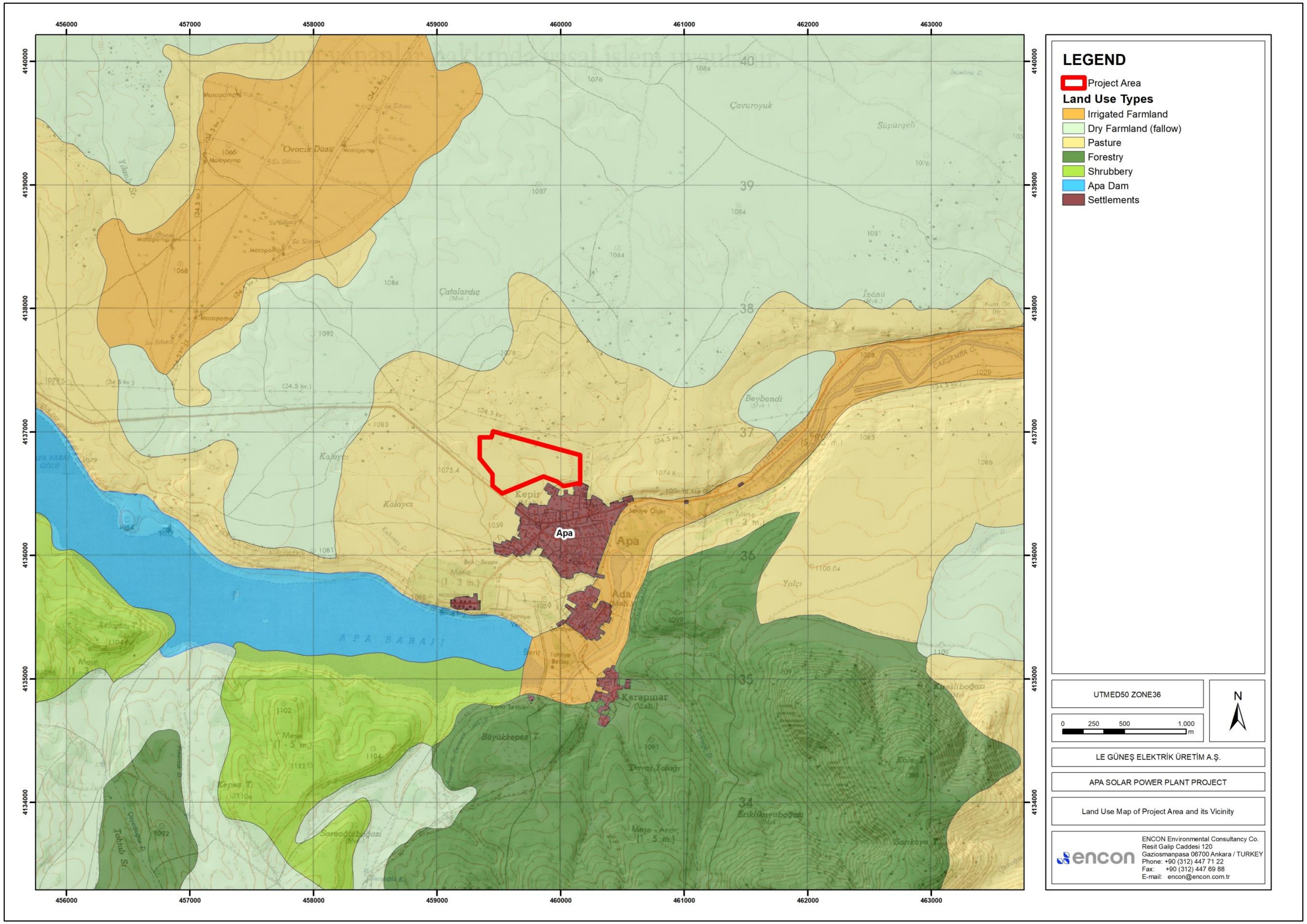


Figure 5.13. Land Use Map of Project Area and its Vicinity

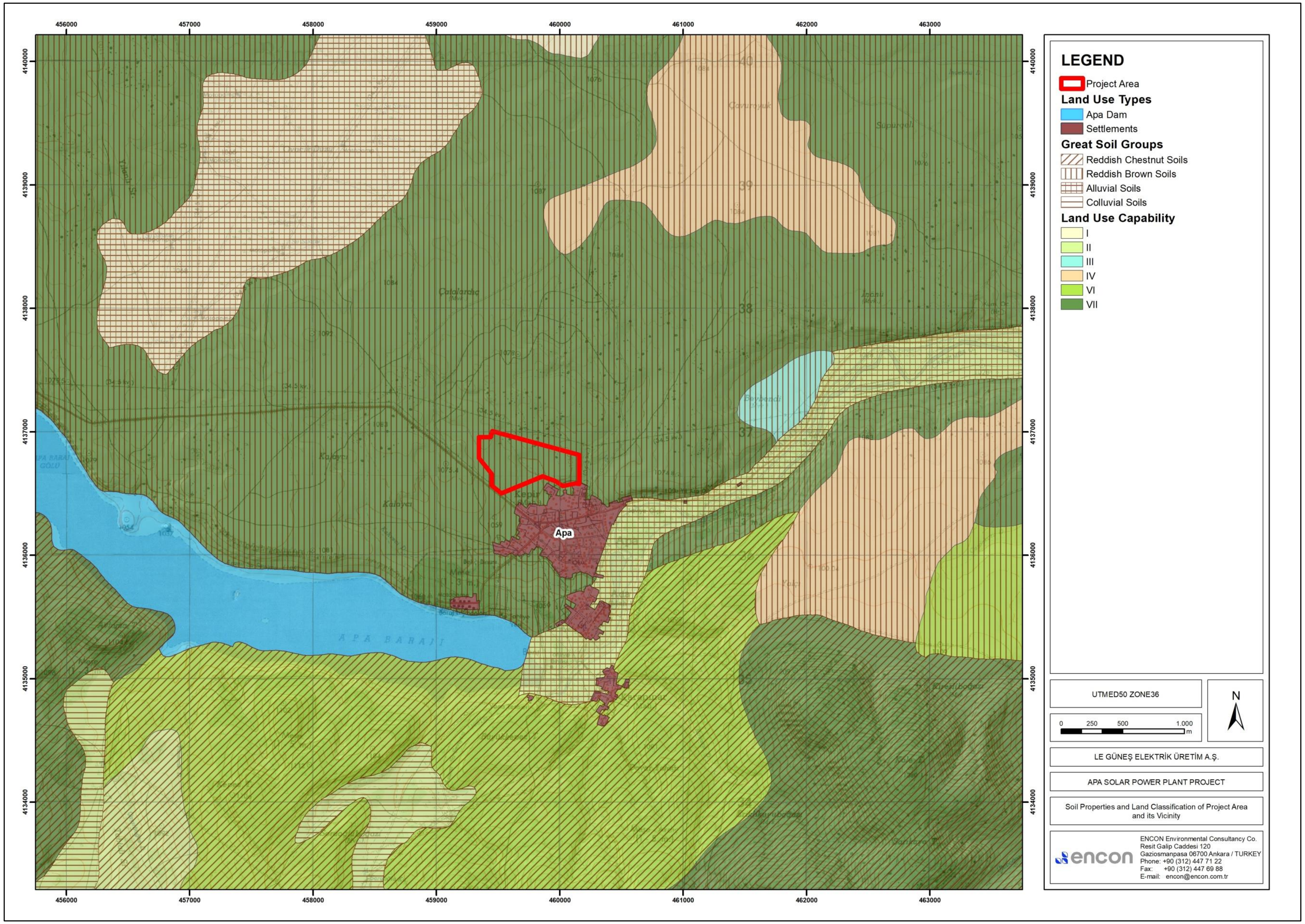


Figure 5.14. Soil Properties and Land Classification of Project Area and its Vicinity

In the Technical Procedure on Soil and Land Classification Standards (July 2008) of former General Directorate of Agricultural Production and Development, the land use suitability of different land use capability classes for cultivation, grazing, forestry and wild life activities are defined as in Table 5.1. As can be seen from the table, Class VII lands are suitable only for wild life, forestry and grazing activities to a limited extent.

Table 5.1. Usage Suitability Matrix for Different Land Use Capability Classes

Land Use Capability Class	Wild life	Forestry	Grazing			Cultivation			
			Limited	Moderate	Intensive	Limited	Moderate	Intensive	Very Intensive
I									
II									
III									
IV									
V									
VI									
VII									
VIII									

**Colored boxes show the suitable uses for each type of class.*
Source: Former General Directorate of Agricultural Production and Development, July 2008.

Soil erosion is described as the transportation of soil material resulting in extensive degradation. The process can either occur naturally within its own balance or be accelerated as a result of human activity. The rate of erosion is increased due to improper agricultural practices such as cultivation on relatively high slope lands, plowing of the fields in the direction of the slope and excessive grazing on pasturelands or deforestation. The agents of soil erosion are water and wind, where the former is more prominent. Water erosion takes place on lands with weak or no vegetative cover where runoff can flow with sufficient energy transporting loosened soil particles down the slope. Consequently, fertile top layer of the soil is lost from the agricultural lands resulting in reduced agricultural productivity and water quality of the surface water resources deteriorates as a result of sedimentation and eutrophication (*Former GDSR, July 2008*). According to former GDSR database, whole Project Area is located also on the lands that have very severe erosion levels (Erosion Level 4).

Soil Sampling and Analyses

On 23.03.2016, soil sampling activities has carried out at two points in the Project Area by ENCON Laboratory Inc. In these samples, antimony, arsenic, copper, barium, boron, mercury, zinc, cadmium, lead, molybdenum, selenium, total chromium, total petroleum hydrocarbons and TOX concentrations were measured. The coordinates of the sampling points are given in Table 5.2. A map showing the sampling points is given in Figure 5.15.

Table 5.2. Coordinates of Soil Sampling Stations

Station	Coordinates (UTM ED50, ZON35)	
	X	Y
T1	459154	4137135
T2	459560	4136667

The study was conducted in order to identify the baseline conditions in the Project Area before the Project was conducted. The measurement results are presented in Table 5.3 together with the measurement methods.

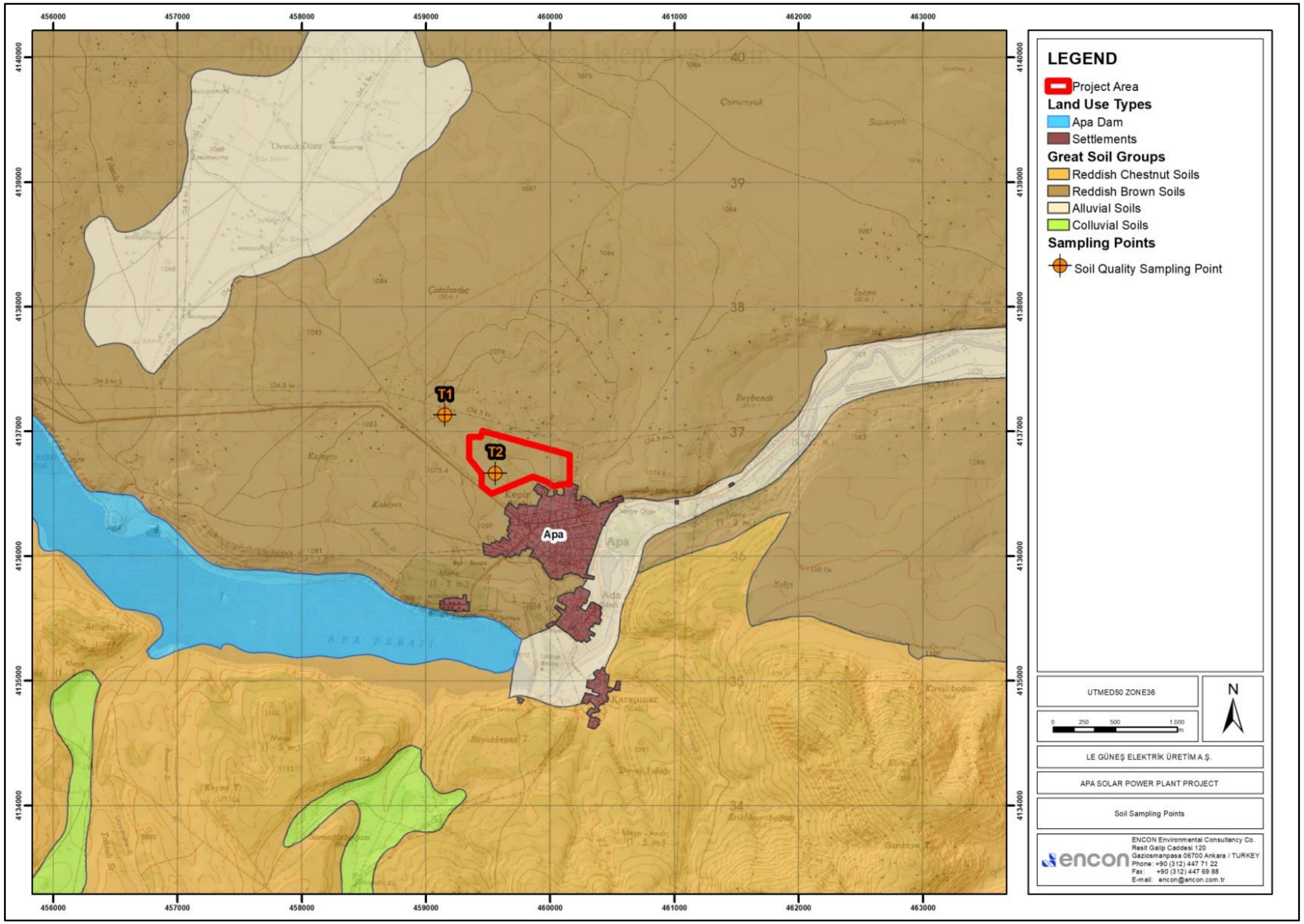


Figure 5.15. Soil Sampling Points

Table 5.3. Measurement Results of Soil Samples

Parameter	Unit	T1	T2	Method
Antimony	mg/kg	2.637	3.625	EPA 3051 A, EPA 200.7
Arsenic	mg/kg	30.77	24.18	EPA 3051 A, EPA 200.8
Barium	mg/kg	232.8	326.8	EPA 3051 A, EPA 200.10
Boron	mg/kg	33.43	45.44	EPA 3051 A, EPA 200.11
Cadmium	mg/kg	<0.5	<0.5	EPA 3051 A, EPA 200.14
Copper	mg/kg	14.69	23.27	EPA 3051 A, EPA 200.9
Lead	mg/kg	8.863	14.16	EPA 3051 A, EPA 200.15
Mercury	mg/kg	<0.2	<0.2	EPA 3051 A, EPA 200.12
Molybdenum	mg/kg	<0.5	0.507	EPA 3051 A, EPA 200.16
Selenium	mg/kg	0.237	0.223	EPA 3051 A, EPA 200.17
Total chromium	mg/kg	93.15	135.5	EPA 3051 A, EPA 200.18
Total Petroleum Hydrocarbons	mg/kg	54.26	58.91	TS EN 14039
TOX	mg/kg	<57.0	<57.0	DIN 38414 PART 18/KYTC 504-124/CEN PR EN 16166
Zinc	mg/kg	49.91	68.45	EPA 3051 A, EPA 200.13

In addition to the studies and evaluations described above, an additional study on determining land use capability, soil characteristics and land use pattern of the site for non-agricultural use has conducted by TAM-LAB Tarim Insaat Ltd. Sti. in 2016. Within the scope of the study, 1 control and 1 sampling borehole has drilled in the Project Area in order to determine the land use capability class. As a result of survey studies, great soil group in the Project Area was identified as brown soil and land use capability class defined as Class IV. However, abundant stony areas in the field increase the land use capability class of the area to Class VI. The depth of the soil is determined as 15 cm. This depth can be expressed as “very shallow”. Also, it has been determined that the amount of lime accumulation is high. The soil is classified as CL (silty, clayey) and it is crumbly when moist and it is slightly hard when it is dry. In the prepared report it is stated that pasture has various types pasture plants, and the density of them is very weak. Results of soil sampling are presented in Table 5.4.

Table 5.4. Results of Soil Analysis within the Scope of Land Use Capability Determination Study

Depth (cm)	Water Saturation (%)	Saturated Soil pH	EC (micromhos/cm)	Total Salinity (%)	Lime (%)
0-15	51.92	7.92	600	0.02	29.25
Soil Class	**Ca+Mg (me/l)**	**Na (me/l)**	**SAR**	**ESP (%)**	
CL	2.122	0.894	0.868	0.02	

Souce: TAM-LAB Mühendislik Tarim Insaat Ltd. Sti., 2016.

5.3.3. Forestlands

According to 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area approved by the MoEU, the closest forest area to the Project Area is the area that is located at the southeast of Apa Dam and about 1 km south of the Project Area. Therefore, there is no forestland exist within the Project Area and its vicinity. There are no tree species or forestlands to be affected due to the activities to be carried out within the scope of the Project. Forest Stand Map of the Project Area is presented in Figure 5.16. In this map, the Project Area is located at the region that is shown as agricultural area-treeless forest soil. Therefore, there will be no impact on the forestlands.

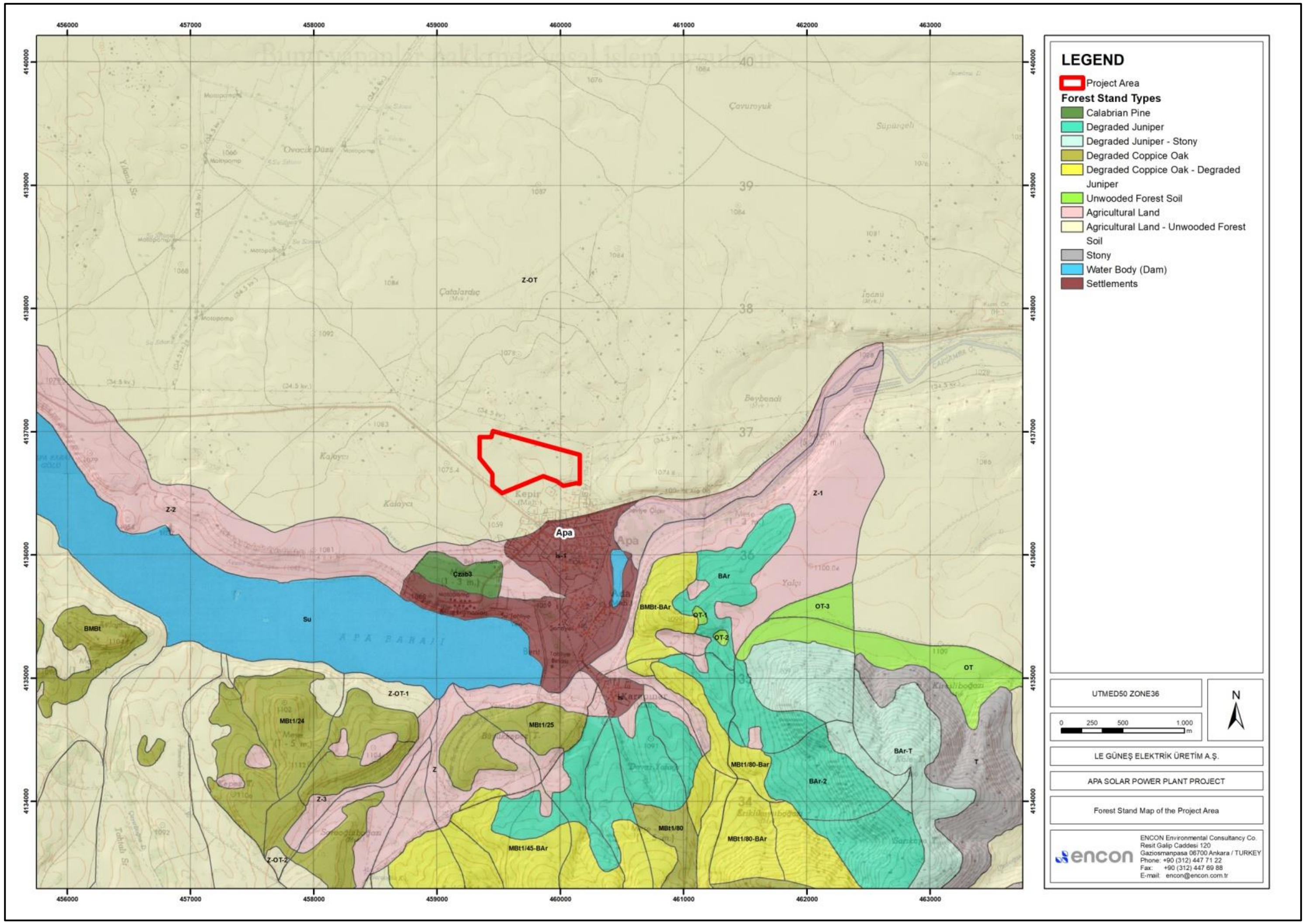


Figure 5.16. Forest Stand Map of the Project Area

5.3.4. Agricultural Lands

In terms of size of agricultural area, Konya Province rank first in the country, with a total of 19,239,667 decares of agricultural land. This amount corresponds to about 8% of the agricultural lands in Turkey. Data showing the distribution of agricultural lands in the context of cultivated crop groups in Konya Province by 2015 is presented in Table 5.5.

Table 5.5. Size of Agricultural Land in Konya Province and Their Distribution in the Total Area of the Province

Grains and Other Crops Area (decares)	Fallow Area (decares)	Vegetable Gardens Area (decares)	Fruit, Beverage and Spice Plants Area (decares)	Ornamental Plants Area (decares)	Total Area (decares)
13,015,127	5,603,015	207,665	412,918	942	19,239,667
67.60%	29.10%	1.10%	2.10%	0.005%	100%

Among the agricultural products produced in the province, grains and other crops are the mostly produced goods with 13,105,127 decares. Quantities of agricultural products produced in the province by groups are given in Table 5.6. As can be seen from the table, the production amount of grains and other crop products is 12,230,150 tones. In this product group, the plants used for sugar production are rank first with 4,570,731 tones of production and share of the same product within Turkey is 29%. Similarly, grains produced in the province accounts for 11% of the grain produced in Turkey with 4,119,865 tones.

Table 5.6. Quantities of Agricultural Products Produced in Konya Province

Product Group	Product Type	Amount Produced (tones)
Grains and Other Crops	Perfumery-Pharmacy etc., Plants-Sugar Beet etc.	8,701
	Potato-Legumes-Edible Roots and Tubers	600,962
	Hay and Grass	2,697,403
	Plants That is Being Used in Sugar Production	4,570,731
	Grains	4,119,865
	Oily Seeds	232,488
Subtotal		**12,230,150**
Vegetables	Root and Tuber Vegetables	350,899
	Vegetables Grown for their Fruits	410,790
	Other Vegetables (Not Classified)	23,649
Subtotal		**785,338**
Fruit, Beverage and Spice Plants	Grape	51,104
	Other Fruits-Stone Fruits-Pome Fruits	183,990
	Olives and Achenes	4,001
	Spice Plants(raw)	6,780
Subtotal		**245,875**
Total		**13,261,363**

Other than grains and other crops, production of vegetables and fruits, beverage and spice plants are also carried out in the province. The production amount of vegetables produced in 2015 is 785,338 tones while the production amount of fruit, beverage and spice plants is 245,875 tones.

5.4. Potential Impacts

Direct impacts on topography, soil and land use risks will be a concern mainly during the construction phase of the Project since the operation activities will not include direct and/or extensive physical interaction with the environmental components. Assessment of the impacts for the land preparation and construction and operation phases, in consideration of the baseline conditions is provided in the following headings.

5.4.1. Land Preparation and Construction Phase

Land preparation works to be performed before the construction phase will involve mainly; vegetation clearing, topsoil stripping with an average depth of 15 cm in an area about 10 hectares by using suitable instruments, and temporary storage of stripped topsoil on an 6,000 m^2 area located at the east part of the Project Area that will provide a storage capacity of 15,000 m^3.

Following vegetation clearing, levelling works will begin on site. There will not be major excavation and filling works due to the properties of the site and requirements of the Project. Therefore, excavation wastes will not be generated at site. Subsoil will be extracted in addition to topsoil (having a depth of 15 cm) only for the cable channels/ducts that will have 40 cm bottom width, 60 cm top width and 80 cm depth. Subsoil will be temporary stored along the cable channel and will be reused for filling of the channel.

The stack height at the temporary storage area for stripped topsoil will not be higher than 2.5 m and side slope will not be more than 45^0. The drainage of the area will be provided by open channels and barriers at appropriate height will be formed, if necessary.

Within the scope of described activities, potential impacts and possible risks on the soil environment in the case that necessary measures will not be taken during land preparation and construction phase of the Project are summarized below:

- The loss of organic matter content and productivity of soil as a result of improper topsoil stripping from the Project Area and improper temporary storage of the topsoil;
- Soil compaction as a result of soil stripping, levelling, excavation and filling activities, work of construction machinery and increase in pedestrian traffic;
- Mixing of soil layers as a result of excavation and filling activities;
- Soil transport/loss due to the effect of wind and surface flow resulting from precipitation in open areas as a result of vegetation clearance;
- Soil contamination as a result of oil or fuel leaks or spillage that may result from accidents or unexpected events from construction machinery;
- Soil pollution which may occur in case of uncontrolled storage or disposal of solid and/or liquid wastes to be generated within the scope of the Project.

Excavation works that will be carried out after topsoil stripping activities within the scope of APA GES Project will be realized in a limited area and with a limited depth due to the nature and scale of the activity and site conditions. Additionally, limited amount of staff and construction machinery will be used for the works on site within the scope of land preparation and construction activities compared to large-scale energy projects. Significant erosion or sedimentation impact is also not foreseen in the Project Area due to the mitigation measures to be taken during stripping and excavation activities and rehabilitation applications thereafter. As the impacts on soil environment within the scope of the Project will occur only in the Project Area, the magnitude of impact is evaluated as “restricted”.

As described in the previous sections, the Project Area is completely covered by reddish brown soils and the entire Project Area is classified as Class VII, which indicates that the entire area is not suitable for agricultural soil cultivation and has a limited suitability in terms of grazing. These lands have very severe erosion levels (Erosion Level 4) and covered with reddish brown soils that are medium-rich in terms of organic matter content.

Significance of impacts determined in the light of assessments made, considering the magnitude of impact limited to the Project Area and the severity of impacts (value of source) identified for different impact issues in line with the specified properties of soil source, are summarized in Table 5.7. As the soils on site do not have a high value in terms of agricultural suitability, grazing suitability and organic matter content, the Project Area is accepted to have “low” or “medium” sensitivity for these issues and this lead the assessment of impact significance regarding to loss of soil for agricultural and grazing purposes to be “low”. On the other hand, as the area has a severe erosion level, the site is accepted to have “high” sensitivity (severity) and this lead the assessment of impact significance for this issue to be “medium”.

Table 5.7. Assessment of Impacts on Soil Environment

Impact Issue	Magnitude of Impact	Severity of Impact			Significance of Impact
		High (3)	Medium (2)	Low (1)	
Agricultural Suitability	Restricted (C)	Land Use Capability Class I-II-III-IV (lands suitable for agricultural soil cultivation)	Land Use Capability Class V-VI-VII (lands not suitable for agricultural soil cultivation)	Land Use Capability Class VIII (non-arable lands)	Low (C2)
Grazing Suitability	Restricted (C)	Land Use Capability Class I- V	Land Use Capability Class VI	Land Use Capability Class VII- VII	Low (C1)
Erosion Potential	Restricted (C)	Erosion Level 3-4	Erosion Level 2	Erosion Level 1	Medium (C3)
Topsoil Loss	Restricted (C)	Rich soils in terms of organic matter content	Medium-rich soils in terms of organic matter content (reddish brown soils belongs to this group)	Poor soils in terms of organic matter content	Low (C2)

5.4.2. Operation Phase

In operation phase, the activities will not involve any additional physical interaction with the environment, thus no additional significant direct impact on soil environment is anticipated under normal operating conditions.

5.4.3. Closure Phase

After the Project completed its operational life time, if there is no planning for use of the site for similar purposes (energy production, other industrial activities), the site will be returned to the state of the pre-project land use (pasture), with necessary restoration/rehabilitation works by Project Owner. Pasture Land Rehabilitation Project prepared for the Project Area has already been approved by the Provincial Directorate of Food, Agriculture and Livestock on 24.11.2016. Therefore, the use of the Project Area other than pasture purpose will be long term but be temporary and reversible and the significance of this impact is assessed to be “low”.

5.5. Mitigation Measures

5.5.1. Land Preparation and Construction Phase

As the Project Area has a severe erosion level, if vegetation clearing activities on site are performed without necessary mitigation measures, the significance of soil loss impact due to erosion would be assessed as “medium”. Although the significance of other impacts on soil environment are low, it is expected that the significance of residual impacts of the Project on soil environment during land preparation and construction phase will also be “low” by the effective implementation of the mitigation measures described below.

- In order to avoid permanent impacts of construction activities on topsoil, before construction works started, productive topsoil layer will be stripped to the appropriate depth.
- Topsoil stripped from the Project Area will be temporarily stored in the Topsoil Storage Area, located at the east of the Project Area, in piles not exceeding 2.5 meters in height, separated from other materials (e.g. subsoil, construction materials, etc.).
- No compaction and reduction in organic matter content of soil is expected since the temporary storage period for topsoil will be limited. Irrigation will be applied on stored topsoil in case of high weather temperatures and no seasonal rainfall during storage period.
- Following the completion of construction and installation works, topsoil will be reused at the area where the panels will be installed and at the other areas within the facility reserved for landscaping in order to provide restoration of these areas.
- Cable channels will be closed simultaneously following cable laying into the excavated channels. Within this scope, the channels will first be filled with subsoil and then covered with topsoil to restore the soil environment. Long-term storage of subsoil will not be the issue.
- The relevant provisions of the Regulation on the Control of Excavation Soil, Construction and Demolition Wastes will be complied with during stripping, storage and reuse of topsoil.
- In order to minimize the impacts on soil environment, the amount of soil that could be subject to compaction and contamination/pollution will be minimized by ensuring the use of only the designated work sites and routes for the construction machinery and equipment and field personnel.
- By establishing a suitable drainage system in the field, the potential impact on soil environment and surrounding water resources will be minimized. In this context, drainage channels will be constructed in accordance with the topographical conditions of the site.
- Wastes and wastewater to be generated during the land preparation and construction phases of the Project will be stored and disposed in a controlled manner in accordance with the relevant regulations and in line with the

management practices described in this report. Thus, it will not be possible for the wastes and wastewater to be generated in the Project Area interact with the soil environment and cause any impacts.

- The fuel required for the construction equipment and vehicles to be used within the site during construction phase will be supplied primarily from the nearest station; if deemed necessary, fuels that may possibly be stored at site will be stored in the areas where necessary impermeability precautions are taken. Measures to be taken in case of leaks and spills that may arise from work machinery and vehicles due to fuel storage and unexpected accidents will be described in site-specific Emergency Response Plan to be prepared by considering the framework plan given in this report.

- Provisions of the Regulation on the Control of Soil Pollution and Sites Contaminated by Point Sources will be complied within the scope of the Project.

5.5.2. Closure Phase

Measures to be taken for the protection of soil environment during closure phase are given below:

- After the Project completed its operational life time, if there is no planning for use of the site for similar purposes (energy production, other industrial activities), the site will be returned to the state of the pre-project land use (pasture), with necessary restoration/rehabilitation works by Project Owner.

- As a result of using a pressure pile driving machine for the installation of panel legs, the impacts on soil environment during the removal of these legs will be minimized.

- The cables installed in the soil will be left in channels if it is suitable for the land use purposes after the closure. Thus, there will not be any excavation-filling works in this context.

5.6. Summary of Assessment and Residual Impacts

Table 5.8 provides a summary of impact assessments made on soil environment. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 5.8. Summary of Impact Assessments on Soil Environment

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Soil Environment	Land preparation and construction	Agricultural suitability, grazing suitability, topsoil loss	Adverse	Low	• In order to avoid permanent impacts of construction activities on topsoil, before construction works started, productive topsoil layer will be stripped to the appropriate depth. • Topsoil stripped from the Project Area will be temporarily stored in the Topsoil Storage Area, located at the east of the Project Area, in piles not exceeding 2.5 meters in height, separated from other materials (e.g. subsoil, construction materials, etc.). • Irrigation will be applied on stored topsoil in case of high weather temperatures and no seasonal rainfall during topsoil storage period. • Cable channels will be closed simultaneously following cable laying into the excavated channels. Within this scope, the channels will first be filled with subsoil and then covered with topsoil to restore the soil environment. • In order to minimize the impacts on soil environment, the amount of soil that could be subject to compaction and contamination/pollution will be minimized by ensuring the use of only the designated work sites and routes for the construction machinery and equipment and field personnel. • The fuel required for the construction equipment and vehicles to be used within the site during construction phase will be supplied primarily from the nearest station; if deemed necessary, fuels that may possibly be stored at site will be stored in the areas where necessary impermeability precautions are taken. • The relevant provisions of the Regulation on the Control of Excavation Soil, Construction and Demolition Wastes will be complied with during stripping, storage and reuse of topsoil. • Provisions of the Regulation on the Control of Soil Pollution and Sites Contaminated by Point Sources will be complied within the scope of the Project. • Wastes and wastewater to be generated during the land preparation and construction phases of the Project will be stored and disposed in a controlled manner in accordance with the relevant regulations and in line with the management practices described in this report. Thus, it will not be possible for the wastes and wastewater to be generated in the Project Area interact with the soil environment and cause any impacts.	Low

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Soil Environment	Land preparation and construction	Erosion potential	Adverse	Medium	• By establishing a suitable drainage system in the field, the potential impact on soil environment and surrounding water resources will be minimized. In this context, drainage channels will be constructed in accordance with the topographical conditions of the site. • Following the completion of construction and installation works, topsoil will be reused at the area where the panels will be installed and at the other areas within the facility reserved for landscaping in order to provide restoration of these areas.	Low
	Closure	Land use change	Adverse	Low	• After the Project completed its operational life time, if there is no planning for use of the site for similar purposes (energy production, other industrial activities), the site will be returned to the state of the pre-project land use (pasture), with necessary restoration/rehabilitation works by Project Owner. • As a result of using a pressure pile driving machine for the installation of panel legs, the impacts on soil environment during the removal of these legs will be minimized. • The cables installed in the soil will be left in channels if it is suitable for the land use purposes after the closure. Thus, there will not be any excavation-filling works in this context.	Low

CHAPTER 6

AIR QUALITY, METEOROLOGICAL CONDITIONS AND CLIMATE CHANGE

6. AIR QUALITY, METEOROLOGICAL CONDITIONS AND CLIMATE CHANGE

In this section, the potential impacts of the Project on air quality and climate of the region is assessed. Within this scope, mainly the construction phase of the Project is taken into consideration due to nature of the Project and impacts are evaluated accordingly. This chapter includes the following:

- Baseline air quality,
- Assessment and quantification of potential emissions,
- Assessment of potential impacts on air quality,
- Mitigation measures regarding air quality,
- Residual impacts on air quality,
- Meteorological and climatic conditions of the Project Area, and
- Assessment of potential impacts regarding climate change.

6.1. Air Quality

Air pollution can be defined as pollutants emitted from various sources reaching the level that affects human health and the environment negatively. Main sources that result in air pollution are anthropogenic sources such as traffic (motor vehicles), industrial activities, domestic heating and natural sources. In addition, topographical and meteorological conditions play significant role in air quality and pollution.

There will not be any air emissions during the operation of the Project as there is not any stack or a project unit that could be a source for air emissions (e.g. PM_{10}, CO_2, NO_x, SO_x). Therefore, air emissions are not a concern during the operation phase of the Project. However, during construction of the Project PM_{10} is expected to be emitted as a result of earthworks, land preparation and construction of project components. Particles can vary according to size and composition. PM_{10} (particulate matter with aerodynamic diameter smaller than 10 μm) standard is set to define the particles that people are likely to inhale and PM_{10} has become the general measure of particulate matter. In this sense, generally limit values are defined for PM_{10}. Other potential pollutants are expected to arise from operation of construction machinery and equipment during construction.

6.1.1. Baseline Conditions

Turkish Legal Requirements

Ambient air quality is regulated in Turkey by the Regulation on Assessment and Management of Air Quality. Appendices I and I-A of this regulation provide limit values for the 2009-2014 period and for the period after 1 January 2014. Both are based on a tiered system to reduce limit values to target values over time.

Air quality standards are defined in the Regulation on Assessment and Management of Air Quality published on 06.06.2008 in Official Gazette No 26898 and Industrial Air Pollution Control Regulation (IAPCR) published on 03.07.2009 in Official Gazette No 27277. Ambient air quality limit values for various pollutants defined in Turkish regulations are presented in Table 6.1. The standards in Table 6.1 are for 2024 and further years.

Table 6.1. Ambient Air Quality Limit Values – Turkish Regulations

Parameter	Duration	Limit Value* ($\mu g/m^3$)
SO_2	Hourly (cannot be exceeded more than 24 times a year)	350
	24 hour	125
	Long term limit	60
	Annual and winter season (October 1 - March 31)	20
NO_2	Hourly (cannot be exceeded more than 18 times a year)	200
	Annual	40
Particulate Matter (PM_{10})	24 hour (cannot be exceeded more than 35 times a year)	50
	Annual	40
CO	8 hour daily maximum	10,000
O_3	8 hour daily maximum	120
VOC**	Hourly	280
	24-hour	70

** Regulation on Assessment and Management of Air Quality*
*** Industrial Air Pollution Control Regulation*

IFC Standards

The IFC General EHS Guidelines – Environmental Air Emissions and Ambient Air Quality refer to the World Health Organization (WHO) Ambient Air Quality Guidelines for recommended values. These limit values are presented in Table 6.2.

Table 6.2. Ambient Air Quality Limit Values – IFC Standards

Parameter	Duration	($\mu g/m^3$)*
SO_2	10 minute	500
	24 hour	20
NO_2	Hourly	200
	Annual	40
Particulate Matter (PM_{10})	24 hour	50
	Annual	20
Particulate Matter ($PM_{2,5}$)	24 hour	25
	Annual	10
O_3	8 hour daily maximum	100

**Environmental, Health and Safety Guidelines, General EHS Guidelines: Environmental, Air Emissions and Ambient Air Quality*

Air Quality Measurements

Intense urbanization, increase in the number of motor vehicles, industrial plants and consumption of low quality fuel result in air pollution throughout the city especially in winter season. There are 9 organized industry zones and 2 technology development zones in Konya Province which has a population of about 2 million.

In order to determine baseline air quality in Konya Province, regular measurements are carried out. These stations work under automatic data recording system and the records are transferred to national air quality monitoring network of Turkish Ministry of Environment and Urban Planning. Air quality measurement results carried out within this scope in two stations in Konya Province (Meram and Selcuklu stations) and comparison of these results with regulatory limit values are presented in Table 6.3.

In addition, result of PM_{10} measurement carried out within the scope of APA GES Project at the nearest house to the Project Area in Apa neighborhood in order to obtain baseline condition is given in Table 6.4.

Table 6.3. Results of Air Quality Measurements in Various Districts of Konya

Parameter	2012	2013	2014	2015	2016
Meram Station					
PM_{10} Average (µg/m^3)	73	63	61	58	60
PM_{10} (24 hour) (µg/m^3)	140	100	100	90	80
PM_{10} (annual) (µg/m^3)	78	60	60	56	52
SO_2 Average (µg/m^3)	21	12	14	10	7
SO_2 (24 hour) (µg/m^3)	280	250	250	225	200
SO_2 (UVS) (µg/m^3)	150	150	60	60	60
Selcuklu Station					
PM_{10} Average (µg/m^3)	56	50	50	51	49
PM_{10} (24 hour) (µg/m^3)	140	100	100	90	80
PM_{10} (annual) (µg/m^3)	78	60	60	56	52
SO_2 Average (µg/m^3)	19	8	7	6	7
SO_2 (24 hour) (µg/m^3)	280	250	250	225	200
SO_2 (UVS) (µg/m^3)	150	150	60	60	60

Source: Republic of Turkey, Ministry of Environment and Urbanization, http://www.havaizleme.gov.tr/. 2017

Table 6.4. PM_{10} Measurement Result (at the nearest house to the Project Area in Apa Neighborhood)

Coordinates of the measurement	Empty weight of filter (g)	Filled weight of filter (g)	Amount of air passing through (m^3)	PM_{10} Result (µg/m3)
459684-4136412	0.1326	0.1330	28.78	13.9

**UTMED50 ZON36*

As can be seen from Table 6.4, the result of the measurement carried out is well below the 24 hours (80 µg/m^3) and annual (52 µg/m^3) limits values set for the year 2016 according to Table 6.2 (Ambient Air Quality Limit Values in the Facility Impact Area) of IAPCR, as expected. A photograph taken while the measurement is being performed is presented in Figure 6.1.

Figure 6.1. PM_{10} Measurement Study

6.1.2. Potential Impacts

Land preparation and construction activities within the scope of the Project will include mainly; vegetation clearing, topsoil stripping, leveling, establishment of camp site, transportation and storage of construction equipment and materials, construction of site/inner roads and drainage channels, provision of water/wastewater infrastructure, construction of the project components such as administrative building, central inverter station, transformer station, distribution center and security cabins, preparation/construction of cables channels, preparation of panel support system and installation of panels. Emissions within this scope will be:

- Dust emissions as a result of land preparation and construction activities, and
- Exhaust emissions from construction machinery and equipment.

Dust Emissions

Main activities that might cause dust emissions during land preparation and construction phase will include vegetation clearing, top soil stripping, leveling activities and vehicle traffic. Any crushing, screening, grinding, etc. activities will not be performed at site. In addition to this, a limited dust emission is expected during land preparation and construction phase due to the fact that; the area to be excavated-filled after the stripping will be limited to cable channels, structures will be prefabricated and/or container type, and major excavation and filling works (deep excavation and quality filling works) will not be needed. Moreover, significant impact due to exhaust emissions from machinery and equipment is not expected, as limited amount of machinery and equipment will be used within the scope of works.

The emission factors defined in Annex-12 of IAPCR and taken into account during the calculation of dust emissions to be occurred are given in Table 6.5. The term “uncontrolled” defines that the activities are carried out without any precautions (mitigation measures), “controlled” one defines the activities that are carried out with mitigation measures such as watering on site, keeping the material humid, execution of the activities without sweeping, etc. The relevant factors were used to calculate the dust emissions within the scope of the project.

Table 6.5. Emission Factors Used in Mass Flow Calculation for Dust Emission

Sources	Unit	Emission Factors	
		Controlled	Uncontrolled
Explosion	kg/ton	0.080	-
Dismantling	kg/ton	0.025	0.0125
Loading	kg/ton	0.010	0.005
Unloading	kg/ton	0.010	0.005
Primary crasher	kg/ton	0.243	0.0243
Secondary crasher	kg/ton	0.585	0.0585
Tertiary crasher	kg/ton	0.585	0.0585
Transport (total round trip distance)	kg/km-vehicle	0.7	0.35
Storage	kg dust/ha.day	5.8	2.9

Source: IAPCR, Annex-12.

As previously mentioned, top soil stripping will be performed on required area at site and sub-soil excavation will be performed along the cable channels before the construction works. Accordingly, the amount of material to be stripped during top soil stripping will be

15,000 m^3 and the total amount of material to be excavated during the excavation of cable channels will be 1,600 m^3 (for a section of 40 cm bottom and 60 cm top widths and a depth of 80 cm along a 4 km cable line). Hence, the total amount of material to be excavated has been calculated as 16,600 m^3. The total, daily and hourly excavation quantities to be formed during land preparation and construction activities are calculated as in Table 6.6 when the stripping and channel excavation activities are considered to be completed within 90 days in a progressive manner.

Table 6.6. Total, Daily and Hourly Stripping/Excavation Quantities

Source Activity for Emission	Amount of Soil Stripped/Excavated			
	Total (m^3)	Total (ton)*	Average per day (ton/day)	Average per hour (ton/hour)
Top soil stripping in the footprint areas of solar panels, switchyard, control building, administrative building, inner access roads, drainage channels to be constructed (if needed), and cable channels	15,000	24,000	266.67	11.11
Cable channel excavation and filling	1,600	2,560	28.44	1.19
Total	16,600	26,560	295.11	12.30

**Density of the soil is taken as 1.6 ton/m.^{3}*

Calculations related to uncontrolled and controlled dust emissions that will occur during dismantling, loading, transfer and disposal of topsoil, and excavation and backfilling of cable channels are detailed below and the results are summarized in Table 6.7. When the activities are considered as uncontrolled (without any mitigation measures), the expected dust emission value is calculated as 0.85 kg/h. Since the cable channels will be backfilled simultaneously after the cables are laid down into the excavated channels, no long-term soil storage will be carried out and there will be no storage-related emissions.

Uncontrolled Dust Emission

Top Soil

Amount of top soil: 11.11 ton/hour

Dismantling: 11.11 ton/hour * 0.025 kg/ton = 0.28 kg/hour

Loading: 11.11 ton/hour * 0.010 kg/ton = 0.11 kg/hour

Transport (11 trucks will be needed when total material is thought to be transported by 25 ton trucks, the average distance to the top soil storage area is accepted as 0.5 km):

0.7 kg/km-trucks * 11 trucks/day * 0.5 km / 24 h = 0.16 kg/hour

Unloading: 11.11 ton/hour * 0.01 kg/ton = 0.11 kg/hour

Storage: 0.6 ha * 5.8 kg dust/ha.day * 1day /24 hour = 0.15 kg/hour

Cable Channel Excavation

Dismantling: 1.19 kg/hour * 0.025 kg/ton = 0.03 kg/hour

Loading: 1.19 ton/hour * 0.010 kg/ton = 0.01 kg/hour

Unloading: 1.19 ton/hour * 0.010 kg/ton = 0.01 kg/hour

Total uncontrolled dust emission has been calculated as 0.85 kg/hour.

<u>Controlled Dust Emission</u>

Top Soil

Amount of top soil: 11.11 ton/hour

Dismantling: 11.11 ton /hour * 0.0125 kg/ton = 0.14 kg/hour

Loading: 11.11 ton/hour * 0.005 kg/ton = 0.05 kg/hour

Transportation (11 trucks will be needed when total material is thought to be transported by 25 ton trucks, the average distance to the top soil storage area is accepted as 0.5 km):

0.35 kg/km-trucks * 11 trucks/day * 0.5 km / 24 hour= 0.08 kg/hour

Unloading: 11.11 ton/hour * 0.005 kg/ton = 0.06 kg/hour

Storage: 0.6 ha * 2.9 kg dust/ha.day * 1day /24 hour = 0.07 kg/hour

Cable Channel Excavation

Dismantling: 1.19 kg/hour * 0.0125 kg/ton = 0.01 kg/hour

Loading: 1.19 ton/hour * 0.005 kg/ton = 0.01 kg/hour

Unloading: 1.19 ton/hour * 0.005 kg/ton = 0.01 kg/hour

Total controlled dust emission has been calculated as 0.43 kg/hour.

Table 6.7. Estimated Total Dust Emission Mass Flows

Sources	Amount of Emission (kg/hour)	
	Uncontrolled	Controlled
Top Soil Dismantling-Loading	0.39	0.19
Top Soil Transport	0.16	0.08
Top Soil Unloading	0.11	0.06
Top Soil Storage	0.15	0.07
Cable Channel Dismantling-Loading	0.04	0.02
Cable Channel Unloading	0.01	0.01
Total	**0.85**	**0.43**

Since the uncontrolled emission value is below the threshold value of 1 kg/hour presented in IAPCR Annex 2 that requires the calculation of the contribution to the air pollution, there was no need to make a modeling study.

The total emissions will be even lower (0.43 kg/hour) when the activities are carried out in a controlled manner by taking necessary dust suppression measures. For this reason, no impact is expected outside the Project Area and the magnitude of impact is evaluated as "restricted". The existing quality of the receiving air environment has been taken into consideration in determining the severity of the impact. According to the PM_{10} measurement carried out at the nearest house to the Project Area in Apa neighborhood, the existing PM_{10} concentration (13.9 µg/m^3) is well below the limit values of IAPCR for the year 2016 (80 µg/m^3 for 24 hours and 52 µg/m^3 for annual) and meets also the limit values set for the year 2024 (50 µg/m^3 for 24 hours and 40 µg/m^3 for annual). For this reason, the air quality of the receiving environment is good and the level of severity is identified as "low" accordingly. Therefore, the significance of foreseen impact due to dust emissions on air environment is assessed as "low" (see Table 6.8).

Table 6.8. Assessment of Dust Emission Impact on Air Environment

Impact Issue	Magnitude of Impact	Receptor/Source				Significance of Impact
		Relevant Ecosystem Component	Severity of Impact			
			High (3)	Medium (2)	Low (1)	
Dust Emissions	Restricted (C)	Air Environment	Environment where the existing air quality is bad (if the existing pollutant concentration exceeds the limit values of IAPCR for the year 2016)	Environment where the existing air quality is medium (if the existing pollutant concentration meets the limit values of IAPCR for the year 2016)	Environment where the existing air quality is good (if the existing pollutant concentration meets the limit values of IAPCR for beyond 2016)	Low (C1)

Exhaust Emission

In the scope of the Project, fuel will be used for the machinery and equipment to be used during land preparation and construction phase. The number and type of machinery and equipment to be used in this phase is given in Chapter 3 (Project Description). Diesel fuel is the type that will be used for these vehicles. Since this is the case, limited amount of NO_x, CO, SO_2, HC and PM emissions are expected to be generated during land preparation and construction phase.

IAPCR aims to control the soot, dust, gas, smoke, steam and aerosol emissions, to protect occupational and community health and environment from the impacts of these emissions and mitigate the possible negative impacts. In the regulation, limit values are given for emissions which arise from the places other than the chimney and from the chimney which require calculation of contribution values to the air pollution in case of being exceeded. The limit values have been demonstrated Table 6.9.

The calculated values for the exhaust emissions that are expected to be generated from the machinery and equipment to be used in the construction activities are presented in Table 6.10. It has been determined that the limit values given in the Regulation are not exceeded when these emission values are compared with the mass flow values specified in Table 6.9. Since this is the case, there is no need to carry out a modeling study to evaluate the exhaust emissions.

Table 6.9. Emission Values from Chimney and Places other than the Chimney

Parameters	Mass Flow (kg/hour)	
	From Chimney	From Places other than the Chimney
Carbon Monoxide	500	50
Nitrogen Dioxide (NO_x)	40	4
Sulphur Dioxide (SO_2)	60	6
Hydrogen Chloride and Inorganic Chloride Compounds in Gas State	20	2
Dust	10	1

Table 6.10. Expected Amounts of Exhaust Emissions from Equipment (kg/h)

NO_X	CO	SO_2	HC	PM
0.171	0.285	0.029	0.055	0.015

According to the calculations made, exhaust emissions are quite below the IAPCR limit values for all parameters. For this reason, no impact originating from the exhaust emissions is expected outside of the Project Area, and the magnitude of the impact is defined as "restricted". The existing quality of the receiving air environment has been taken into consideration in determining the severity of the impact. According to the PM_{10} measurement carried out at the nearest house to the Project Area in Apa neighborhood, the existing PM_{10} concentration (13.9 µg/m^3) is well below the limit values of IAPCR for the year 2016 (80 µg/m^3 for 24 hours and 52 µg/m^3 for annual) and meets also the limit values set for the year 2024 (50 µg/m ^{3} for 24 hours and 40 µg/m^3 for annual). For this reason, the air quality of the receiving environment is good and the level of severity is identified as "low" accordingly. Therefore, the significance of foreseen impact due to exhaust emissions on air environment is assessed as "low" (see Table 6.11).

Table 6.11. Assessment of Exhaust Emissions Impact on Air Environment

Impact Issue	Magnitude of Impact	Receptor/Source				Significance of Impact
		Relevant Ecosystem Component	Severity of Impact			
			High (3)	Medium (2)	Low (1)	
Exhaust Emissions	Restricted (C)	Air Environment	Environment where the existing air quality is bad (if the existing pollutant concentration exceeds the limit values of IAPCR for the year 2016)	Environment where the existing air quality is medium (if the existing pollutant concentration meets the limit values of IAPCR for the year 2016)	Environment where the existing air quality is good (if the existing pollutant concentration meets the limit values of IAPCR for beyond 2016)	Low (C1)

6.1.3. Mitigation Measures

Mitigation measures to protect the air quality during the land preparation and construction phase of the Project will include; erosion measures to be applied in areas where vegetation clearing has been done, dust suppression methods, covering inner roads with materials to prevent dust, and regular control of the exhaust systems of the vehicles.

Moreover, the dust-generating activities will be performed gradually over a period of 90 days in total in order to minimize dust emission related environmental impacts during land preparation and construction phase. Watering (water spraying) will be carried out at sufficient frequency and with adequate amount in the absence of precipitation (arid days), and measures will be taken as specified in Annex 1 of the IAPCR such as unloading and loading without throwing/scattering and keeping the top soil at 10% humidity in the working areas.

In addition, vehicles with regular exhaust inspection routines will be used and the speed limits for the vehicles will be obeyed in order to minimize the emissions from the machinery and equipment.

6.1.4. Summary of Assessment and Residual Impacts

Table 6.12 provides a summary of air quality impact assessments. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

6.2. Meteorological and Climatic Characteristics

Apa GES Project is located in the Cumra District of Konya Province. Hence it is affected by the continental climate of the Central Anatolia region. Generally, winters are rainy and cold; summers are hot and dry. Rainfall is generally seen in spring and winter and the temperature differences between summer and winter and day and night is very high. The province is spread over a wide geography and has microclimate zones with more rainy and mild climatic conditions throughout the Province (*Governorship of Konya, Provincial Directorate of Environment and Urbanism, 2015)*.

Within the scope of the EIA studies performed for the Project, application made to the Turkish State Meteorological Service in order to obtain the data of the best representative meteorological observation station of Project Area and Cumra Meteorology Station has been identified by the Turkish State Meteorological Service being the most representative station. Within this scope, long-term statistical data for years 1971-2015 at Cumra Meteorological Station (station code: 17900) obtained from Turkish State Meteorological Service. Evaluations provided in the sections below are based on this statistical data.

The Cumra Meteorology Station is established 1014 meters above sea level with coordinates 37.5658 latitude and 32.7900 longitude.

Table 6.12. Summary of Air Quality Impact Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Air Environment	Land preparation and construction	Dust emissions, exhaust emissions	Adverse	Low	• Measures defined in Annex 1 of Industrial Air Pollution Control Regulation (IAPCR) such as installation/use of wind breakers at site; loading and unloading without throwing/scattering; and keeping the top soil at 10% humidity in the working areas will be applied. • Vehicles with regular exhaust inspection routines will be used.	Low

6.2.1. Pressure Distribution

According to observation records from Cumra Meteorology Station the annual average local pressure is 900.4 hPa. The lowest pressure encountered during the period of observation was 879.2 hPa, measured in January. The highest pressure encountered during the same period of time was 916.8, measured in December. Monthly average, minimum and maximum pressure values recorded at the station are provided graphically in Figure 6.2 and in tabular format in Table 6.13.

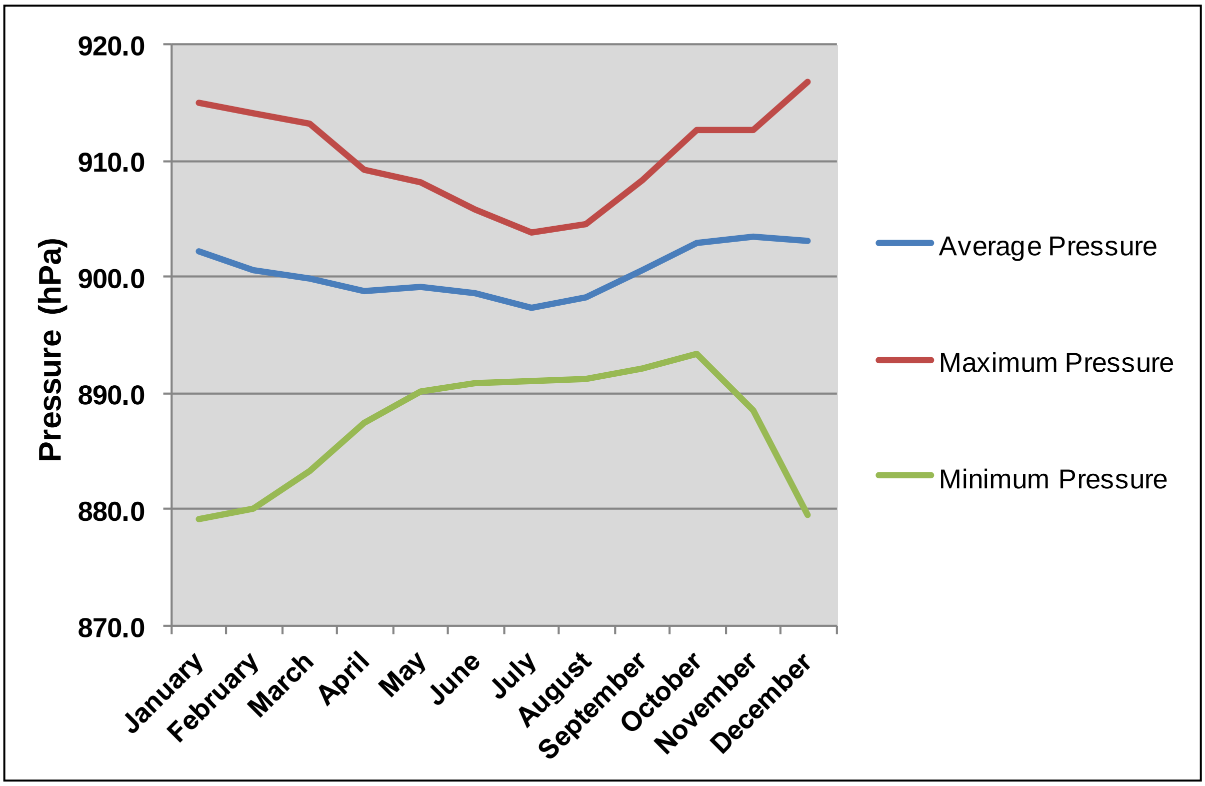


Figure 6.2. Monthly Average, Maximum and Minimum Pressure

Table 6.13. Monthly Average, Maximum and Minimum Pressure Values

Months	Average Pressure (hPa)	Maximum Pressure (hPa)	Minimum Pressure (hPa)
January	902.1	914.9	879.2
February	900.6	914.0	880.0
March	899.8	913.2	883.3
April	898.7	909.3	887.4
May	899.1	908.1	890.1
June	898.6	905.8	890.8
July	897.4	903.8	891.0
August	898.3	904.5	891.2
September	900.5	908.4	892.1
October	902.9	912.6	893.3
November	903.5	912.7	888.4
December	903.1	916.8	879.4
Annual	900.4	916.8	879.2

6.2.2. Temperature Distribution

According to observation records from Cumra Meteorology Station, the annual average temperature is 11.4°C. The highest temperature observed was 39.9°C, measured in July. The lowest temperature observed was -26.3 °C, measured in February. Average, maximum and minimum temperatures measured in this station are provided graphically in Figure 6.3 and in tabular format in Table 6.14.

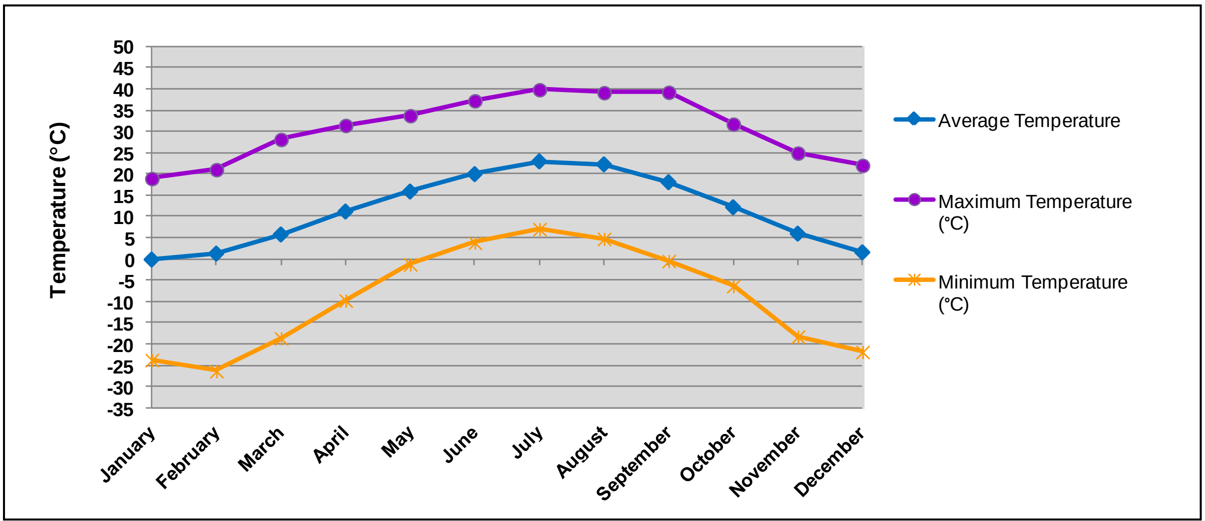


Figure 6.3. Average, Maximum and Minimum Temperatures

Table 6.14. Temperature Values

Months	Average Temperature (°C)	Maximum Temperature (°C)	Minimum Temperature (°C)
January	-0.1	19.0	-23.7
February	1.3	21.1	-26.3
March	5.8	28.2	-18.6
April	11.2	31.5	-9.7
May	15.9	33.8	-1.2
June	20.0	37.3	3.9
July	23.0	39.9	7.1
August	22.3	39.2	4.8
September	18.1	39.3	-0.4
October	12.2	31.8	-6.3
November	6.0	25.0	-18.2
December	1.6	22.1	-21.8
Annual	11.4	39.9	-26.3

6.2.3. Precipitation Distribution

According to observation records from Cumra Meteorology Station, annual total precipitation is 290.0 mm. The highest amount of precipitation observed was 40.0 mm, measured in December, and the lowest amount of precipitation observed was 3.3 mm, measured in August. During observation period, maximum daily precipitation encountered was 50.1 mm, measured in April. Annual total precipitation and daily maximum precipitation by months are provided graphically in Figure 6.4 and in tabular format in Table 6.15.

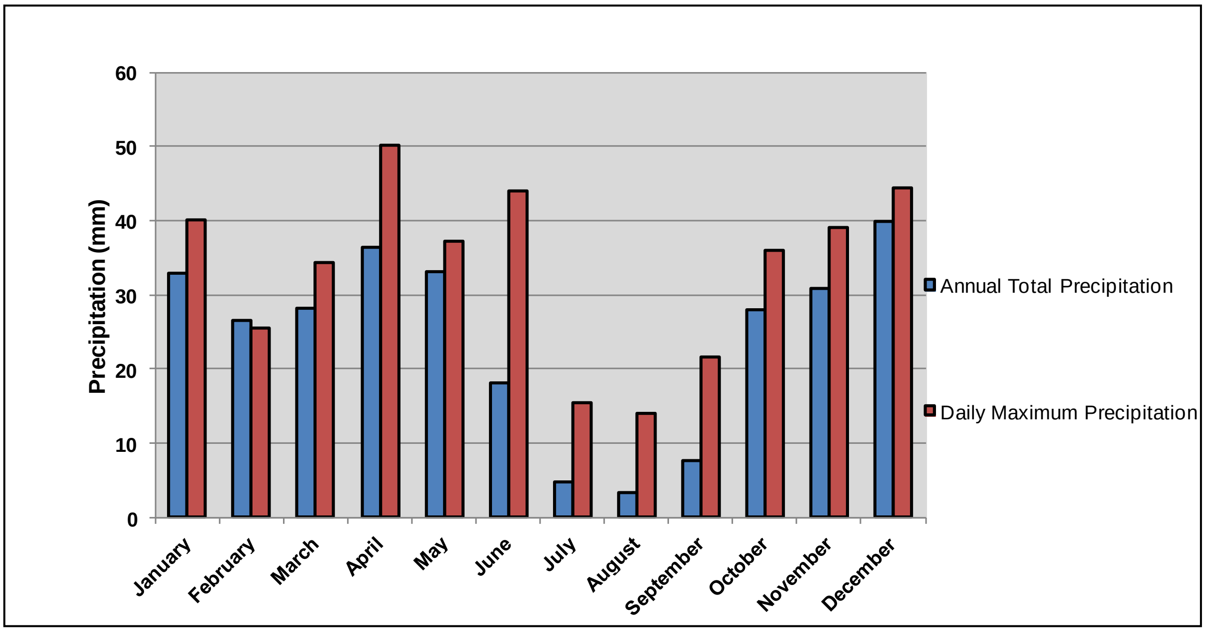


Figure 6.4. Annual Total Precipitation and Daily Maximum Precipitation

Table 6.15. Annual Total Precipitation and Daily Maximum Precipitation Values

Months	Annual Total Precipitation (mm)	Daily Maximum Precipitation (mm)
January	33.0	40.1
February	26.6	25.5
March	28.2	34.3
April	36.4	50.1
May	33.1	37.3
June	18.1	44.0
July	4.7	15.5
August	3.3	14.1
September	7.7	21.6
October	28.1	36.0
November	30.8	39.1
December	40.0	44.5
Annual	290.0	50.1

Activities in the construction of substructures/infrastructures and superstructures within the scope of the Project will be performed by considering 100 years 24 hours precipitation value of 65.8 mm according to Peak Precipitation Values Observed on Standard Time at Cumra Meteorological Station .

6.2.4. Humidity Distribution

According to observation records from Cumra Meteorology Station, annual average relative humidity is 62.1%. Lowest average relative humidity was measured in July with a value of 48.5% and highest relative humidity was measured in December with a value of 77.0%. The monthly average and minimum relative humidity values are provided graphically in Figure 6.5 and in tabular format in Table 6.16.

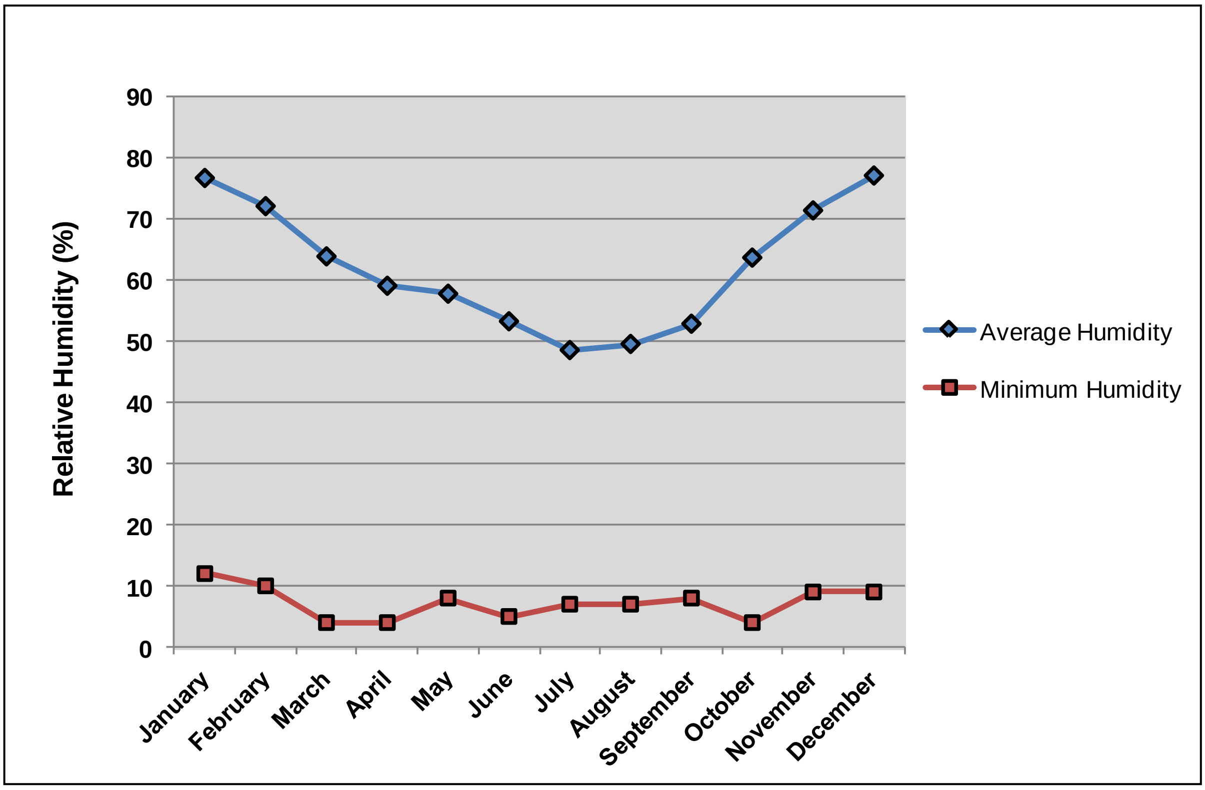


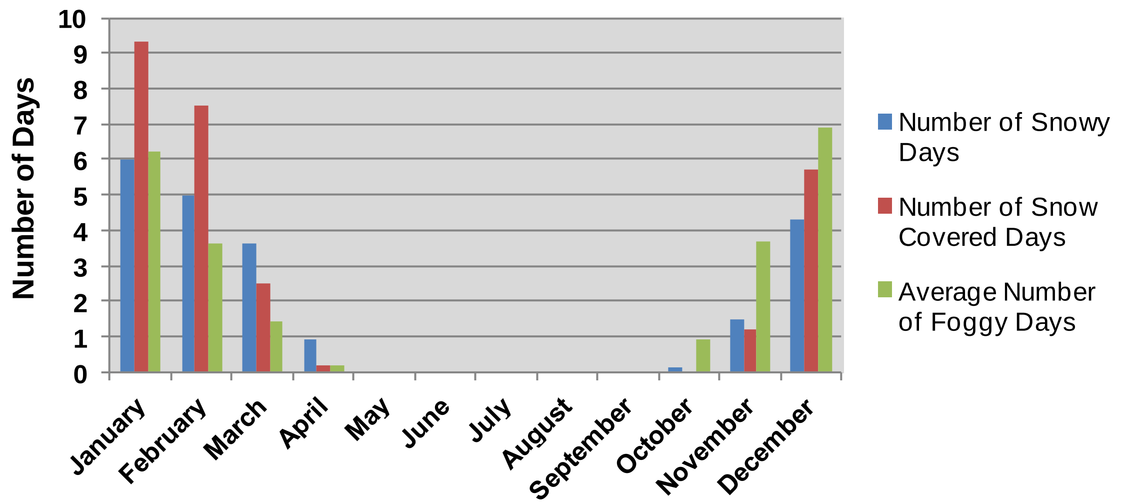
Figure 6.5. Average and Minimum Relative Humidity

Table 6.16. Average and Minimum Relative Humidity Values

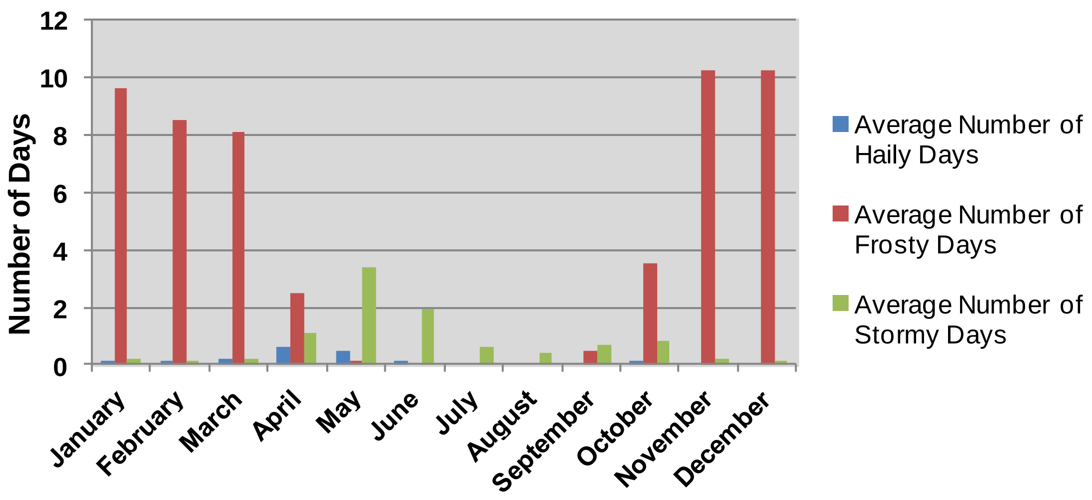
Months	Average Relative Humidity (%)	Minimum Relative Humidity (%)
January	76.6	12.0
February	72.0	10.0
March	63.8	4.0
April	59.0	4.0
May	57.7	8.0
June	53.2	5.0
July	48.5	7.0
August	49.5	7.0
September	52.8	8.0
October	63.6	4.0
November	71.3	9.0
December	77.0	9.0
Annual	62.1	4.0

6.2.5. Foggy, Snowy, Haily, Frosty and Stormy Days Distribution

According to observation records from Cumra Meteorology Station, the number of annual average snowy days is 21.4, annual average number of days with snow covered is 26.4 and the number of average foggy days is 22.9. According to observation records, average numbers of haily, frosty and stormy days are 1.7, 53.2, and 9.7, respectively. Monthly distribution of average snowy, snow covered, foggy, haily, frosty and stormy days are provided graphically in Figure 6.6 and in tabular format in Table 6.17.



Average Number of Snowy, Snow Covered and Foggy Days



Average Number of Haily, Frosty and Stormy Days

Figure 6.6. Snowy, Snow Covered, Foggy, Haily, Frosty and Stormy Days Distribution

Table 6.17. Average Number of Snowy, Snow Covered, Foggy, Haily, Frosty and Stormy Days

Months	Number of Snowy Days	Number of Snow Covered Days	Average Number of Foggy Days	Average Number of Haily Days	Average Number of Frosty Days	Average Number of Stormy Days
January	6.0	9.3	6.2	0.1	9.6	0.2
February	5.0	7.5	3.6	0.1	8.5	0.1
March	3.6	2.5	1.4	0.2	8.1	0.2
April	0.9	0.2	0.2	0.6	2.5	1.1
May	0.0	0.0	0.0	0.5	0.1	3.4
June				0.1		1.9
July				0.0		0.6
August						0.4
September				0.0	0.5	0.7
October	0.1		0.9	0.1	3.5	0.8
November	1.5	1.2	3.7	0.0	10.2	0.2
December	4.3	5.7	6.9	0.0	10.2	0.1
Annual	21.4	26.4	22.9	1.7	53.2	9.7

6.2.6. Maximum Snow Depth

According to observation records from Cumra Meteorology Station, the highest depth of snow was 52 cm, measured in January. Monthly distribution of maximum snow depth is provided graphically in Figure 6.7 and in tabular format in Table 6.18.

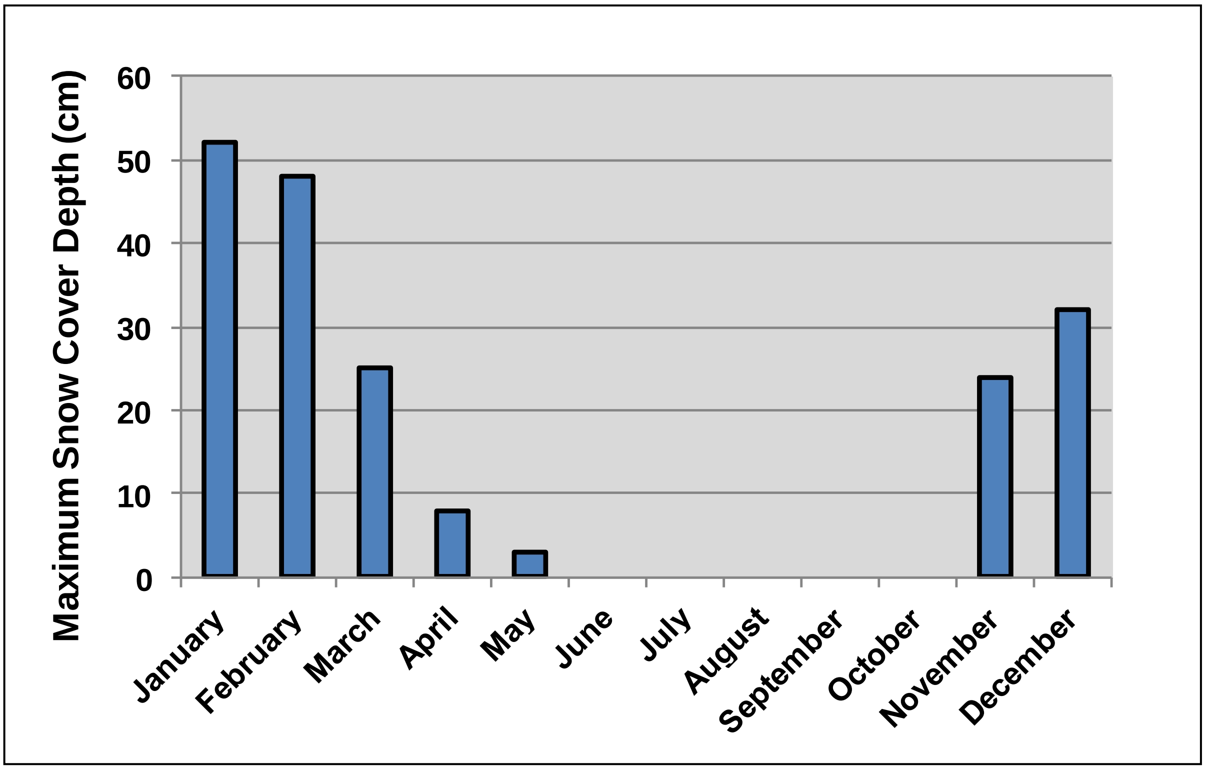


Figure 6.7. Monthly Distribution of Maximum Snow Depth

Table 6.18. Monthly Maximum Snow Depth Values

Months	January	February	March	April	May	November	December	Annual
Maximum Snow Depth (cm)	52	48	25	8	3	24	32	52

6.2.7. Evaporation Distribution

According to observation records from Cumra Meteorology Station, monthly maximum open surface evaporation was 11.6 mm, measured in April. Annual total average open surface evaporation is 996.6 mm. Monthly maximum and average open surface evaporation values are provided graphically in Figure 6.8 and in tabular format in Table 6.19.

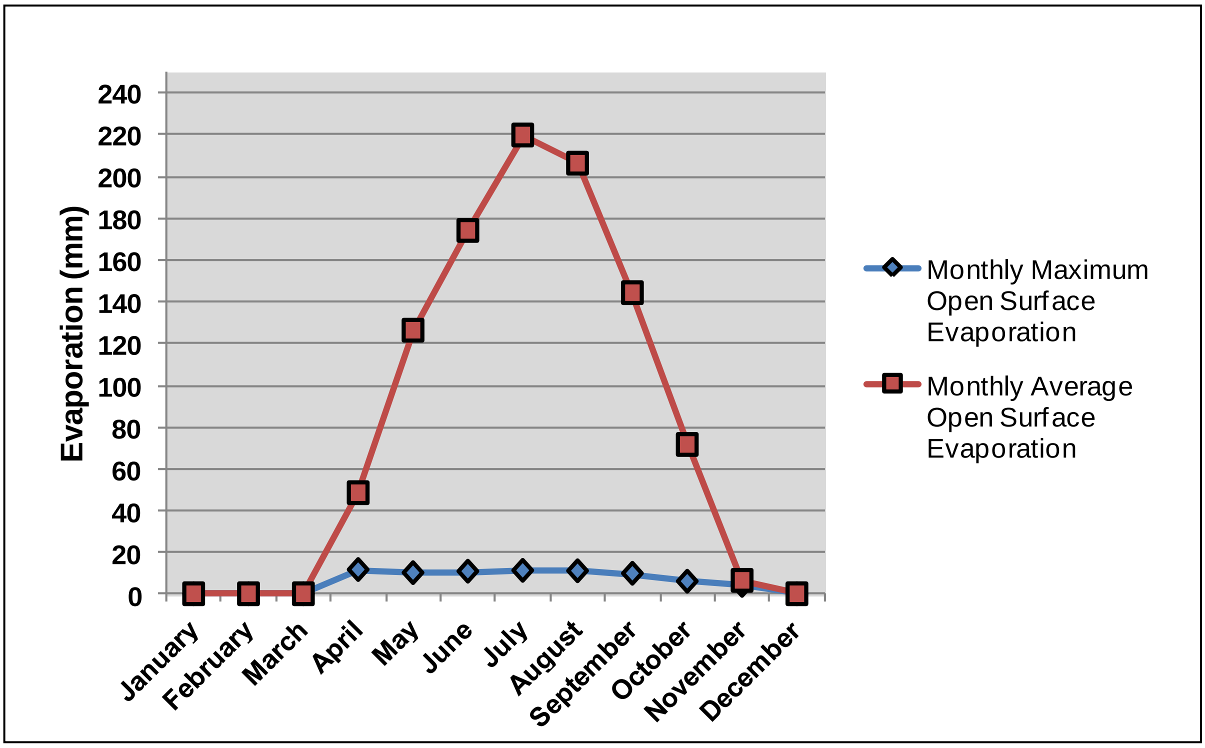


Figure 6.8. Monthly Maximum and Monthly Average Open Surface Evaporation

Table 6.19. Monthly Maximum and Monthly Average Open Surface Evaporation Values

Months	Monthly Maximum Open Surface Evaporation (mm)	Monthly Average Open Surface Evaporation (mm)
January		
February		
March		
April	11.6	48.4
May	10.1	126.2
June	10.8	174.0
July	11.2	219.7
August	11.0	206.2
September	9.8	144.2
October	6.0	71.5
November	4.0	6.4
December		
Annual	11.6	996.6

6.2.8. Wind Distribution

The monthly, yearly and seasonally distribution of wind blow numbers and wind speeds recorded in Cumra Meteorology Station are given in Table 6.20. Table 6.21 and Table 6.22, and graphical representations are provided in Figure 6.9 and Figure 6.10. According to annual wind blow numbers, first dominant wind direction is N (north), second dominant wind direction is NW (northwest), third dominant wind direction is SE (southeast) and fourth dominant wind direction is NE (northeast).

Table 6.20. Distribution of Monthly and Yearly Wind Blow Numbers According to Directions (1971-2015)

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	3206	359	1286	136	816	219	2729	1072	1238	336	954	128	482	127	1504	733
February	3084	411	1314	156	639	263	2285	1133	1437	453	1293	163	416	234	1451	915
March	3393	379	1474	106	907	346	2596	1113	1697	575	1832	309	460	233	2168	947
April	2520	462	1299	239	924	282	2810	737	1970	799	2399	420	622	299	1769	812
May	3002	689	1990	201	738	199	2228	539	1347	365	1627	273	778	325	2496	848
June	4457	839	2921	177	849	89	1372	187	556	183	1120	190	651	319	3414	1237
July	6069	1012	2953	306	703	156	980	135	555	108	877	142	669	508	3686	1599
August	5343	839	3039	251	922	96	941	97	362	72	605	107	607	327	3422	1414
September	3543	618	2220	220	729	181	1158	193	634	254	956	240	669	310	2387	1054
October	2758	408	1723	143	687	137	1554	332	632	210	1153	213	556	300	2025	985
November	3052	340	1080	107	788	151	2022	681	1173	238	881	243	350	235	1537	945
December	3167	338	1242	138	875	226	2646	909	1578	379	783	139	486	157	1547	754
Annual	43594	6694	22541	2180	9577	2345	23321	7128	13179	3972	14480	2567	6746	3374	27406	12243

Table 6.21. Monthly and Yearly Average Wind Speeds According to Directions (m/sec) (1971-2015)

Months	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
January	1.5	0.7	1.3	0.8	1.6	1.2	1.9	2.5	1.5	1.3	1.3	0.9	1.1	0.9	1.7	1.2
February	1.8	1.0	1.5	0.8	1.4	1.2	2.0	2.4	2.1	1.6	1.8	0.9	1.0	1.1	1.6	1.7
March	1.9	1.2	1.8	1.0	1.8	1.5	2.0	2.4	1.9	1.9	1.8	1.3	1.4	1.1	1.8	1.9
April	1.7	1.4	1.6	1.3	1.9	1.5	2.1	2.5	1.8	2.6	2	1.6	1.4	1.2	1.6	1.8
May	1.5	1.2	1.6	1.1	1.8	1.4	1.7	1.9	1.7	1.8	1.6	1.3	1.5	1.3	1.7	1.7
June	1.6	1.6	1.6	1.3	1.9	1.4	1.6	1.6	1.7	1.7	1.7	1.4	1.3	1.3	1.7	1.7
July	1.7	1.8	1.7	1.4	1.7	1.2	1.7	1.6	1.8	1.4	1.4	1.1	1.2	1.2	1.7	1.9
August	1.6	1.5	1.7	1.4	1.6	1.3	1.4	1.3	1.5	1.2	1.6	0.9	1.3	1.1	1.5	1.6
September	1.4	1.2	1.6	1.1	1.7	1.3	1.3	1.4	1.4	1.3	1.4	0.9	1.1	0.9	1.4	1.5
October	1.3	0.9	1.2	0.9	1.5	1.2	1.7	1.7	1.5	1.3	1.5	1.0	1.1	0.9	1.5	1.1
November	1.5	0.7	1.3	0.7	1.6	1.2	1.8	2.2	1.7	1.1	1.2	0.9	0.9	0.8	1.3	1.2
December	1.5	0.6	1.2	0.7	1.5	1.0	1.9	2.1	1.9	1.3	1.2	0.7	0.9	1.0	1.4	1.3
Annual	1.6	1.2	1.5	1.0	1.7	1.3	1.8	2.0	1.7	1.5	1.5	1.1	1.2	1.1	1.6	1.6

Table 6.22. Distribution of Seasonal Wind Blow Numbers According to Directions (1971-2015)

Season	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
Winter	9457	1108	3842	430	2330	708	7660	3114	4253	1168	3030	430	1384	518	4502	2402
Spring	8915	1530	4763	546	2569	827	7634	2389	5014	1739	5858	1002	1860	857	6433	2607
Summer	15869	2690	8913	734	2474	341	3293	419	1473	363	2602	439	1927	1154	10522	4250
Autumn	9353	1366	5023	470	2204	469	4734	1206	2439	702	2990	696	1575	845	5949	2984

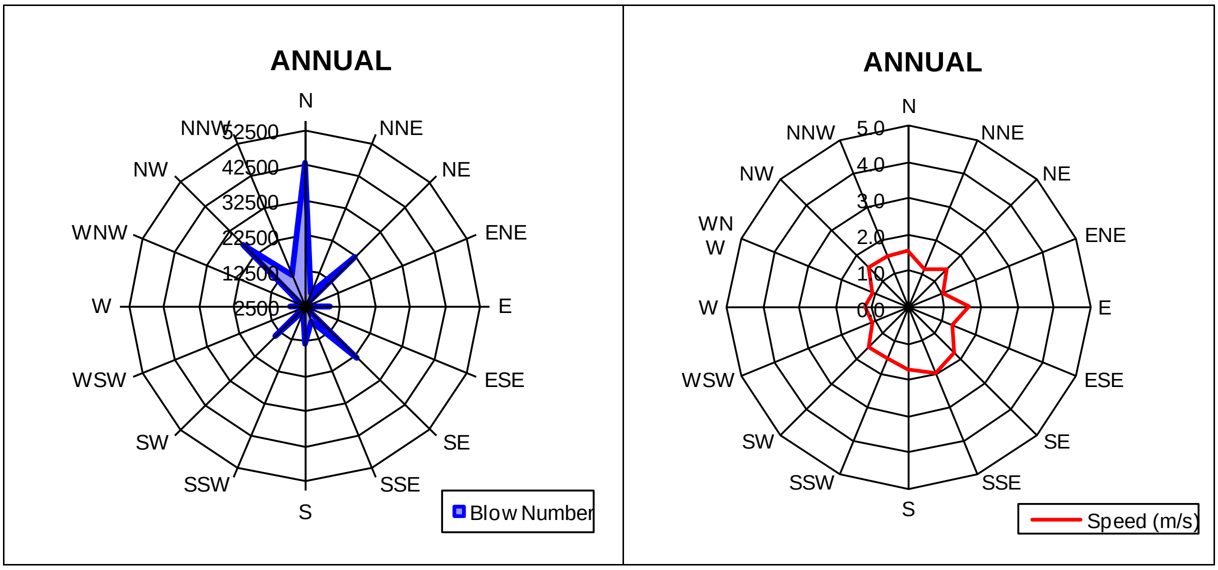


Figure 6.9. Annual Wind Diagram of Wind Blow Numbers and Average Wind Speeds

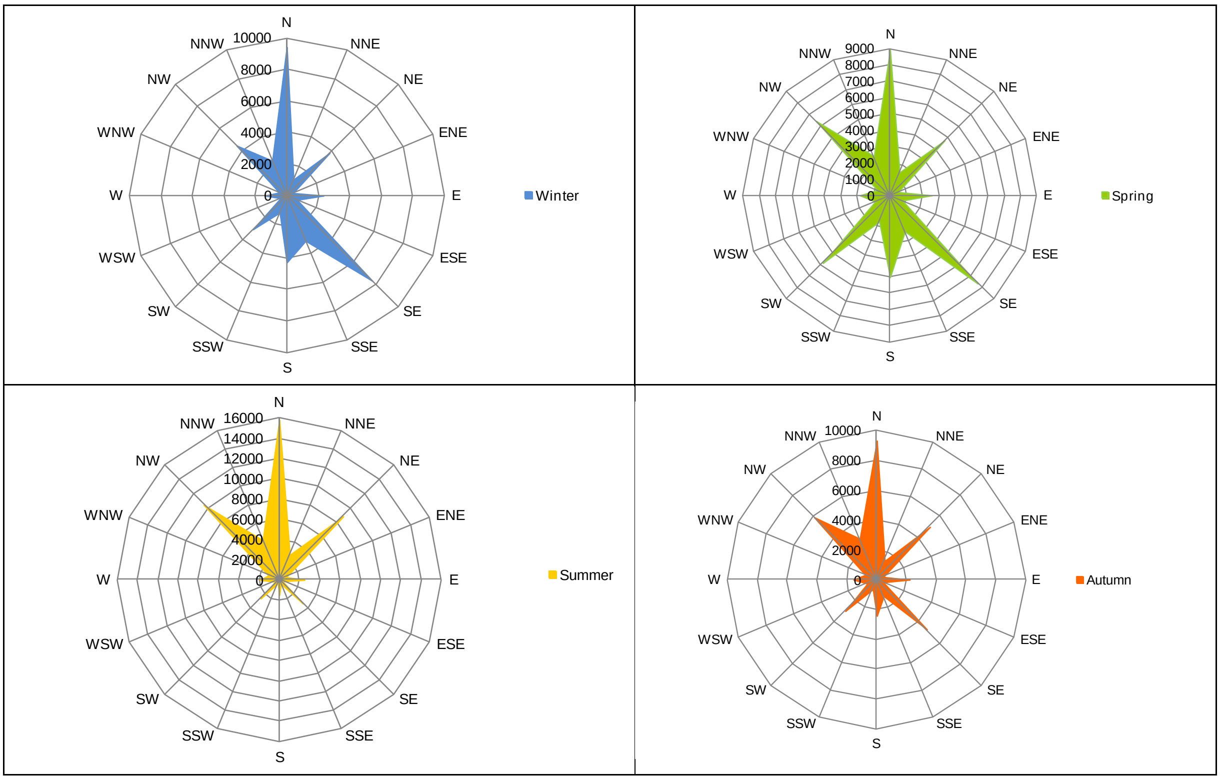


Figure 6.10. Seasonal Wind Diagram of Wind Blow Numbers

Monthly wind diagrams of wind blow numbers are given in Figure 6.11.

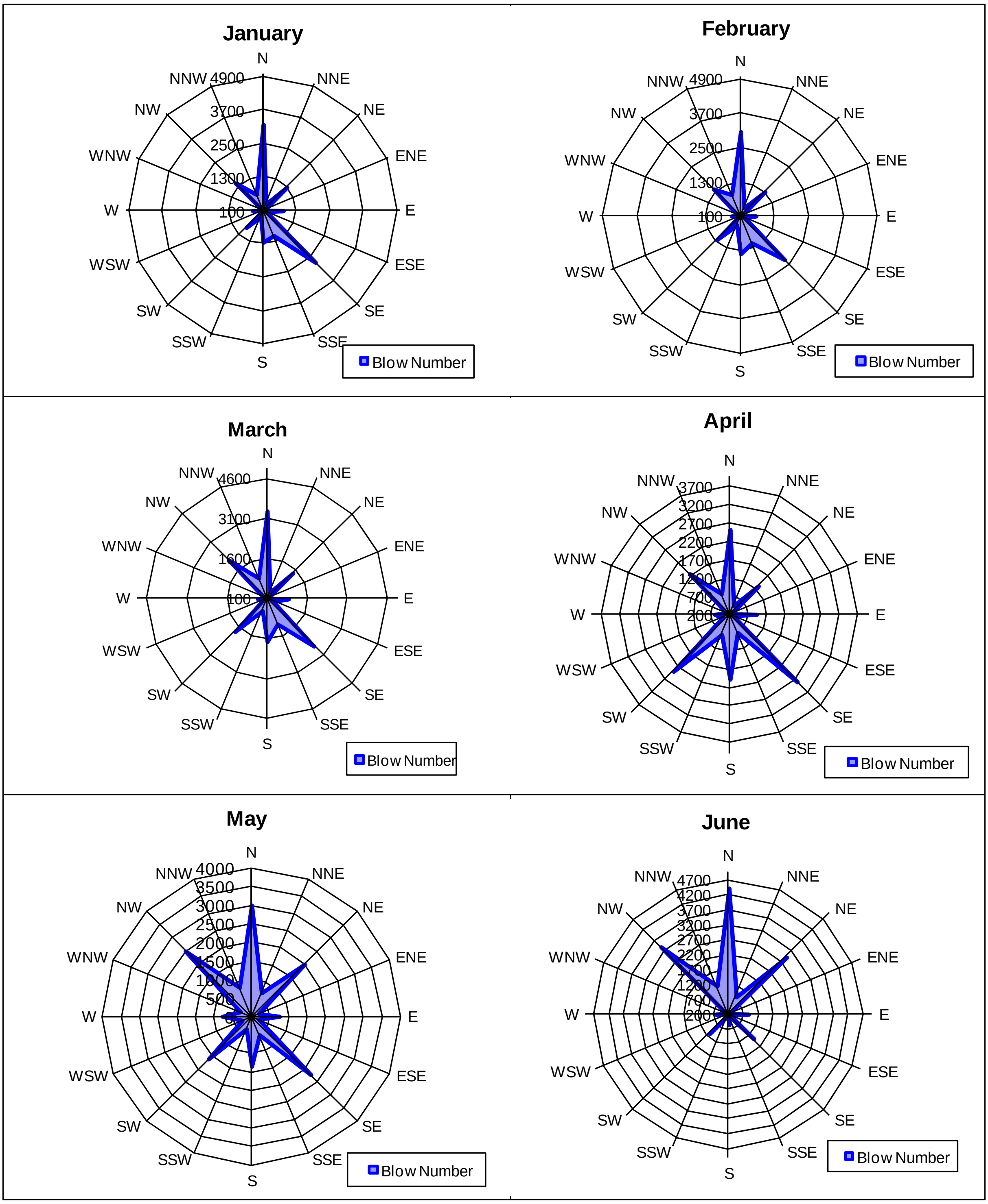


Figure 6.11. Monthly Wind Diagrams of Wind Blow Numbers

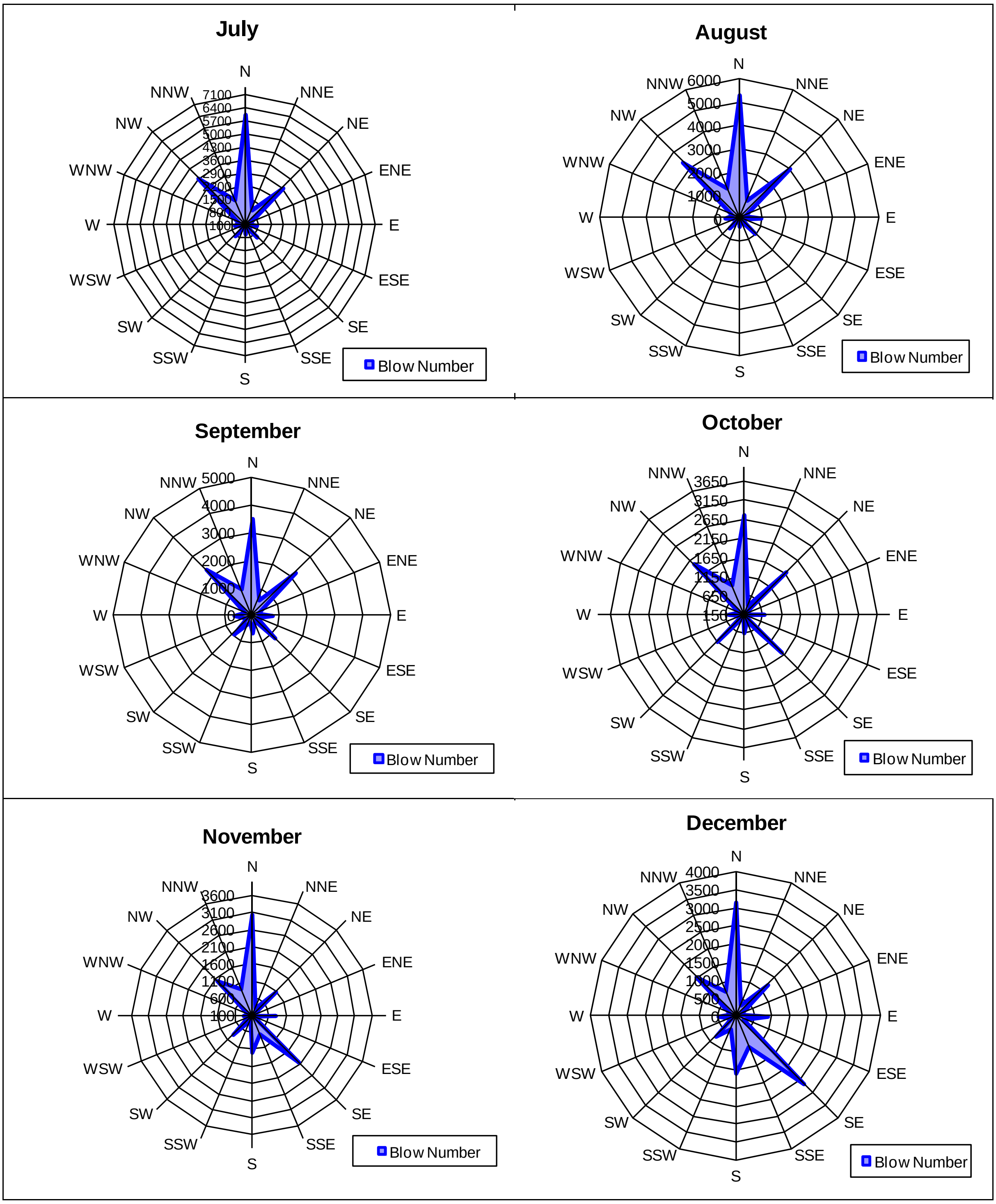


Figure 6.11. Monthly Wind Diagrams of Wind Blow Numbers (Continue)

According to observation records from Cumra Meteorology Station, annual average wind speed is 1.0 m/sec. Monthly average wind speeds are given in Table 6.23 and graphical representation is provided in Figure 6.12.

Table 6.23. Monthly Average Wind Speeds

Months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
Average Speed (m/sec)	1.0	1.2	1.3	1.3	1.0	1.1	1.2	0.9	0.8	0.7	0.8	0.9	1.0

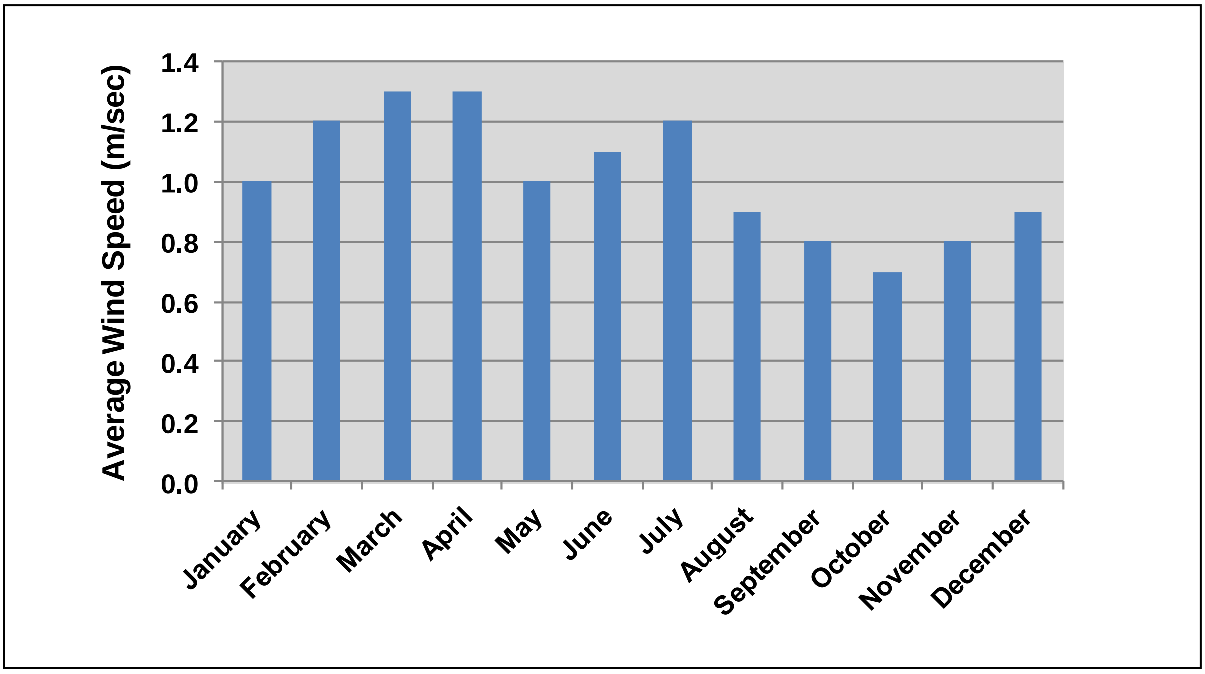


Figure 6.12. Monthly Average Wind Speeds

According to observation records from Cumra Meteorology Station, the direction of the highest wind speed is south-southeast (SSE) with 19.6 m/sec. According to observation records from Cumra Meteorology Station, annual number of average stormy day is 0.1 and annual number of average strong windy day is 4.6. Maximum wind speeds and directions and numbers of average stormy and average strong windy days are provided in Table 6.24 and graphically representations are provided in Figure 6.13 and Figure 6.14.

Table 6.24. Maximum Wind Speed and Direction, Numbers of Average Stormy and Average Strong Windy Days (1960-2015)

Months	Direction of Maximum Wind	Maximum Wind Speed (m/sec)	Number of Average Stormy Days*	Number of Average Strong Windy Days**
January	SSE	16.4		0.7
February	S	19.0	0.1	0.5
March	SE	18.5	0.0	0.7
April	SSE	19.6	0.0	0.8
May	SSW	15.6		0.3
June	W	16.2		0.4
July	SSW	11.6		0.1
August	NW	15.5		0.1
September	SW	15.5		0.1
October	SW	15.5		0.3
November	SE	15.5		0.2
December	S	19.0	0.0	0.4
Annual	SSE	19.6	0.1	4.6

** Wind speed >= 17.2 m/sec, ** Wind speed: 10.8 – 17.1 m/sec*

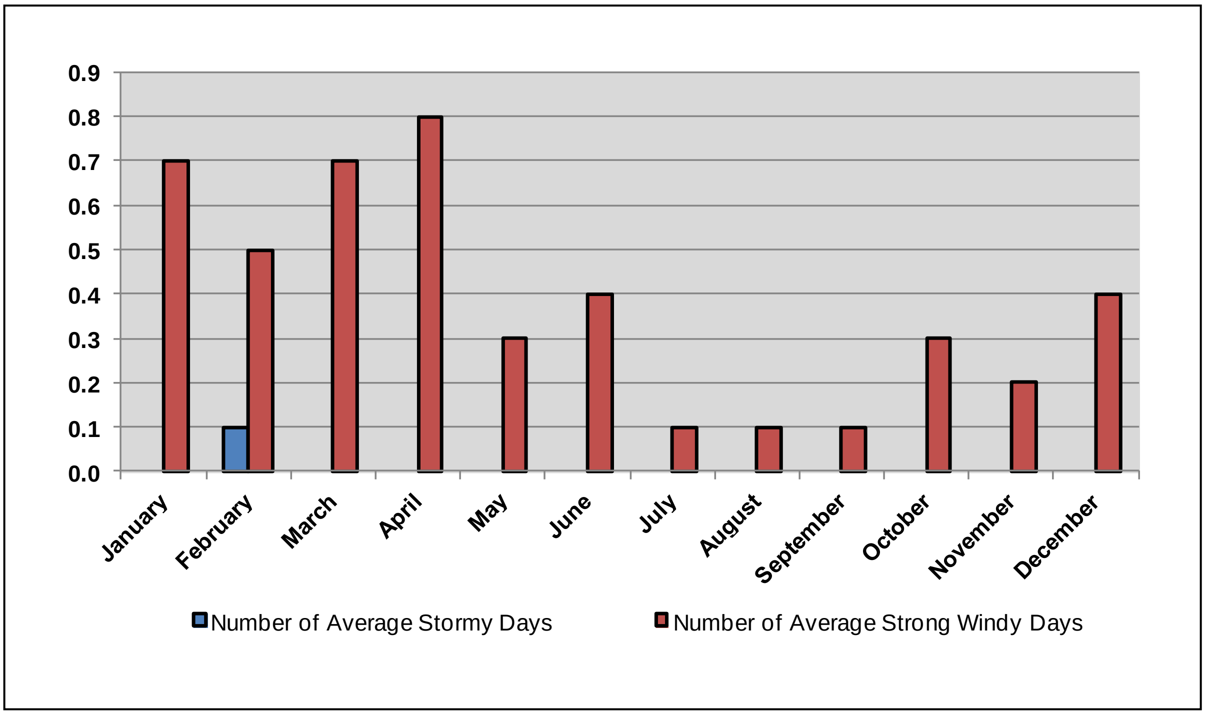


Figure 6.13. Numbers of Average Stormy and Average Strong Windy Days

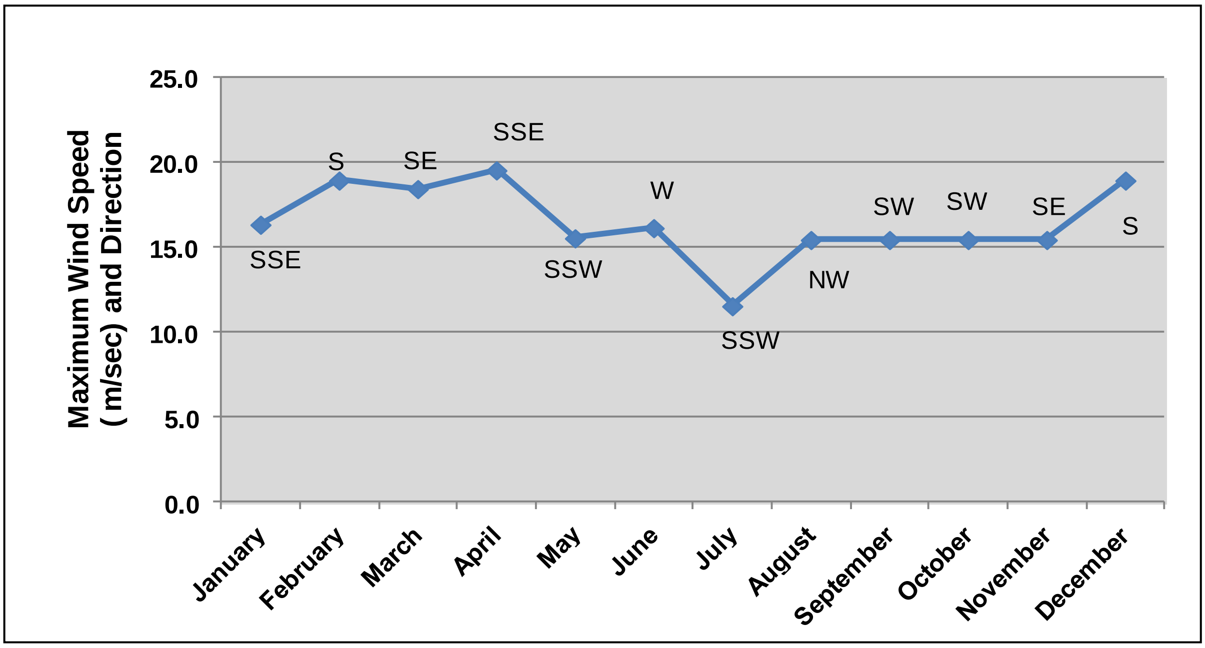


Figure 6.14. Maximum Wind Speed and Direction

6.2.9. Extreme Meteorology Events

Long term extreme meteorology events recorded at Cumra Meteorology Station is provided in Table 6.25.

Activities in the construction of substructures/infrastructures and superstructures within the scope of the Project will be performed by considering extreme meteorology events data.

Table 6.25. Extreme Meteorology Events Recorded at Cumra Meteorology Station

Year	Date	Location	Event	Remark/Explanation
1976	11.07.1976	Cumra	Hail	Agricultural products damaged by hail
1994	24.04.1994	Cumra	Frost	Agricultural products damaged due to frost
2000	06.04.2000	Cumra	Drought	Existing situation needs precipitation
2000	02.06.2000	Cumra	Rain and flood	Agricultural products damaged due to flood
2000	02.06.2000	Cumra	Hail	Agricultural products damaged by hail
2001	28.05.2001	Cumra	Hail	Laid down crops planted in 400 decare area and damaged vegetables
2005	01.04.2005	Cumra	Frost	Trees damaged due to frost
2007	31.05.2007	Cumra	Drought	Weak grain formation was observed at ears of corn
2007	18.06.2007	Cumra	Stroke of lightning	People suffered
2011	26.05.2011	Cumra	Rain and flood	Residential areas damaged

6.2.10. Peak Precipitation Values Observed on Standard Time and Precipitation Intensity – Duration - Frequency Curves

Peak precipitation values observed on standard time and precipitation intensity – duration – frequency curves recorded at Cumra Meteorology Station are given in Figure 6.15 and Figure 6.16, respectively.

6.3. Climate Change

6.3.1. Greenhouse Gases

Greenhouse gas emissions refer to the release of greenhouse gases (GHG) into the atmosphere. United Nations Framework Convention on Climate Change (UNFCCC) lists GHG as below:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulfur hexafluoride (SF_6)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)

Mobile sources and transportation account for a large fraction of fossil fuel combustion in most countries which can be accepted as the main contributor to GHG emissions. Internal combustion engines derive energy from burning of hydrocarbon fuel in air, generating carbon dioxide (CO_2) and water vapor (H_2O). During combustion, some amount of the fuel is either not burnt or partially burnt. This results in generation of carbon monoxide (CO), volatile organic compounds (VOCs) and particulate matter (PM).

Turkish State Meteorological Service
Cumra Meteorology Station
Peak Precipitation Values Observed on Standard Time

(mm) KAYITLARA UYGUNDUR.
Selami YILDIRIM
Veri Kontrol ve İstatistik

GOZLEM YILI	DAKIKA 5	10	15	30	SAAT 1	2	3	4	5	6	8	12	18	24	24 +
2010	2,4	4,7	5,9	8,0	14,7	18,4	18,7	18,7	18,9	19,0	19,4	20,8	31,4	44,5	
2009	2,2	3,1	4,2	6,8	7,4	9,0	10,2	11,7	12,3	12,3	12,7	14,5	15,9	40,1	*
2008	3,2	6,3	7,9	8,4	8,4	10,7	12,9	15,7	16,2	16,2	16,2	16,3	16,3	18,4	
2007	6,2	10,2	14,3	20,3	21,6	26,4	26,9	26,9	26,9	27,0	30,1	37,4	48,8	52,4	
2006	3,8	5,8	6,1	9,1	10,7	11,7	11,7	11,7	11,8	11,8	11,8	15,1	15,2	17,9	
2005	3,1	5,6	7,3	13,1	14,9	17,1	18,1	18,1	18,1	18,1	18,1	18,1	18,6	39,1	*
2004	1,7	3,2	4,8	7,0	7,3	13,1	15,9	16,8	16,9	16,9	16,9	17,0	17,0	18,3	
2003	1,0	1,4	2,1	3,4	6,6	10,7	14,8	18,7	22,4	25,8	33,1	47,3	61,4	61,8	
2002	5,1	9,5	12,1	15,0	17,5	20,6	21,3	21,4	21,5	21,5	21,6	21,6	23,2	34,6	
2001	5,1	7,8	9,3	12,1	13,1	15,6	17,8	18,0	18,1	18,1	20,7	22,8	25,4	33,6	
2000	8,4	13,4	16,8	28,7	36,3	37,3	37,3	37,3	37,3	37,3	37,3	37,3	37,3	37,3	
1999	1,1	1,6	2,1	3,1	3,3	3,6	5,2	6,7	6,9	7,0	7,4	7,6	7,6	7,6	
1998	5,8	7,6	8,7	10,6	12,6	13,7	13,7	13,7	13,7	13,7	13,7	13,7	13,7	36,0	*
1997	3,9	6,5	9,2	12,3	12,5	12,6	12,7	14,6	15,8	16,6	17,8	23,3	23,8	28,7	
1996	1,8	3,4	4,7	6,2	6,2	8,7	10,4	12,6	14,8	15,8	17,2	17,3	20,0	35,0	
1995	2,4	2,9	3,3	4,3	6,2	10,1	14,0	14,6	16,4	19,0	21,5	23,4	23,5	23,6	
1994	4,1	4,8	5,2	5,3	8,3	12,5	17,7	19,7	20,0	20,2	23,7	26,5	26,5	26,5	
1993	4,5	6,0	6,4	7,7	9,9	13,6	18,0	18,7	18,7	18,8	18,8	18,9	21,4	21,5	
1992	2,0	3,5	4,0	4,1	4,4	5,1	5,4	6,6	6,8	6,9	6,9	8,0	13,1	16,7	
1991	2,7	2,7	3,0	3,0	4,8	7,1	7,6	8,4	8,8	8,8	8,8	9,9	11,8	19,8	
1990	2,0	4,0	4,8	8,5	11,9	13,5	14,1	14,2	15,1	16,7	16,7	17,5	25,5	25,5	
1989	2,3	2,7	3,5	5,1	6,8	10,6	10,8	10,9	11,5	12,9	13,0	18,3	19,8	34,3	*
1988	9,5	11,9	12,6	12,8	12,8	14,5	16,0	16,1	16,1	16,1	16,1	16,1	17,3	28,6	
1987	2,5	3,6	4,5	5,8	6,7	7,7	8,0	8,0	8,0	8,0	8,0	8,0	9,4	26,8	*
1986	2,0	3,5	4,4	8,4	14,0	19,0	19,0	19,0	19,0	27,2	27,2	32,0	32,0	32,0	
1985	5,0	6,0	6,4	9,6	11,8	14,0	16,1	16,1	16,1	16,1	16,1	16,1	16,1	29,9	
1984	2,0	3,9	4,1	7,1	7,1	7,1	7,4	7,4	7,4	7,4	7,4	7,4	7,4	22,5	*
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N	21	21	21	21	21	21	21	21	21	21	21	21	21	21	27
Y-ORT	3,7	5,7	6,9	9,4	11,5	14,2	15,9	16,8	17,4	18,2	19,3	21,5	24,5	29,3	30,1
Y-EB	9,5	13,4	16,8	28,7	36,3	37,3	37,3	37,3	37,3	37,3	37,3	47,3	61,4	61,8	61,8
Std.S	2,27	3,29	4,07	6,17	7,27	7,41	7,09	6,74	6,67	7,09	7,86	10,02	12,59	12,60	11,59
Car.K	1,16	0,96	1,06	1,79	2,11	1,61	1,26	1,25	1,09	0,74	0,57	1,02	1,56	0,93	0,72
UDF	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3	LN3
2 YIL	3,4	5,2	6,3	8,1	9,8	12,7	14,7	15,7	16,4	17,5	18,6	20,1	22,0	27,6	28,9
5 YIL	5,4	8,2	10,0	13,5	16,1	19,3	21,0	21,7	22,3	23,8	25,6	29,1	33,1	38,9	39,2
10 YIL	6,7	10,0	12,3	17,3	20,6	23,8	25,2	25,6	26,1	27,6	29,7	34,7	40,8	45,4	45,9
25 YIL	8,3	12,2	15,1	22,3	26,9	29,6	30,4	30,6	30,8	32,1	34,4	41,7	50,6	52,8	54,4
50 YIL	9,5	13,8	17,2	26,2	31,8	34,1	34,2	34,3	34,3	35,3	37,6	46,7	57,9	58,2	60,4
100 YIL	10,7	15,4	19,3	30,3	37,0	37,7	37,9	38,1	38,3	38,7	40,7	51,6	62,8	65,8	66,4
PLF	0,15	0,22	0,27	0,39	0,47	0,53	0,56	0,57	0,58	0,61	0,65	0,77	0,91	1,00	1,02
PLV	0,14	0,21	0,25	0,34	0,41	0,50	0,57	0,61	0,63	0,66	0,69	0,75	0,84	1,00	1,00

Figure 6.15. Peak Precipitation Values Observed on Standard Time

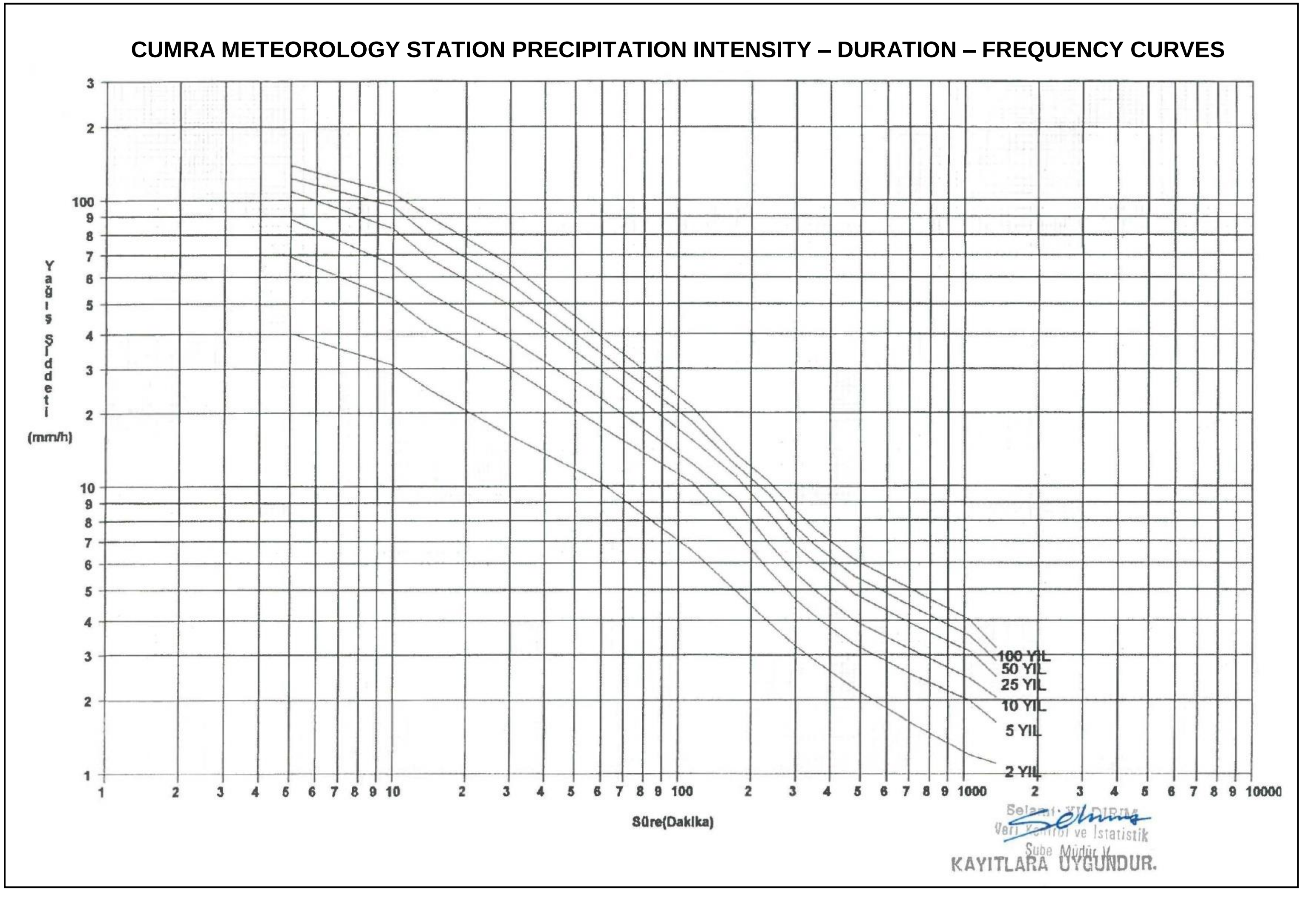


Figure 6.16. Precipitation Intensity – Duration - Frequency Curves

In addition, at the high temperatures and pressures found in the combustion chamber, some of the nitrogen in the air and fuel is oxidized, forming mainly nitric oxide (NO) with a small amount of nitrogen dioxide (NO_2). By convention, the sum total of oxides of nitrogen (i.e. NO + NO_2) is abbreviated as NO_x. To summarize, CO, VOCs, NO_x and PM, have normally been regarded as the pollutants of most concern, and rates of emission are legally restricted in many countries. CO_2, being a major contributor to global warming, is now also considered to be an atmospheric pollutant.

6.3.2. Regulatory Framework

Turkish Legal Requirements

Turkey became a party of the United Nations Framework Convention on Climate Change in 2004. In the 7th Conferences of the Parties meeting held in Marrakech in 2001, the special conditions of Turkey which has a different position than the other countries in the Annex-I list of the Convention, were recognized and it was decided that its name will remain on the Annex-I while it will be removed from the Annex-II list.

The process that is started when Turkey is recognized as an Annex-I country having special conditions different from the other parties of the Convention, has affected and accelerated the country's political decision of being a party of the Kyoto Protocol.

Around five years after becoming a part of the Convention, in February 2009, "The Law on the convenience of Turkey's entrance to the Kyoto Protocol for the United Nations Framework Convention on Climate Change" came into force, in May 2009, Turkey's entrance to the Kyoto Protocol was documented and sent to the General Secretariat of the United Nations. The whole ratification process of the Protocol was completed in 26 August 2009.

As a country that ratified the UN Convention Framework on Climate Change and the Kyoto Protocol, Turkey has taken the responsibilities described under UNFCCC, that are related to the adaptation to the effects of the climate change which are imposed to the parties. The issues of some of the international UN conventions that Turkey is a party are also indirectly related with the adaptation to the effects of the climate change. These are; Convention to Combat Desertification, Convention on Biological Diversity, Bern Convention on the Conservation of European Wildlife and Natural Habitats, Conventions for the Protection of Mediterranean Sea and the Black Sea Against Pollution and its additional protocols. *(Ministry of Environment and Urbanization, 2011).*

Within this scope, adaptation to climate change and actions towards mitigation of potential impacts of climate change are regulated through a variety of national legislation including topics such as disaster risk management, conservation of biodiversity, water safety and security, food safety and security.

IFC Standards

IFC has established the Performance Standards on Environmental and Social Sustainability and relevant guidance notes. IFC Performance Standard (PS) 3 on Resource Efficiency and Pollution Prevention states that; for projects that are expected to or currently produce more than 25,000 tons of CO_2eq annually, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. It suggests the client to consider alternatives and implement technically and financially feasible and cost-effective options to reduce project related GHG emissions during the design and operation of the project which may include, but not limited to, alternative project locations, adoption of renewable or low carbon energy sources, sustainable agricultural, forestry and livestock management practices, the reduction of fugitive emissions and the reduction of gas flaring. Another requirement of PS 3 is quantification of GHG emissions which will be conducted by the client annually in accordance with internationally recognized methodologies and good practice.

6.3.3. Potential Impacts

The Apa GES Project will have a positive impact in terms of prevention of climate change through the reduction of greenhouse gas emissions during the operation phase. Instead of using facilities/plants based on the burning of fossil fuels in electricity generation, the use of a power plant based on renewable resources such as Apa GES will reduce the amount of pollutant/greenhouse gases emitted into the air. Table 6.26 provides samples from different sources for CO_2 emissions to the air as a result of generating electricity in facilities/plants based on fossil fuels instead of solar power plants. The Apa GES Project will have an installed capacity of 13.1 MWe and will produce 26,200 MWh electricity in annual average. Thanks to electricity production based on photovoltaic technology instead of facilities/plants based on fossil fuels, about 18,000 tons of CO_2 savings in annual average will be made by the Apa GES Project (considering average value of 716 kg/year.MWh for CO_2 emission).

Table 6.26. CO_2 Emission Amount per MWh for Fossil Fuels-Based Electricity Generation (kg/year.MWh)

Pollutant	Source	Amount of Emission (kg/year.MWh)
CO_2	USA Ministry of Interior, Land Management Bureau (July 2012)	716
	UCTEA (Union Of Chambers Of Turkish Engineers and Architects) The Chamber of Electrical Engineers Izmir Branch (2013)	443-960

CHAPTER 7

NOISE

7. NOISE

This chapter assesses the likely noise impacts of the Project and includes the following:

- Baseline environmental noise level,
- Assessment and quantification of potential project noise sources,
- Assessment of potential noise impacts,
- Mitigation measures regarding noise impacts, and
- Residual impacts regarding noise impacts.

7.1. Baseline Conditions

Noise is defined as undesired sound that is loud or unpleasant or that causes disturbance. Sound consists of vibrations transmitted to the ear as rapid variations in air pressure. The fluctuations in atmospheric pressure are sensed by the ear. Frequency is the number of pressure fluctuations per second and is expressed in Hertz (Hz). In other words, the frequency of sound is the rate at which a sound wave oscillates, measured in number of cycles per second. The human ear is more sensitive to frequencies important for voice communication and hearing sensitivity decreases markedly at frequencies below about 250 Hz. The upper frequency limit of audibility is around 20 kHz. Human ear can respond to a wide range of amplitudes and frequencies of sound.

The response of the hearing system to the amplitude of sound pressure is non-linear and can be characterized by a logarithmic relationship. The relationship is also frequency dependent and an adjustment or weighting is applied to the response of a microphone to different frequency components of a sound in order to produce a scale that better reflects the hearing system.

Sound pressures are measured in units of Pascals (Pa). In order to cope with such a range of sound pressure values it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as sound pressure levels in decibels (dB).

Several different weightings have been proposed to convert measured sound pressure to a measure that correlates with perceived loudness in different circumstances. The ‘A’ weighting can be accepted as the most commonly used.

Turkish Legal Requirements

Environmental noise in Turkey is regulated by the Regulation on the Assessment and Management of Environmental Noise (RAMEN) which is published on 04.06.2010 in Official Gazette No: 27601. This regulation is intended to ensure that precautions are taken to prevent disturbance to peace and tranquility, and to ensure the physical and mental health of persons potentially exposed to environmental noise. For this purpose the regulation sets out requirements regarding noise mapping, acoustic reporting, environmental noise assessment for determination of noise exposure levels and preparation and application of action plans to prevent or mitigate negative impacts of noise exposure on human being and environment.

According to the RAMEN, noise limit values are defined in Annex VII, Table 4 Environmental noise limits defined in the regulation are presented in Table 7.1.

Table 7.1. Environmental Noise Limits for Industrial Plants

Areas	L_{day} **(dBA)**	$L_{evening}$ **(dBA)**	L_{night} **(dBA)**
Educational, cultural and health facilities as noise sensitive areas, and places densely populated with summer houses and camp grounds	60	55	50
Areas densely populated with residences among the areas containing commercial structures and noise sensitive structures all together	65	60	55
Areas with dense work places among the areas containing commercial structures and noise sensitive structures all together	68	63	58
Industrial Areas	70	65	60

For construction activities noise limit values are defined in Table 5 Appendix VII of RAMEN and presented in Table 7.2.

Table 7.2. Environmental Noise Standards for Construction

Type of Activity (Construction, Demolition and Repair)	L_{day} **(dBA)**
Building	70
Road	75
Other Sources	70

IFC Standards

Noise limit levels are described under, Environmental, Health and Safety (EHS) Guidelines, General EHS Guidelines: Environmental Noise. The noise limit values are based on World Health Organization Guidelines for Community Noise. Noise levels defined by IFC are presented in Table 7.3.

Table 7.3. Noise Level Guidelines of IFC

Receptor	**One Hour** L_{Aeq} **(dBA)**	
	Daytime 07:00 – 22:00	**Nighttime 22:00 – 07:00**
Residential, institutional, educational	55	45
Industrial, commercial	70	70

IFC requires that noise impacts should not exceed the levels presented in Table 7.3, or result in a maximum increase in background noise levels of 3 dB at the nearest receptor location off-site.

The IFC EHS Guideline also presents examples of noise reduction options that should be considered where noise levels exceed these guideline values, along with recommendations for noise monitoring to be carried out either to establish existing ambient noise levels or to verify operational noise levels.

Noise Measurements

The Project does not have a noise source by its nature except the leveling, excavation works, construction of Project structures and installation activities to be performed during the land preparation and construction phase and these will be carried out in a limited level. However, before the construction phase of the Project started, noise measurements were carried out to determine the background noise level within the scope of EIA process. The result of the noise measurements made at the nearest house to the Project Area in Apa neighborhood is presented in Table 7.4.

Table 7.4. Background Noise Levels Measured at Nearest House to the Project Area

Location	Measurement Coordinates		Date of measurement	Measurement Results (Leq) (dBA)		
	X	Y		Daytime (07:00-19:00)	Evening (19:00-23:00)	Night (23:00-07:00)
Apa Neighborhood	4136412	459684	23-24.03.2016	60.0	57.9	55.3

As can be seen from the table, the background noise levels are relatively high in the neighborhood where no industrial work has taken place. During the noise measurements, sources that might affect the background noise levels such as daily activities, animal noises, weather conditions, etc. at the settlement have been recorded. Especially the wind observed during the measurements might be the reason for a relatively higher noise levels than the acceptable normal levels for rural areas. In addition to this, the measured noise levels in all time zones (daytime, evening and night) are below the threshold noise levels defined in RAMEN. A photograph taken while the measurement is being performed is presented in Figure 7.1.

Figure 7.1. Noise Measurement Study

7.2. Potential Impacts

7.2.1. Land Preparation and Construction Phase

Noise generation from machinery and equipment to be used on the site during the land preparation and construction phase is quite possible. At this phase, pile driving of the solar panel legs will be the most intense noise generating activity. Other activities might also generate noise to certain extent.

The list of machinery and equipment, which will be used during the land preparation and construction phase and are likely to cause noise, and their number and noise intensity levels are presented in Table 7.5. For the machinery and equipments that are likely to cause noise, noise levels were calculated according to noise intensity levels defined in Article 5 of the Regulation on the Environmental Noise Emission Created by the Equipment Used Outdoors.

Table 7.5. Machinery and Equipment and their Noise Intensity Levels (Lw)

Machinery and Equipment	Number	Noise Intensity Level* (dB)
Earth Digger	2	104
Excavator	1	104
Dozer	1	106
Wheeled Loader	1	104
Mini Loader (Bobcat)	2	104
Truck	2	104
Water Truck	1	104
Pile Driving Machine (Pressurized)	4	114
Concrete Batching Mixer	1	104
Concrete Pump	1	104
Crane	1	104
Tractor	1	104
Trencher	1	96

**Source: Regulation on the Environmental Noise Emission Created by the Equipment Used Outdoors, 2006*

While the unit of noise intensity levels provided in Table 7.5 is dB, the unit of noise level reaching a particular distance is dBA. Correction factors given in Table 7.6 were used to convert the units from dB to dBA. The frequency intervals of machinery used in industry is generally about 500-8000 Hz. As it can be seen in Table 7.6, noise levels are not changing significantly at this frequency interval. For this reason, the dBA values of the machinery equipments are accepted to be equal to dB values.

Table 7.6. Correction Factors Used to Convert Noise Level Units (from dB to dBA)

Frequency (Hz)	31.5	63	125	250	500	1000	2000	4000	8000
Correction Factors	-40	-27	-15	-10	-3	0	1	1	-1

Within the scope of the worst case scenario approach adopted in the calculations, noise assessment was made assuming that all of the machinery and equipments listed above were operating simultaneously at maximum noise intensity levels at three different work sites within the Project Area. Designated work sites are; south-southeast section of the solar panels' location where the solar panels are closest to Apa neighborhood (Work Site 1), northwest section of the solar panels' location (Work Site 2) and switchyard (Work Site 3). The distances of the designated work sites to the nearest residential building considered as the receiver are presented in Table 7.7.

Table 7.7. Designated Work Sİtes

Work Site	Description of Location	Distance to the Nearest Building in Apa Neighborhood (m)
Work Site 1	Plant Site (south-southeast section of the solar panels' location)	130
Work Site 2	Plant Site (northwest section of the solar panels' location)	540
Work Site 3	Switchyard	165

The activities to be performed in the designated sites will temporarily cause an increase in noise level around Project Area. The assessment of the change in noise level due to the mentioned activities in Apa neighborhood, that is the closest residential area to the Project Area located in the south-southeast direction, has been made with the noise calculations presented in detail below. The calculations have been performed according to the worst case scenario that all the machinery and equipments were operating simultaneously at the maximum noise intensity levels at the three work sites defined in Table 7.7.

The formulas given below were used for the calculation of noise levels regarding land preparation and construction phase of the Project. While Formula (1) is used to calculate total noise level at the source according to noise intensity level of each equipment, Formula (2) is used to calculate the noise level that reaches a definite distance (Lpt).

$$Lwt = 10 \log \Sigma n İ=1\ 10Lwi/10 \quad (1)$$
$$Lpt = Lwt + 10\log (Q/4\pi r2) \quad (2)$$

L_{wt} : Noise level at the source
L_{pt} : Noise level that reaches a defined distance
Q : Orientation coefficient/atmospheric reduction factor
r : Distance from the source

In the equations given above, it is accepted that construction equipment and machinery are used at the same physical location, non-stop at maximum noise intensity levels (worst case scenario). Therefore, it is expected that in reality noise level caused by construction activities will be much smaller than the worst case scenario calculation result.

The foreseen distribution of machinery and equipment according to the designated work sites is given in Table 7.8.

Table 7.8. Distribution of Machinery and Equipment According to Work Sites

Machinery and Equipment	Work Site 1	Work Site 2	Work Site 3
Earth Digger	1	1	-
Excavator	-	-	1
Dozer	-	-	1
Wheeled Loader	-	-	1
Mini Loader (Bobcat)	1	1	-
Truck	1	-	1
Water Truck	1	-	-
Pile Driving Machine (Pressurized)	2	2	-
Concrete Batching Mixer	-	-	1
Concrete Pump	-	-	1
Crane	1	-	-
Tractor	1	-	-
Trencher	1	-	-

The calculations have been performed separately for each work site. Moreover, the values obtained for each study area are summed up with the background noise level logarithmically. Hence, the cumulative environmental noise level caused by the construction activities has been determined at the nearest receiver.

Work Site 1

The calculations for the noise level caused by the machinery and equipment to be used during land preparation and construction phase in Work Site 1, which is located in the south-southeast direction of the Project Area, 130 m distance from the nearest building in Apa neighborhood that is defined as the receiver, have been performed as follows according to the total noise intensity levels of the machinery and equipments:

$$L_{wt} = 10 \log \Sigma^{n}_{i=1} 10L^{wi/10}$$
$$L_{wt} = 10 \log (1x10^{10.4}+1x10^{10.4}+1x10^{10.4}+1x10^{10.4}+2x10^{11.4}+1x10^{10.4}+ 1x10^{10.4}+1x10^{9.6})$$
$$L_{wt} = \mathbf{118.2\ dBA}$$

The calculation of noise level that reaches to the nearest building at Apa neighborhood (receiver) is as follows:

$$L_{pt} = L_{wt} + 10\log (Q/4\pi r^2)$$

L_{wt} : Noise level at the source
L_{pt} : Noise level that reaches a defined distance
Q : Orientation coefficient/atmospheric reduction factor (2)
r : Distance from the source (130 m)

$$L_{pt\ (130m)} = 118.2 + 10 \log (2/4x3.14x130^2)$$
$$L_{pt\ (130m)} = \mathbf{67.9\ dBA}$$

The decrease of noise generated at Work Site 1 with distance is presented in tabular format in Table 7.9 and graphically in Figure 7.2. Environmental noise level decreases below the limit value defined for construction activities (70 dBA) in RAMEN at a distance about 100 m from the source. The nearest house to the work site accepted as receptor is located at Apa neighborhood that is about 130 m away. Noise level encountered in the source is expected to decrease to 67.9 dBA at this distance for the worst case scenario.

Table 7.9. Distribution of Noise Generated in Work Site 1 Relative to Distance

Distance (m)	L_{pt} (dBA)	Distance (m)	L_{pt} (dBA)
15	86.7	400	58.2
30	80.7	500	56.2
50	76.2	600	54.6
100	70.2	700	53.3
130	**67.9**	800	52.1
150	66.7	900	51.1
200	64.2	1000	50.2
300	60.7		

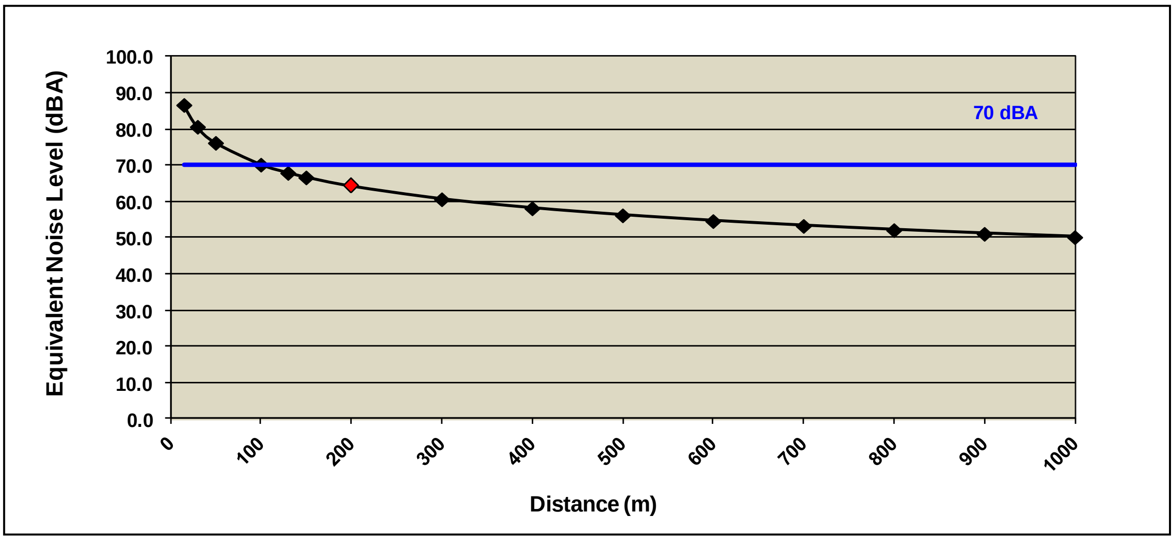


Figure 7.2. Distribution of Noise Generated in the Work Site 1 Relative to Distance

Work Site 2

The calculations for the noise level caused by the machinery and equipment to be used during land preparation and construction phase in Work Site 2, which is located in the northwestern direction of the Project Area, 540 m distance from the nearest building in Apa neighborhood that is defined as the receiver, have been performed as follows according to the total noise intensity levels of the machinery and equipments:

$$L_{wt} = 10 \log \Sigma^{n}_{i=1} 10L^{wi/10}$$
$$L_{wt} = 10 \log (1x10^{10.4}+1x10^{10.4}+2x10^{11.4})$$
$$L_{wt} = \mathbf{117.4\ dBA}$$

The calculation of noise level that reaches to the nearest building at Apa neighborhood (receiver) is as follows:

$$L_{pt} = L_{wt} + 10\log (Q/4\pi r^2)$$

L_{wt} : Noise level at the source
L_{pt} : Noise level that reaches a defined distance
Q : Orientation coefficient/atmospheric reduction factor (2)
r : Distance from the source (540 m)

$$L_{pt\ (540m)} = 117.4 + 10 \log (2/4x3.14x540^2)$$
$$L_{pt\ (540m)} = \mathbf{54.8\ dBA}$$

The decrease of noise generated at Work Site 2 with distance is presented in tabular format in Table 7.10 and graphically in Figure 7.3. Environmental noise level decreases below the limit value defined for construction activities (70 dBA) in RAMEN at a distance about 95 m from the source. The nearest house to the work site accepted as receptor is located at Apa neighborhood that is about 540 m away. Noise level encountered in the source is expected to decrease to 54.8 dBA at this distance for the worst case scenario.

Table 7.10. Distribution of Noise Generated in Work Site 2 Relative to Distance

Distance (m)	L_{pt} (dBA)	Distance (m)	L_{pt} (dBA)
15	85.9	500	55.5
30	79.9	**540**	**54.8**
50	75.5	600	53.9
100	69.4	700	52.5
150	65.9	800	51.4
200	63.4	900	50.4
300	59.9	1000	49.4
400	57.4		

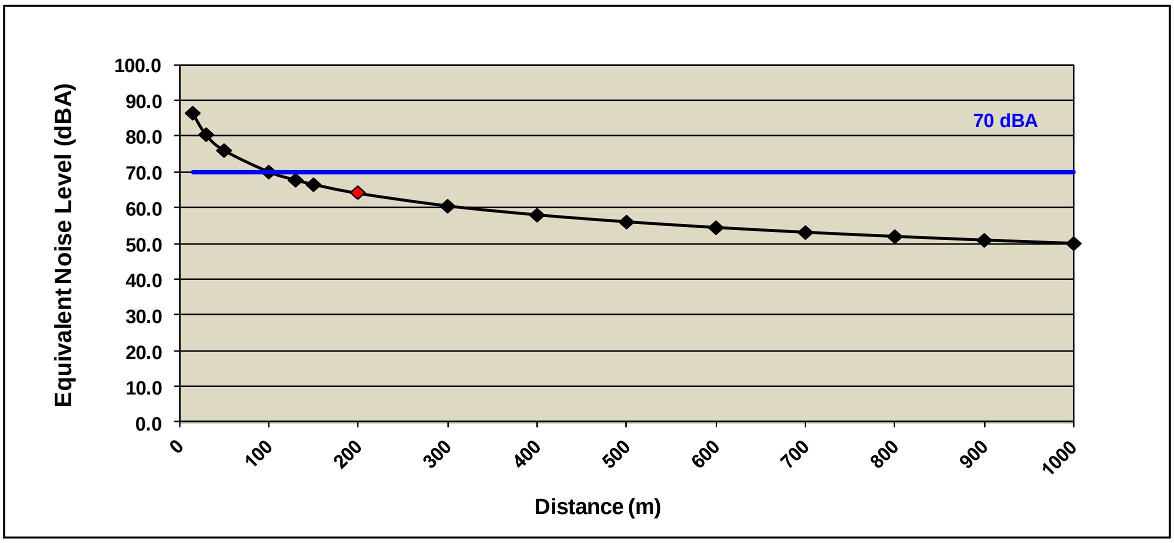


Figure 7.3. Distribution of Noise Generated in Work Site 2 Relative to Distance

Work Site 3

The calculations for the noise level caused by the machinery and equipment to be used during land preparation and construction phase in Work Site 3, which is located in the south direction of the Project Area, 165 m distance from the nearest building in Apa neighborhood that is defined as the receiver, have been performed as follows according to the total noise intensity levels of the machinery and equipments:

L_{wt} = $10 \log \Sigma^{n}_{i=1} 10L^{wi/10}$
L_{wt} = $10 \log (1x10^{10.4}+1x10^{10.4}+1x10^{10.6}+ 1x10^{10.4}+1x10^{10.4}+1x10^{10.4})$
L_{wt} = **112.2 dBA**

The calculation of noise level that reaches to the nearest building at Apa neighborhood (receiver) is as follows:

L_{pt} = $L_{wt} + 10\log (Q/4\pi r^2)$

L_{wt} : Noise level at the source
L_{pt} : Noise level that reaches a defined distance
Q : Orientation coefficient/atmospheric reduction factor (2)
r : Distance from the source (165 m)

$L_{pt\,(540m)}$ = 112.2 + 10 log (2/4x3.14x165^2)
$L_{pt\,(540m)}$ = **59.9 dBA**

The decrease of noise generated at Work Site 3 with distance is presented in tabular format in Table 7.11 and graphically in Figure 7.4. Environmental noise level decreases below the limit value defined for construction activities (70 dBA) in RAMEN at a distance about 52 m from the source. The nearest house to the work site accepted as receptor is located at Apa neighborhood that is about 165 m away. Noise level encountered in the source is expected to decrease to 59.9 dBA at this distance for the worst case scenario.

Table 7.11. Distribution of Noise Generated in Work Site 3 Relative to Distance

Distance (m)	L_{pt} (dBA)	Distance (m)	L_{pt} (dBA)
15	80.7	400	52.2
30	74.7	500	50.2
50	70.2	600	48.6
100	64.2	700	47.3
150	60.7	800	46.1
165	**59.9**	900	45.1
200	58.2	1000	44.2
300	54.7		

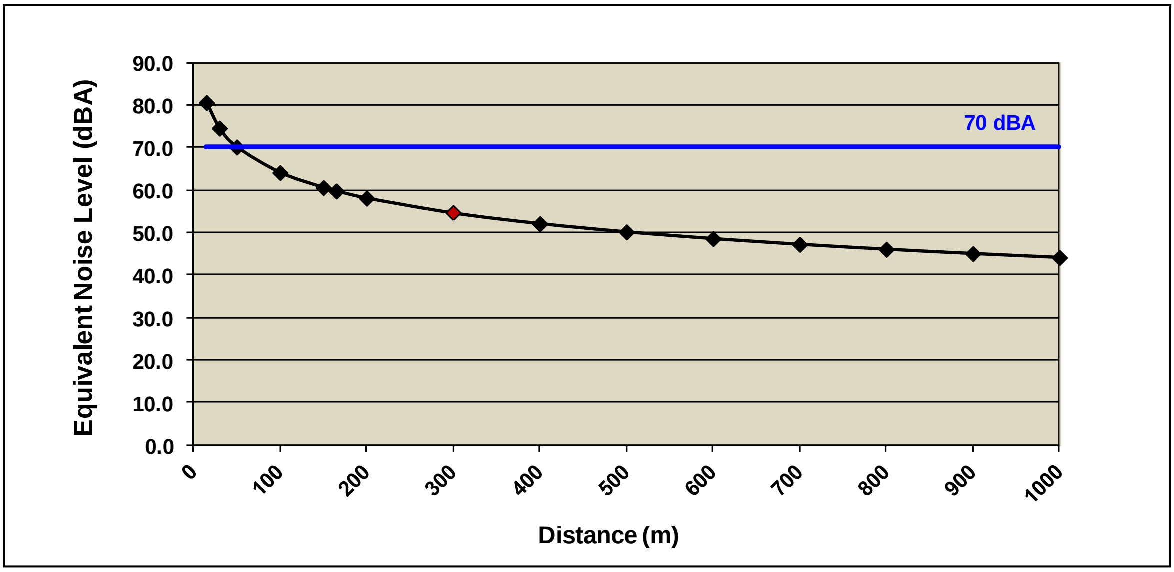


Figure 7.4. Distribution of Noise Generated in Work Site 3 Relative to Distance

According to the calculations made for the different Work Sites above, the noise that will be generated at the site during the land preparation and construction phase of the Project will cause a cumulative impact on the background noise level by reaching the nearest building in the Apa neighborhood at different levels. In this context, the cumulative noise level expected at the settlement is calculated numerically by logarithmically adding of the noise resulting from the construction activities to the background noise level measured at the settlement (see Table 7.12).

Table 7.12. Estimated Noise Level around the Nearest Building in APA Neighborhood

Settlement	Background Noise Level (dBA)	Working Site (dBA)			Cumulative Noise Level (dBA)	RAMEN Daytime Noise Limit (dBA)
		1	2	3		
Apa Neighborhood	60.0	67.9	54.8	59.9	69.3	70

In the worst-case scenario, as indicated in Table 7.12, the maximum noise level to occur around the nearest building considered as a receiver in the Apa neighborhood is 69.3 dBA. This value provides the construction noise limit value defined in the RAMEN. In the worst case scenario, all construction machinery and equipments were operating simultaneously at maximum noise intensity levels, the expected noise level reaching to the nearest building in the Apa neighborhood is below the daytime noise limit value (70 dBA) allowed by the RAMEN.

On the other hand, it is unlikely in reality that all construction machinery and equipments are used at the same physical location and non-stop at maximum noise intensity levels (worst case scenario). In addition, as the construction activities will occur outdoors, it is expected that there will be a decrease in noise level depending on the distance due to the atmospheric reduction in real conditions. Similarly, topographic conditions and vegetation cover are among the factors that could reduce the impact during the spread of noises. However, since calculations are based on the worst case approach, factors such as effect of location, atmospheric reduction, topographic conditions, vegetation cover, etc. have not been taken into consideration. According to all these evaluations, it is expected that in real terms the noise level at Apa neighborhood will be lower than the calculated value during land preparation and construction activities of the Apa GES Project.

As the noise to be generated at the Project Area during the land preparation and construction activities could have an impact beyond the borders of the Project Area during certain times of the 4 months temporary land preparation and construction phase and the background noise level at certain parts of Apa neighborhood could increase within the limit values of RAMEN, the magnitude of the noise impact is defined as “local”. In determining the severity of impact, the areas defined in RAMEN Annex-7 have been taken into account and the sensitivity of receptor has been identified as “medium”. Accordingly, the significance of noise impact is assessed as “medium” (see Table 7.13).

Table 7.13. Assessment of Noise Impact

Impact Issue	Magnitude of Impact	Severity of Impact			Significance of Impact
		High (3)	Medium (2)	Low (1)	
Noise	Local (B)	Educational, cultural and health facilities as noise sensitive areas, and places densely populated with summer houses and camp grounds	Areas densely populated with residences among the areas containing commercial structures and noise sensitive structures all together	Areas with dense work places among the areas containing commercial structures and noise sensitive structures all together and industrial areas	Medium (B2)

7.2.2. Operation Phase

In photovoltaic solar power plants in operation, inverters, transformer and other electrical equipment could cause buzzing around themselves during daytime hours when electricity energy is produced. However, there will not be a noise impact due to the operation of equipments in the facility that might cause an impact on the receivers outside the facility or the security personnel working in the facility. Therefore, the significance of the noise impact during operation phase would be “low”.

7.3. Mitigation Measures

7.3.1. Land Preparation and Construction Phase

The machinery and equipments to be used during the land preparation and construction activities will not be operated at the same point/location but homogeneously distributed in the site. This will enable noise level be at reasonable levels and not to exceed related limit values defined in RAMEN during the land preparation and construction phase of the Project. Nevertheless, it will be ensured that machinery and equipments are not operated together in the close section of the Project Area to the Apa neighborhood (south-southeast direction) so that the noise level at the Apa neighborhood does not exceed the regulatory limit values.

In order to minimize the noise that will be generated within the scope of the Project; the maintenance of the construction machinery and equipments will be carried out regularly and speed limitations will be defined and obeyed for construction vehicles. The Project Owner will designate a liaison staff, in case of complaints related with noise that could be received from Apa neighborhood, for the evaluation of the complaints and where necessary, for the planning and implementation of corrective actions. Prior to pile driving activities, local people will be informed about the activity and its duration through headman of Apa neighborhood. In the selection of power plant equipments, sound power levels of the equipments will be taken into account.

During the land preparation and construction phase of the Project, noise monitoring activities will be performed according to the monitoring plan and the impact of noise on the settlements in the vicinity will be controlled/followed. If monitoring activities indicates any inconsistency with the relevant regulatory noise limit values, corrective actions will be taken in order to decrease the noise level to regulatory limit values.

7.3.2. Operation Phase

The Project Owner will take into account the sound power levels of the equipments given in the technical specifications/data sheet, in the selection of inverter, transformer and other electrical equipments. Moreover, relevant provisions and limit values of RAMEN will be complied with during the operation of the power plant.

7.4. Summary of Assessment and Residual Impacts

Table 7.14 provides a summary of noise impact assessments. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 7.14. Summary of Noise Impact Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Local Communities	Land preparation and construction	Increase in noise levels	Adverse	Medium	• The machinery and equipments to be used during the land preparation and construction activities will not be operated at the same point/location but homogeneously distributed in the site. This will enable noise level be at reasonable levels and not to exceed related limit values defined in RAMEN during the land preparation and construction phase of the Project. • It will be ensured that machinery and equipments are not operated together in the close section of the Project Area to the Apa neighborhood (south-southeast direction) so that the noise level at the Apa neighborhood does not exceed the regulatory limit values. • In order to minimize the noise that will be generated within the scope of the Project; the maintenance of the construction machinery and equipments will be carried out regularly and speed limitations will be defined and obeyed for construction vehicles. • The Project Owner will designate a liaison staff, in case of complaints related with noise that could be received from Apa neighborhood, for the evaluation of the complaints and where necessary, for the planning and implementation of corrective actions. • Prior to pile driving activities, local people will be informed about the activity and its duration through headman of Apa neighborhood.	Low
	Operation	Increase in noise levels	Adverse	Low	• The Project Owner will take into account the sound power levels of the equipments given in the technical specifications/data sheet, in the selection of inverter, transformer and other electrical equipments. Moreover, relevant provisions and limit values of RAMEN will be complied with during the operation of the power plant.	Low

CHAPTER 8

WATER RESOURCES

8. WATER RESOURCES

This Chapter identifies hydrogeological and hydrological characteristics of the Project Area and the region based on literature and sampling and water quality studies. Potential impacts, measures proposed for the mitigation of these impacts and the residual impacts on water resources are also described in this Chapter.

8.1. Baseline Conditions

8.1.1. Hydrogeology

Regional Hydrogeology

The APA GES Project is located within the boundaries of Konya Closed Basin. This basin covers an area of 4,980,534 hectares and surrounded by Sakarya and Kizilirmak basins in the north, Kizilirmak and Seyhan basins in the east, Eastern Mediterranean basin in the south, Antalya and Akarcay basins in the west. The drainage in the basin, which covers a large part of the Central Anatolian Plateau, is insufficient and therefore the soil is generally salted. It is defined as closed watershed because the waters do not reach to the sea due to its topographical position and discharge occurs in lake and swamp environments within the basin (*TUBITAK-MAM, 2010*).

The average annual flow of the Konya Closed Basin is determined $6.04x10^9$ m^3 (3.39 $L/s.km^2$) and this figure represents approximately 3.29% of the total surface water potential of Turkey. The average available surface water ratio is calculated as $3.02x10^9$ m^3/year assuming that the available surface water ratio corresponds to about 50% of the total water ratio. On the other hand, groundwater potential in the basin is $2,629.3x10^6$ m^3/year and groundwater operation reserve is determined as $1.972x10^6$ m^3/year with the assumption that it is about 70-80% (taken as 75%) of the groundwater potential (*TUBITAK-MAM, 2010*). Table 8.1 shows the location of the groundwater operation reserve of the basin within 11 basins where groundwater operation reserves have been determined in Turkey.

Table 8.1. Groundwater Condition for 11 Basins (*TUBİTAK-MAM, 2010*)

Basin Name	Basin No	GW Operation Reserve (hm^3/year)	Given Allocation Documents for Various Purposes (hm^3/year)	Allocated GW Reserve to Irrigation Projects (hm^3/year)	Planned Irrigation Area with GW Irrigation Projects (Decare)	Planned Well Number with GW Irrigation Projects (number)	Transferred Well with Constructed GW Irrigation Project (Name)	Transferred Well Area with Constructed GW Irrigation Project (Decare)
Marmara	2	296.96	273.73	23.98	31,000.00	86	56	19,610.00
Susurluk	3	503.29	284.80	71.621	113,832.00	280	141	53,105.00
North Aegean	4	186.66	119.01	56.48	63,590.00	198	175	77,800.00
K. Menderes	6	185	112.61	68.235	81,199.00	315	220	77,815.00
B. Menderes	7	700.24	137.00	169.44	260,025.00	623	400	156,845.00
Burdur	10	43	25.86	129.048	193,627.00	561	435	151,475.00
Yesilirmak	14	456.62	167.81	146.34	207,400.00	528	355	140,680.00
Kizilirmak	15	1,023.30	354.58	1,052.09	478,716.00	1,125	693	287,135.00
Konya	16	1,972.00	285.74	1,559.911	2,256,364.00	4.634	3,794	1,773,650.00
Seyhan	18	223.50	254.93	15.52	25,658.00	77	50	15,360.00
Ceyhan	20	558.90	449.93	155.08	212,470.00	420	180	74,310.00

The total water potential of the basin is calculated as 8.7x10^9 m^3/year considering the surface water potential of 6.04x10^9 m^3 and groundwater potential of 2,629.3x10^6 m^3/year and the available water potential in the basin is calculated as 8.7x10^9 m^3/year considering the available surface water of 3.02x10^9 m^3/year and the groundwater operation reserve of 1,972.0x10^6 m^3/year.

There are Konya, Cumra, Karapinar, Cihanbeyli, Yeniceoba, Kulu, Karaman-Ayranci and Eregli plains in the Konya Basin. The water-bearing formations in the plains of Konya, Cumra and Karapinar are Paleozoic aged crystallized limestones and marbles, Mesozoic (upper cretaceous) aged limestones, Neogene aged limestones and Plio-Quaternary aged deposits. Water-bearing formations in Cihanbeyli Plain are Upper Miocene aged limestones. Apart from these, Pliocene aged sand and gravels are not important but they carry groundwater. The sand and gravels forming the alluvium in the Kulu Plain and the Pliocene aged pebbles are the most important water-bearing units. The Eocene aged flysch sandstone levels that spread in the western part of Kulu district contain groundwater in some parts. The water-bearing formation in Karaman-Ayranci plain consists of pebbles and Neogen limestones that are overlain by 25-50 m thick clay layer. The water bearing formation in Eregli plain consists of Neogene aged clayey, sandy, pebbly sequences or Oligocene aged conglomerate and gypsum sequences. Basin groundwater potential is 2629.3x10^6 m^3/year and the operation reserve is calculated as approximately 1,972.0x10^6 m^3/year, assuming that the operation reserve corresponds to 75% of the potential of groundwater potential. Total water potential is 8.7x10^9 m^3/year in the basin with 6.04x10^9 m^3/year surface water potential (*TUBITAK MAM, 2010*). The total groundwater potential of Konya Province is 1,508 hm^3/year (*Konya Governorship Provincial Directorate of Environment and Urbanization, Konya Province Environmental Status Report for 2014, 2015*).

Neogene aged limestones and marls have highest potential in terms of groundwater potential in the plain. This is found in Cumra district and its vicinity (where the Project Area is located as well) and is located at an average depth of 5 m. The general flow direction of the groundwater in the region is from southwest to northeast (*TUBITAK MAM, 2010*). While months which have the lowest groundwater level in the region, including Cumra Plain, are November, December and January, months which have the highest groundwater level in the region are April, May and June (*TUBITAK MAM, 2010*). The variation observed in the groundwater level between 2006 and 2007 in the Cumra district is presented in the graph given in Figure 8.1 (*Gocmen et.al, 2008*).

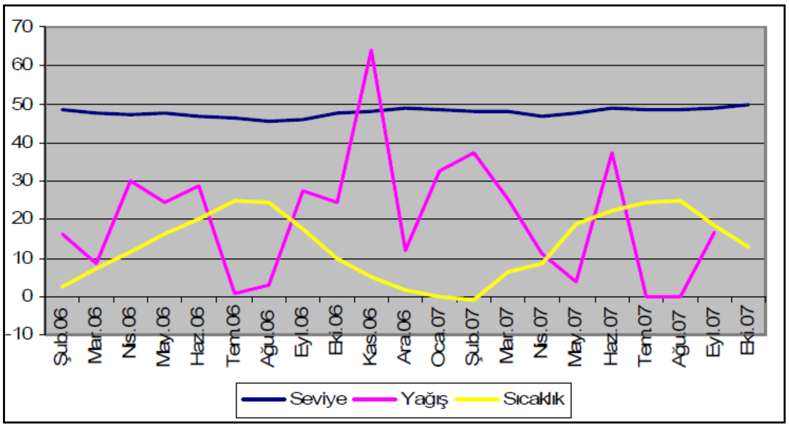


Figure 8.1. Groundwater Level in Cumra District, Relation to Precipitation and Temperature (*Gocmen vd., 2008*)

Within the DSI 4th Regional Directorate's groundwater well inventory study, as of 2009, a total of 27,140 licensed wells were identified, including 4,768 cooperative wells and 22,372 private wells in the basin. With the addition of 66,808 unlicensed private wells identified, there are a total of 93,948 groundwater wells in the basin. As of 2012, this number is estimated to exceed 100 thousand (*Ministry of Development, KOP Regional Development Administration, 2012*). Due to this intense water extraction, precipitation to the basin is not enough to supply the groundwater reserve (*Gocmen et.al, 2008*). In the present case, the yields of the wells drilled in Cumra district are in the levels of 15-60 Lt/sec (*TUBITAK MAM, 2010*).

There are a total of 27 irrigation cooperatives in Cumra district. When Table 8.2, which shows the flow rate used by the cooperatives established in the district, are examined (information of 25 flow rate data from 27 cooperatives are presented), it is seen that the flow rates used vary between 110–4,780 Lt/h (*Uzunlu, 2008*).

Table 8.2. Distribution of Cooperatives According to Total Flow Rate in Cumra District (Uzunlu, 2008)

Total Flow Rate (Lt/sec)	Total Cooperative Number	Percent (%)
110- 250	4	16.0
251- 500	5	20.0
501- 1000	5	20.0
1001–2000	5	20.0
2001–4780	6	24.0
Total	**25**	**100.0**

Project Area Hydrogeology

A map showing the groundwater levels and flow directions in the Project Area and its vicinity is presented in Figure 8.2 (*Goçmen et.al., 2008*). As can be seen from this map, the flow of groundwater in the Project Area and its vicinity is towards northeast, similar to the conditions in the basin in general.

According to the Preparation of Basin Conservation Action Plans-Konya Closed Basin Report prepared by TUBITAK MAM, around the Apa Dam which is located approximately at 1 km south of the Project Area, groundwater recharge can be observed at Neogene aged limestones and marls. In the area where the groundwater is being recharged, the depth of the groundwater level changes between 18-30 m at Apa Dam and vicinity of Apasaraycik. From this location towards the northeast of the Project Area, in the groundwater direction (vicinity of Alibeyhuyugu), the groundwater level reaches up to 1.5-3 m (*TUBITAK MAM, 2010*).

In the region where the Project Area is located, there are groundwater wells and fountains for the purpose of water supply to local people living in Apa neighborhood. At the immediate east-northeast of the Project Area, there is a dry well which is not in use. Currently, water demand of Apa neighborhood is supplied from one main and one spare water well located at the east-northeast of this well. These wells are operated with electrical pumps powered from the national grid and it is learned that there is no continuity in their operation due to the electricity requirement.

Within the scope of EIA studies, groundwater sample was taken on 23.03.2016 from Haci Mehmet and Ayse Elmaci Hayrati fountain in the Apa neighborhood, adjacent to the Project Area, and analyzes were carried out. The analysis results are given in Table 8.3 and map showing the sampling point is presented in Figure 8.3.

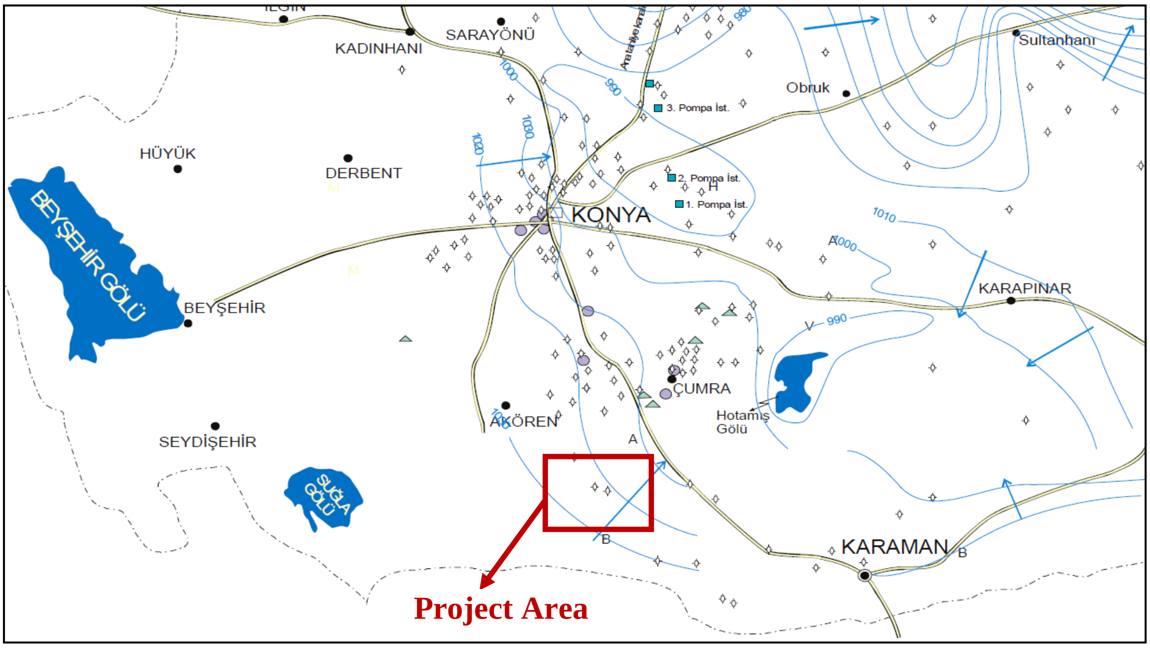


Figure 8.2. Groundwater Table and Flow Direction Map in the Southern Section of the Konya Closed Basin (*Modified from Gocmen vd., 2008*)

Table 8.3. Groundwater Analysis Results (Apa Neighborhood)

Parameter	Unit	Analysis Result
Aluminum	mg/L	<0.1
Ammonium Nitrogen	mg/L	<0.20
Arsenic	µg/L	<2.0
Copper	µg/L	7.31
Barium	µg/L	<100.0
Biochemical Oxygen Demand	mg/L	<3.00
Boron	µg/L	<100.0
Mercury	µg/L	<0.1
Zinc	µg/L	<100.0
Dissolved Oxygen	mg/L	8.48
Dissolved Oxygen Saturation	%	94.3
Iron	µg/L	<100.0
Fecal Coliform	kob/100 mL	0
Fluoride	µg/L	79.9
Conductivity	µS/cm	473.0
Cadmium	µg/L	<0.5
Chemical Oxygen Demand	mg/L	6.14
Cobalt	µg/L	<3.0
Chromium	µg/L	<3.0
Chrome $^{+6}$	µg/L	<20.0
Lead	µg/L	<10.0
Manganese	µg/L	<100.0
Nickel	µg/L	<3.0
Nitrate nitrogen	mg/L	2.895
Nitrite nitrogen	mg/L	0.005
pH	-	8.01
Color	m^{-1}	RES 436: <0.45; RES 525: <0.37; RES 620: <0.016
Selenium	µg/L	<1.0
Free Chlorine	µg/L	78.0
Temperature	°C	14.8
Sulphur	µg/L	<2.0
Total Phosphorus	mg/L	0.104
Total Kjeldahl Nitrogen	mg/L	2.38
Total Coliform	kob/100 mL	220.0
Total Cyanide	µg/L	<10.0
Oil and grease	-	Not observed

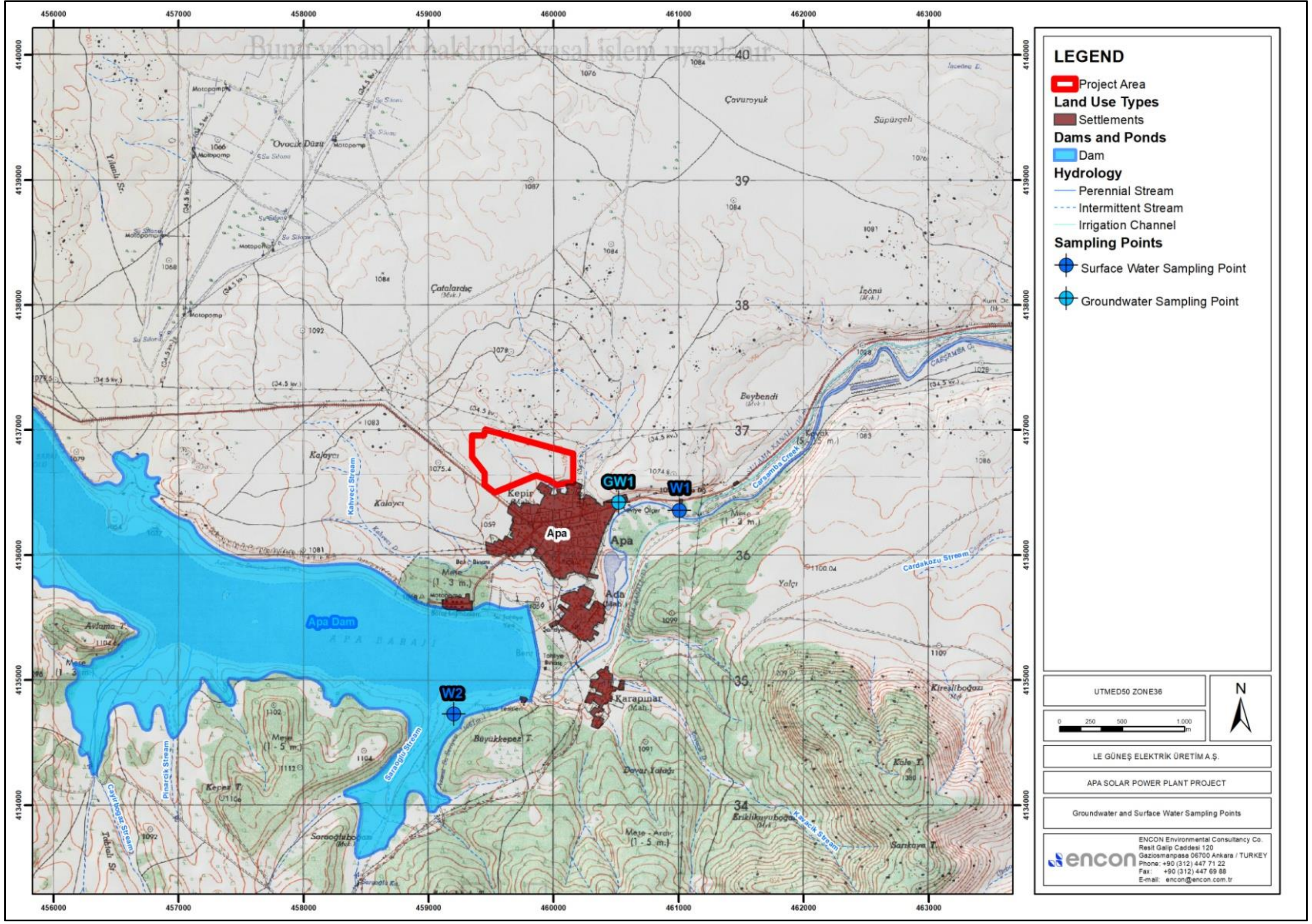


Figure 8.3. Groundwater and Surface Water Sampling Points

The temperature, pH, electrical conductivity and dissolved oxygen parameters were measured in situ and samples have been taken to an accredited laboratory (ENCON Laboratory A.S.) for further analysis. A photograph taken during water sampling study is presented in Figure 8.4.

When the analysis results presented in Table 8.3 are assessed within the scope of the Regulation Concerning Waters for Human Consumption, it is determined that all parameters except Total Coliform provide the parametric values presented in Annex-1 of the Regulation.

Figure 8.4. Groundwater Sampling Study

8.1.2. Hydrology

Hydrological Characteristics of the Region

As mentioned before, Apa GES Project is located in Konya Closed Basin. Total area of Konya Closed Basin is 4,980,534 hectares including artificial areas, agricultural areas, forests and semi-natural areas, wetlands and water surfaces. The ratio of the footprint area of the basin to the area of Turkey is about 7% (*TUBITAK MAM, 2010)*

The rivers in Konya Province together with their flow rates are presented in Table 8.4. The main rivers in the basin are the Melendiz Stream, Uluirmak River and Carsamba Stream which also flows in the vicinity of the Project Area. The Carsamba Stream passes approximately 400 m away from the nearest point to the Project Area (near the southeast corner of the Project Area). The presentation of the Project Area on the regional hydrology map is given in Figure 8.5.

Table 8.4. Rivers in Konya Province

River Name	Flow Rate (hm^3/year)
Uludere	143.2
Cavus stream	37.4
Suberte creek	117.9
Carsamba stream	164.8
Zanapa stream	233.6
May stream	53.6
Meram stream	51.0
Sille stream	2.0
Insuyu stream	14.7
Goksu river	818.7
Yunak Gokpinar stream	223.2
Ilgin stream	124.0
Bakirpinari	36.4

Source: Konya Governorship, Provincial Directorate of Environment and Urbanization, 2015

The main lakes in the basin are Salt Lake and Beysehir Lake. Salt Lake is the second largest lake in Turkey and it is at about 150 km northeast of the Project Area. Beysehir Lake, which is the biggest natural lake of Turkey in terms of available fresh water reserves, is at about 80 km northwest of the Project Area. Irrigation ponds and areas in Konya Province are presented in Table 8.5. Aydogmus Pond located at 11.9 km southeast of the Project Area is the nearest pond in the vicinity *(Konya Governorship, Provincial Directorate of Environment and Urbanization, 2015).*

Table 8.5. Irrigation Ponds in Konya Province

Pond Name	Area (ha)	Pond Name	Area (ha)
May Pond	28	Aydogmus Pond	65
Osmancik Pond	18	Hadim Pond	8
Mecidiye Pond	46	Guneydere Pond	10
Bulcuk Pond	14	Karaaga Pond	25
Doganhisar Pond	23	Ciftlikozu Pond	25
Evliyatekke Pond	14	Asagicigil Pond	25
Bashuyuk Pond	32	Beykavagi Pond	17
Derbent Pond	18	Cavus Pond	16
Destigin Pond	16	Ayaslar Pond	23
Ladik Pond	31	Tarasci Pond	11
Cayhan Pond	48	Selcuklu Malas Pond	33
Cihanbeyli Pond	173	Hadim Inonu Pond	12
Akviran Pond	40	Bozkir Caglayan Pond	25
Cukurcimen Pond	8	Meram Erenkaya Pond	11
Bostandere Pond	40	Akoren Pond	-

Source: T. C. Konya Governorship, Provincial Directorate of Environment and Urbanism, 2015

According to the data of the 4th Regional Directorate of DSI, the dams and storage facilities in operation and under construction in the province are listed in Table 8.6. Altinapa, Beysehir and Bagbasi dams are also designed for drinking water supply in addition to irrigation and/or flood purposes. The Apa Dam in operation on the Carsamba Stream is located at the south-southwest of the Project Area and is used for irrigation purpose. It is the closest dam to the Project Area and the distance of the dam to the Project Area is about 1 km whereas the closest distance of its reservoir to the Project Area is about 900 m. May Dam, located at 12.4 km north of the Project Area, is another dam nearby. Bagbasi Dam is the nearest dam used for drinking water purpose and its distance to the site is about 30 km. Dams and ponds in Project Area and its vicinity are shown on the map presented in Figure 8.6.

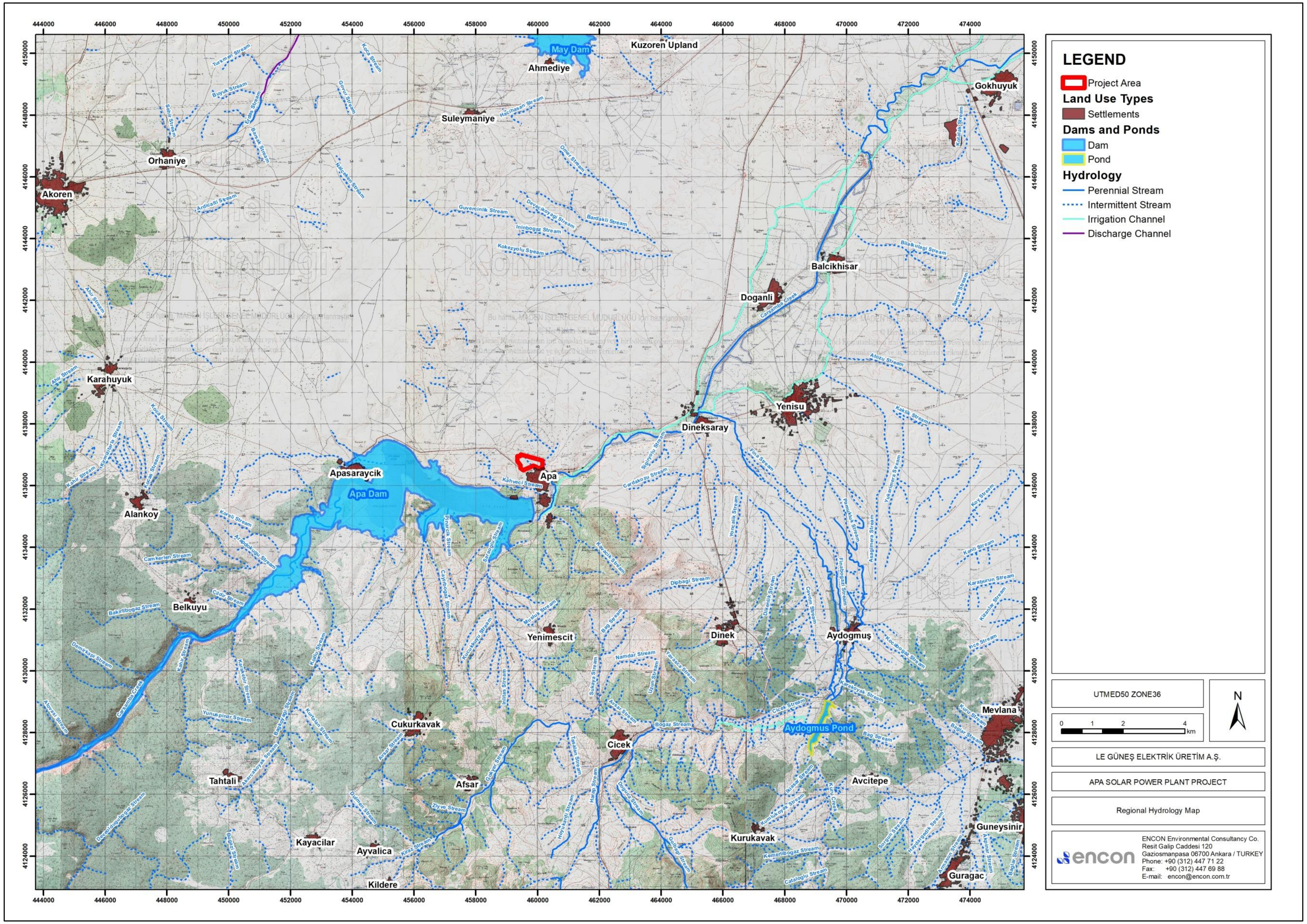


Figure 8.5. Regional Hydrology Map

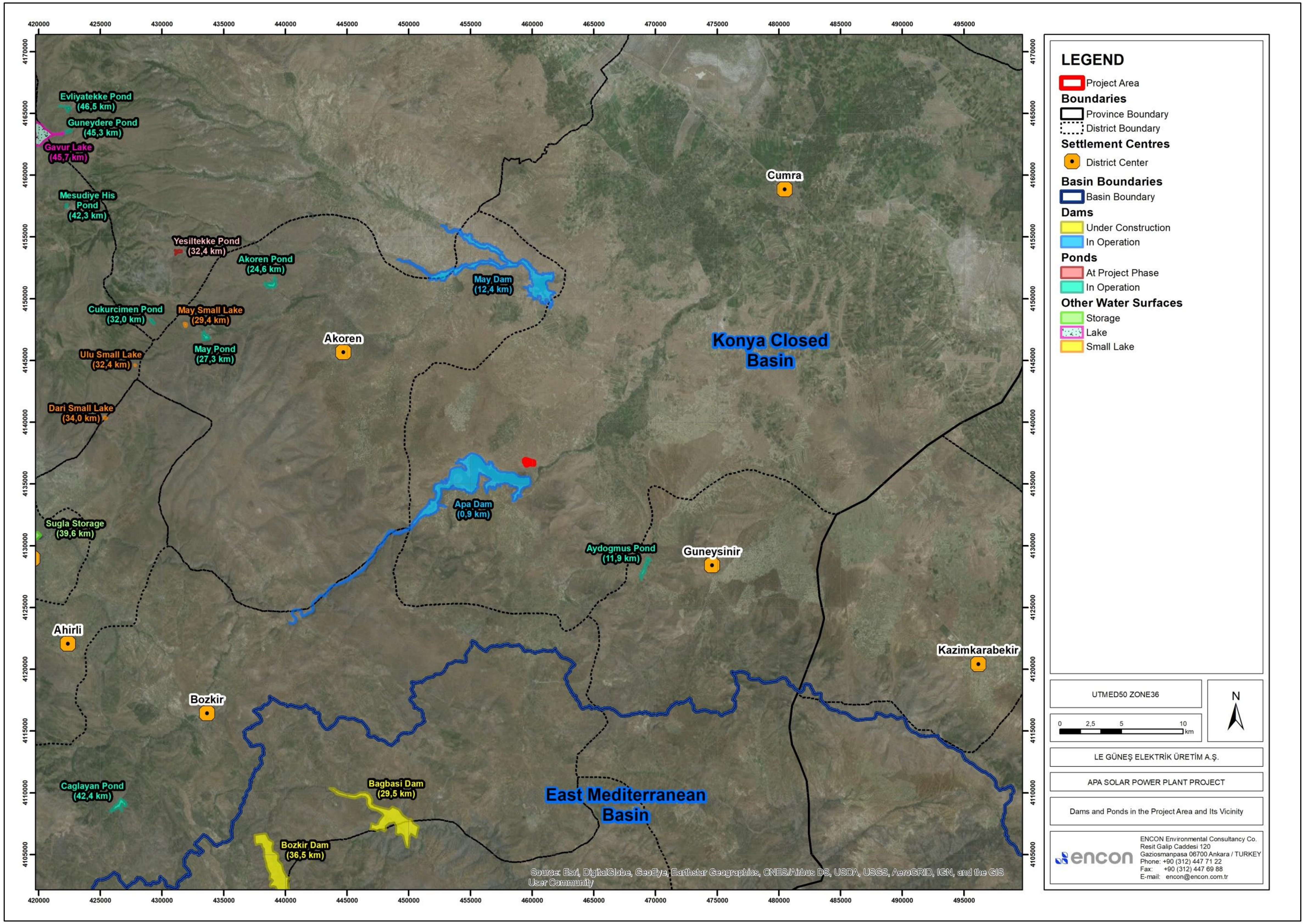


Figure 8.6. Dams and Ponds in the Project Area and Its Vicinity

Table 8.6. Dams/Storages in Konya Province in Operation and Under Construction

Dam Name	Usage Purpose	Status
Sille	Irrigation, Flood	In operation
May	Irrigation, Flood	In operation
Apa	Irrigation	In operation
Altinapa	Irrigation, Flood, Drinking Water	In operation
Ivriz	Irrigation, Flood	In operation
Derebucak	Irrigation	In operation
Cavuscu	Irrigation	In operation
Sugla	Irrigation	In operation
Beysehir	Irrigation, Drinking Water	In operation
Bagbasi Dam	Irrigation, Drinking Water	In operation
Bagbasi Dam	Irrigation, Derivation	Under construction
Hotamis Storage	Irrigation	Under construction
Bozkir Dam	Irrigation Energy	Under construction
Afsar Dam	Irrigation	Under construction
Damlapinar Dam	Irrigation	Under construction

Source: DSI 4th Regional Directorate, 2016

Hydrological Characteristics of the Project Area

Carsamba Stream, being one of the important surface water resources of the Konya Province, passes through about 400 m southeast of the Project Area. There are dry creek beds inside and in the east part of the Project Area.

There is no irregularity in the flow regime of the Carsamba Stream, which is passing relatively close to the Project Area. There are 2 flow observation stations (FOS) established by DSI on Carsamba Stream for flow measurements. Sorkun FOS, numbered 16-115 is between the town of Sorkun and the town of Dere, 16-116 Pinarcik FOS was established near the village of Pinarcik. Annual average flow rate according to the measurements performed at the Sorkun station is 2.31 m^3/sec; while it is 2.88 m^3/sec at Pinarcık station (see Table 8.7) (*Buldur and Sarı, 2012*).

Table 8.7. Monthly Average Flow Rates at Sorkun and Pinarcik FOSs on Carsamba Stream

Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Mean
Sorkun (32 years) (m^3/sec)	2.12	2.51	4.35	6.52	4.81	2.27	0.79	0.46	0.39	0.48	1.06	1.92	**2.31**
Pinarcik (12 years) (m^3/sec)	2.99	4.25	7.80	9.39	4.48	1.49	0.36	0.09	0.05	0.10	0.71	2.83	**2.88**

Source: Buldur and Sari, 2012

As it can be seen in Table 8.7, the flow rate of Carsamba Stream begins to fall from summer months when the temperature is high, and the precipitation is low. The flow rates, which went down to the lowest level in September, starts to increase from October. However, there is no exact match between the increase in precipitation in winter and the flow rate. The sudden rise of the flow rate in spring months is related to the feeding of the stream by snow waters. Average flow rate chart of both FOSs on Carsamba Stream is given in Figure 8.7.

Within the scope of EIA studies, surface water samples were taken from the Carsamba Stream that passes about 400 m southeast of the Project Area and from the Apa Dam reservoir that starts about 900 m south of the Project Area on 23.03.2016. Photographs taken during the sampling study are given in Figure 8.8.

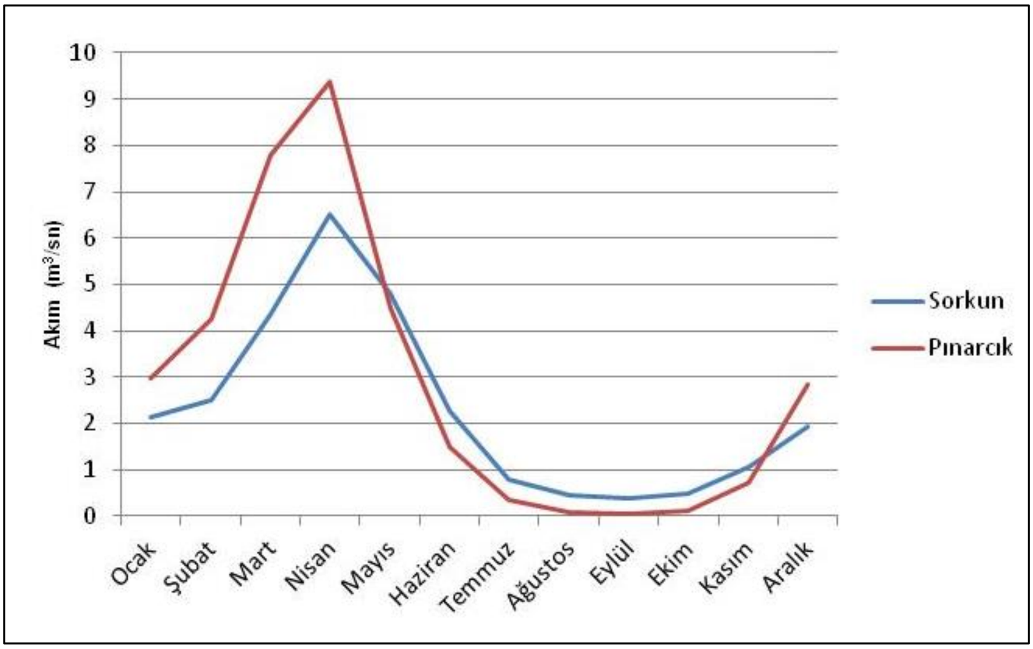


Figure 8.7. Average Flow Rate Chart of Sorkun and Pinarcık FOSs on Carsamba Stream *(Source: Buldur and Sari, 2012)*

W1 (Carsamba Stream)	W2 (Apa Dam Reservoir)

Figure 8.8. Surface Water Sampling Study

The station determined on the Carsamba Stream (W1) was selected from the upstream of the Apa neighborhood. The station determined on Apa Dam reservoir (W2) is located at the downstream of the Apa neighborhood, near the point where the Carsamba Stream flows into the Apa Dam. Coordinates of the mentioned stations are presented in Table 8.8. The map showing the sampling points is given in Figure 8.3.

The temperature, pH, electrical conductivity and dissolved oxygen parameters were measured in situ and samples have been taken to an accredited laboratory (ENCON Laboratory A.S.) for further analysis. The results of the analysis are given in Table 8.9 together with the limit values for quality classes in former Table 5, Annex-5 of the Regulation on Surface Water Quality.

Table 8.8. Coordinates of Surface Water

Station	Coordinates (UTM ED50, ZON 36)	
	X	Y
W1 (Carsamba Stream)	461009	4136358
W2 (Apa Dam Reservoir)	459203	4134730

Table 8.9. Surface Water Analysis Results

Parameter	Unit	Surface Water Quality Regulation ANNEX-5 Former Table 5 Limits				W1	W2
		Class I	Class II	Class III	Class IV		
Aluminum	mg/L	≤0.3	≤0.3	1.0	>1.0	0.1927	0.7028
Ammonium Nitrogen	mg/L	<0.2	1.0	2.0	>2.0	<0.20	<0.20
Arsenic	µg/L	≤20.0	50.0	100.0	>100.0	<2.0	<2.0
Copper	µg/L	≤20.0	50.0	200.0	>200.0	<3.0	<3.0
Barium	µg/L	≤1000.0	2000.0	20000	>2000.0	<100.0	<100.0
Biochemical Oxygen Demand	mg/L	<4.0	8.0	20.0	>20.0	<3.00	<3.00
Boron	µg/L	≤1000	≤1000	≤1000	>1000	<100.0	<100.0
Mercury	µg/L	≤0.1	0.5	2.0	>2	<0.1	<0.1
Zinc	µg/L	≤200.0	500.0	2000.0	>2000.0	720.9	<100.0
Dissolved Oxygen	mg/L	>8.0	6.0	3.0	<3.0	13.17	9.86
Dissolved Oxygen Saturation	%	>90.0	70.0	40.0	<40.0	141.8	103.4
Iron	µg/L	≤300.0	1000.0	5000.0	>5000.0	123.1	333.5
Fecal Coliform	kob/100 mL	≤10	200.0	2000.0	>2000	0	0
Fluoride	µg/L	≤1000	1500.0	2000.0	>2000	142.9	132.0
Conductivity	µS/cm	<400.0	1000.0	3000.0	>3000.0	395.0	271.0
Cadmium	µg/L	≤2.0	5.0	7.0	>7.0	<0.5	<0.5
Chemical Oxygen Demand	mg/L	<25.0	50.0	70.0	>70.0	7.01	5.43
Cobalt	µg/L	≤10.0	20.0	200.0	>200.0	<3.0	<3.0
Chromium	µg/L	≤20.0	50.0	200.0	>200.0	<3.0	<3.0
Krom^{+6}	µg/L	-*	20.0	50.0	>50.0	<20.00	<20.0
Lead	µg/L	≤10.0	20.0	50.0	>50.0	<10.0	<10.0
Manganese	µg/L	≤100.0	500.0	3000.0	>3000.0	<100.0	<100.0
Nickel	µg/L	≤20.0	50.0	200.0	>200.0	<3.0	3.938
Nitrate Nitrogen	mg/L	<5.0	10.0	20.0	>20.0	0.2825	<0.05
Nitrite Nitrogen	mg/L	<0.01	0.06	0.12	>0.3	0.017	0.0080
pH	-	6.5-8.5	6.5-8.5	6.0-9.0	<6.0 or >9.0	8.38	8.75
Color	m^{-1}	RES 436 nm:≤1.5 RES 525 nm:≤1.2 RES 620 nm:≤0.8	RES 436 nm:3.0 RES 525 nm:2.4 RES 620 nm:1.7	RES 436 nm:4.3 RES 525 nm:3.7 RES 620 nm:2.5	RES 436 nm:>4.3 RES 525 nm:>3.7 RES 620 nm:>2.5	<0.45 <0.37 0.02	<0.45 <0.37 0.04
Selenium	µg/L	≤10.0	≤10.0	20.0	>20.0	<1.0	<1.0
Free Chloride	µg/L	≤10.0	≤10.0	50	>50.0	24.0	32.0
Temperature	°C	≤25.0	≤25.0	≤30.0	>30.0	13.8	12.6
Sulphide	µg/L	≤2.0	≤2.0	10.0	>10.0	<2.00	<2.00
Total Phosphorus	mg/L	<0.03	0.16	0.65	>0.65	0.064	0.135
Total Kjeldahl Nitrogen	mg/L	<0.5	1.5	5.0	>5.0	0.728	1.008
Total Coliform	kob/100 mL	≤100.0	20000.0	100000.0	>100000	3000.0	10000.0
Total Cyanide	µg/L	≤10.0	50.0	100.0	>100.0	<10.0	<10.0
Oil and Gres	-	-**	-**	-**	-	-***	-***

** Not measurable.*
*** Floating liquids such as oil, tar, garbage and similar solid materials and foam cannot be found.*
**** Not observed.*

In order to be able to include a water source in any of the water quality classes according to the Regulation on Surface Water Quality, values for all parameter must be in compliance with the values given for that class. Accordingly, the lowest water quality class observed for any parameter determines the class of that water even if other parameters point to a higher class (Class IV - Highly contaminated water - lowest water quality).

When the water quality assessments made in this context, the water sample taken from W1 point, that is at upstream of Apa neighborhood on Carsamba Stream, is classified as "Class III" and the water sample taken from W2 point, that is on the Apa Dam Reservoir and at downstream of the Apa neighborhood, is classified as "Class III". The parameters that are effective in determining the water quality of W1 as "Class III" are Zinc and Free Chlorine whereas the parameters that are effective in determining the water quality of W2 as "Class III" are Aluminum, pH and Free Chlorine.

It might be possible that the free chlorine parameter has been measured in Class III quality at both points, due to chlorination activities carried out in different water sources in the region. Aluminum concentration (from metal concentrations) at W2 point and Zinc concentration at W1 point has been measured as Class III. Such metal concentrations might be measured instantaneously or interference of groundwater to surface water might have occurred.

8.2. Potential Impacts

The water requirement for solar power plant projects is very low compared to other industrial projects. In particular, the water requirement for long-term operation activities is limited to panel cleaning activities which occurs seasonally and do not contain intense water usage. In this context, while it is not expected to have a significant impact resulting from water usage/requirement and wastewater generation, units and activities requiring water during the construction and operation phases of the Project, amount of foreseen water requirement and water resources to be used are described in the following paragraphs within the scope of water supply system. In addition, the wastewater to be generated as a result of water usage and the management of this wastewater are also presented therein.

In the land preparation and construction phase of the Project, there will be water usage/requirement basically for the supply of drinking and utility (domestic) water demand of staff on site, dust suppression (on arid days) and general cleaning purpose.

During the land preparation and construction phase of the Project, 25 persons are planned to work on site in average. Assuming typical daily maximum domestic water consumption/demand of 150 Lt/day/person (*Prof. Dr. Veysel Eroglu, Prof. Dr. Dincer Topacik, 1998*), maximum water consumption for persons employed on site during land preparation and construction phase is estimated to be 3.75 m^3/day. Drinking water for the staff will be provided by bottled water supply while utility water requirement will be provided by water tankers. The drinking water and utility water supply will comply with the provisions of the Regulation Concerning Waters for Human Consumption.

In order to avoid dust that could be occurred during the land preparation and construction activities, watering will be carried out in sufficient quantities in the working areas by street sprinklers to ensure that 10% of top layer of the soil remains humid. The amount of water to be used in this scope might vary depending on the precipitation and site conditions but it is estimated to be around 2 m^3 per day on arid days.

Water usage/requirement during the operation phase of solar power plant based on photovoltaic technology is limited to the supply of drinking and utility (domestic) water demand of staff on site and cleaning (washing) of solar panels in the absence of adequate precipitation/rainfall. There is not any process that requires the use of water (e.g. cooling process) in such plants (*ABD Sandia National Laboratories, July2013*). Accordingly, there will be water requirement for drinking-utility and panel cleaning purposes in the operation phase of the Apa GES Project.

Since the plant is planned to be operated by the remote management system during the operation phase, only 7 security personnel are planned to continuously work on site. Assuming typical daily maximum domestic water consumption/demand of 150 Lt/day/person (*Prof. Dr. Veysel Eroglu, Prof. Dr. Dincer Topacik, 1998*), maximum water consumption for persons employed on site in the operation phase is estimated to be 1.05 m^3/day. Drinking water for the staff will be provided by bottled water supply while utility water requirement will be provided by water tankers. The drinking water and utility water supply will comply with the provisions of the Regulation Concerning Waters for Human Consumption.

The cleaning of solar panels located at the power plant is a factor affecting the performance of the system. Therefore, it is important that the solar panels are constantly kept clean and free of dust and other contaminant factors (e.g. bird droppings). Precipitation/rainfall could provide natural ways for the cleaning of panels to a certain extent. If the precipitation is inadequate for panel cleaning, the panels will need to be cleaned depending on the site's dust and contamination characteristics. In the light of existing assessments, within the scope of maintenance works of the Project during operation phase, it is foreseen that panel surfaces should be cleaned on average twice a year. Panel cleaning can be done by water washing or by other methods such as dry type cleaning (air or brush). Sample photographs of different photovoltaic panel cleaning systems are presented in Figure 8.9.

Modern washing machines/equipments could be used to minimize the water usage in washing processes in solar power plants that were established with today's technology and where panel cleaning is made with water. In this context, with the machines and equipments available in the market, it is possible to carry out washing process with 1 liter water consumption per panel in each washing period. In Apa GES Project, it is aimed to provide 13.1 MWe installed capacity with 55,408 panels in total (according to existing panel technologies) and to clean the panels with pure water. Accordingly, the total amount of water to be consumed per wash ($YSu_{per\ wash}$) for the specified number of panels is calculated as follows:

$$
\begin{aligned}
YSu_{per\ wash} &= \text{Total panel number x water consumption per panel (L/panel)} \\
&= \text{55,408 panels x 1 L/panel} \\
&= \text{55,408 L} \\
&\approx 55\ m^3/\text{wash}
\end{aligned}
$$

Assuming 2 washings per year at the plant, the total annual water consumption ($YSu_{annual\ total}$) for washing is calculated as follows:

$$
\begin{aligned}
YSu_{annual\ total} &= YSu_{per\ wash} \text{ x Number of annual washes (times)} \\
&= 55\ m^3 \text{ x 2 times} \\
&\approx 110\ m^3/\text{year}
\end{aligned}
$$


Crane Cleaning System
(Source: IFC, February 2012)


Brush Cleaning System
(Source: IFC, February 2012)


Cleaning with Whisk
(Source: IFC, February 2012)


Dry (Air) Cleaning Robot
(*Source: http://www.ecoppia.com/ecoppia-e4*)

Figure 8.9. Sample Photographs of Different Photovoltaic Panel Cleaning Systems

Continuous daily water consumption will not be a concern for washing process and this consumption will be periodic/seasonal. Additionally, an annual consumption of 110 m^3 corresponds to a water consumption of around 0.3 m^3 pure water per day (300 Lt/day or 0.003 Lt/sec). It is planned to purchase the water to be consumed per wash (55 m^3 in total) as pure water from the market, if possible, transport it to the site by tankers, and store in water tanks.

It is generally preferred that the water to be used in the washing process is clean and low in mineral content (*IFC, February 2012*). Therefore, in case the washing water could not be supplied as pure water, the quality of the washing water to be transported to the plant by tankers will be assessed/analyzed and in case the water does not provide the required quality, mineral hardness removal will be provided with a water purification unit to be established at the plant with a process to be selected according to the targeted water quality. In case of establishing a water purification unit, necessary permits will be obtained from authorized institutions within the scope of relevant legislation. The addition of any chemical or heat transfer fluid to the wash water will not be the case.

Since the water demand/requirement within the scope of the Project will be provided/supplied by purchasing from the market, a direct impact on surface water or groundwater (water resources) within the area of influence of the Project is not expected.

Domestic wastewater generated within the scope of the Project will be temporary collected/stored in toilet cabins or leak-proof septic tanks and transferred from the site by sewage trucks in compliance with the relevant legislation. Therefore, there will not be any impact on the quality of surface water or groundwater (water resources) in and around the Project Area resulting from wastewater discharge. Cumra Municipality will collect the wastewater from the site by sewage trucks, if requested.

8.3. Mitigation Measures

Water to be used in dust suppression during land preparation and construction phase of the Project will be absorbed by soil or lost by evaporation. Therefore, there will not be any surface runoff formation or wastewater generation due to watering for dust suppression.

Within the scope of the measures to be taken in order to protect the water resources in the region, the limited amount of domestic wastewater generated at site will be collected in the container of toilet cabins to be established or leak-proof septic tanks to be constructed in the Project Area during construction and operation phases and will be disposed within the scope of the protocol to be made with Konya Water and Sewerage Administration (KOSKI). Cumra Municipality might also collect the wastewater from the site by sewage trucks, if requested. No discharge will be made to nearby water resources within the scope of the Project.

Since no chemical or heat transfer fluid is planned to be added to wash water (pure water) during operation phase, it anticipated that the water that will flow through the panel surface will only contain particulate matter that normally accumulates on the panel surface. In case of establishment of a purification unit (by obtaining necessary permits from authorized institutions within the scope of relevant legislation), regeneration waters to be generated from the purification unit will be disposed of in accordance with the provision of the Water Pollution Control Regulation. Wash water will flow naturally into the soil environment. However, surface runoff waters will be controlled by the drainage channels to be constructed in the facility. Thus, flow from the Project Area to the Apa neighborhood, Carsamba Creek and Apa Dam directions will be prevented thereby will result in prevention of interaction with surface waters resources.

8.4 Summary of Assessment and Residual Impacts

Table 8.10 provides a summary of impact assessments made on water resources. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 8.10. Summary of Impact Assessments on Water Resources

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Water Resources	Land preparation and construction	Water requirement and wastewater generation	Adverse	Low	• Limited amount of domestic wastewater generated at site will be collected in the container of toilet cabins to be established or leak-proof septic tanks to be constructed in the Project Area during construction and operation phases and will be disposed within the scope of the protocol to be made with KOSKI. • Surface runoff waters will be controlled by the drainage channels to be constructed in the facility. Thus, flow from the Project Area to the Apa neighborhood, Carsamba Creek and Apa Dam directions will be prevented thereby will result in prevention of interaction with surface waters resources.	Low
	Operation	Water requirement and wastewater generation	Adverse	Low	• Panel washing will be made 1-2 times a year by machines minimizing water usage. There will not be any chemical addition to wash waters. • Limited amount of drinking water requirement of the staff will be provided by bottled water supply and similarly limited amount of utility water requirement will be provided by water tankers. The drinking water and utility water supply will comply with the provisions of the Regulation Concerning Waters for Human Consumption. • Domestic wastewater generated as a result of drinking and utility water usage at the facility will be temporary collected/stored in toilet cabins or leak-proof septic tanks and disposed within the scope of the protocol to be made with KOSKI. • The washing process will be done with modern machines that minimize the use of water. • There will not be any chemical usage at the facility during operation phase.	Low

CHAPTER 9

WASTE GENERATION

9. WASTE GENERATION

As a result of the use of resources, construction and operation/maintenance activities as well as domestic requirements of the personnel, different types of wastes will be generated throughout the life of the Project.

All the wastes to be generated during the land preparation and construction and operation phases of the Project are required to be properly managed in line with the requirements of national waste management legislation and international good practice in order to avoid impacts on soils, nearby water resources and flora and fauna elements. This Chapter identifies the wastes to be generated in this context and assesses the impacts associated with waste generation. Waste management measures to be applied in accordance with relevant Turkish regulations and international standards (i.e. IFC's General EHS Guidelines) are also described in this Chapter. The potential impacts on the physical, biological and socio-economic environment in the land preparation and construction and operation phases of the project, as well as measures to prevent/minimize these effects have been elaborated in detail.

The possible sources that will generate various type of waste are listed below:

- Municipal Solid Waste
- As part of project land preparation and construction and operation phases, packaging waste such as wood, paper, cardboard and plastic, etc.
- Hazardous and special wastes that may be generated within the scope of the land preparation and construction and operation phases of the Project can be listed as contaminated vessels, cloths and overheads, waste batteries and accumulators, medical wastes and waste oils
- Excavation and Construction Wastes

9.1. Baseline Conditions

To understand the existing waste management infrastructure of the region, public information given in the internet site of Konya Metropolitan Municipality has been relied on. For the calculation of the amount of municipal solid wastes, waste statistics have been considered, together with the maximum number of personnel to be employed. It should be noted that amount of certain types of wastes (e.g. hazardous wastes, waste tires, electrical and electronic equipment wastes, medical wastes, waste vegetable oils, etc.) cannot be quantified at this stage thus only the capacity of the existing infrastructure for any waste to be produced will be assessed in the scope of this Chapter.

According to the legislation in force in Turkey, the municipalities are responsible for collecting solid wastes in the metropolitan cities. Collection of solid wastes is an important component of the budget of the district municipalities. The efficient and economical construction of separate collection is also very important for local governments to reduce the cost of this work.

The cities in Turkey are considered to have 1 kg of garbage per person per day if the middle income level is based on. 76 thousand tons of garbage is produced every day in the country. According to this, a family with 4 members produces 4 kg per day, 120 kg per month and 1440 kg of garbage per year.

According to the 2012 statistics published by the Turkish Statistical Institute (TURKSTAT) in February 2014, 25.8 million tons of waste was collected in municipalities. According to the results of the "2012 Municipal Waste Statistics Survey" applied to all municipalities, 2950 municipalities are provided waste service in 2894. A total of 25.8 million tons of waste were collected, including 14.6 million tons in the summer and 11.2 million tons in the winter season. According to the survey results, the average daily waste amount per person collected in municipalities in 2012 was 1.14 kg for summer season, 1.09 kg for winter season and 1.12 kg for annual average.

In 2015, 60% of municipal waste was sent to landfills. In municipalities where waste collection and transportation services were provided, 59.9% of 25.8 million tons sent to regular storage facilities, while 37.8% sent to municipal waste dumps, 0.6% sent to composting facilities and 1.7% was eliminated by other methods (*eBelediye, 2015*).

The general composition of the municipal waste in Turkey is as demonstrated in Figure 9.1. according to the results of the solid waste composition determination study made within the scope of the Solid Waste Master Plan Project (2006). 34% of municipal waste consists of kitchen wastes. Separately collectable and recyclable fractions such as paper, cardboard, bulk cardboard, plastic, glass and metal constitute 25% of municipal waste.

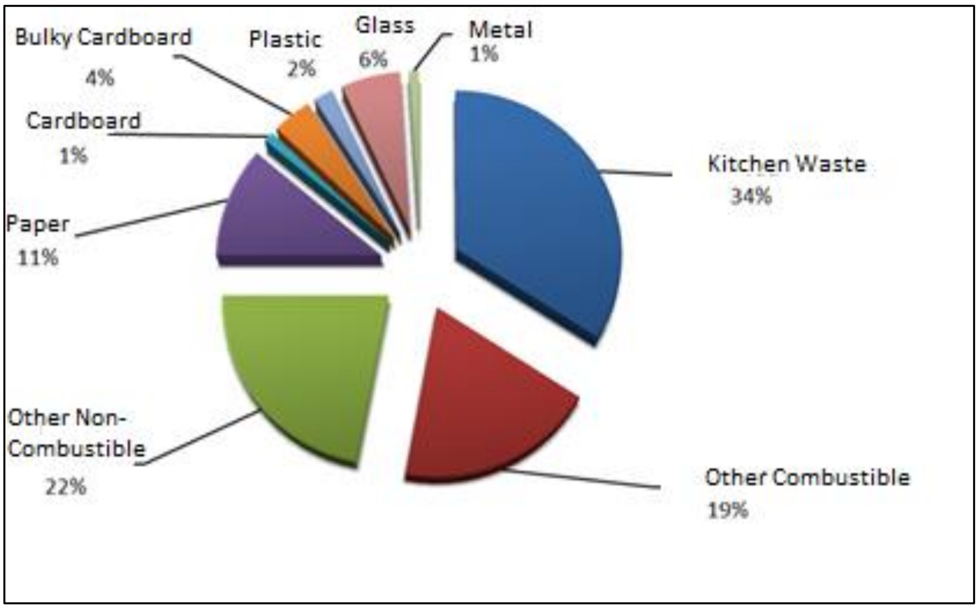


Figure 9.1. Composition of Municipal Waste *(Ministry of Science, Industry and Technology, 2014*)

While this is the situation in Turkey, solid wastes in Konya Province is disposed by wild dumping at Aslim site. A new project has been developed by the municipality for a better solid waste management. Within the scope of "Konya Solid Waste Management Project", financed by the Konya Metropolitan Municipality, the European Union and the Ministry of Environment and Urbanization, a new landfill together including leachate treatment plant and a transfer station is under construction and rehabilitation of existing dump site at Aslim will be provided. Within this project Aslım site will be transformed into a city forest and clean air area and public will benefit from the region. It is aimed to provide all needs of the Province covering all districts and villages (*Konya Metropolitan Municipality, 2017*).

9.2. Potential Impacts

9.2.1. Land Preparation and Construction Phase

During land preparation and construction phase of the Project, activities such as topsoil stripping, levelling, camp site preparation, construction and installation of main operation and auxiliary facilities, provision, transportation and assembly of power plant, transformer station and switchyard equipments will be carried out. Solid waste types expected to be generated within the scope of these activities are; municipal wastes, packaging wastes of panels and other system equipments (e.g. wood, cardboard, plastic, etc.), hazardous wastes, special wastes, excavation and construction wastes (e.g. scrap metal, wood, concrete waste, etc.), and waste system equipments (panels, cables, electronic components). Hazardous and special wastes might contain chemical substances (e.g. paint, solvent) or packaging materials and cloths contaminated with oils, waste oils resulting from operation and maintenance of machinery and vehicles, solvents, accumulators, batteries, filters, machine parts.

Table 9.1 lists the types of wastes and their waste codes, according to the waste lists given in the annexes of the Waste Management Regulation that can be generated during the land preparation and construction phase of the Project.

Table 9.1. List of Possible Waste Types to be Generated During Land Preparation and Construction Phase

Waste Code	Definition of Waste Code
13	**Oil Wastes and Liquid Fuel Wastes (Excluding Edible Oils, 05 and 12)**
13 02	Waste Engine, Transmission and Lubrication Oils
15	**Waste Packages, Unspecified Absorbents, Wipes, Filter Materials and Protective Clothing**
15 01	Packaging Wastes (Including Packaging Wastes Separately Collected by the Municipality)
15 02	Absorbents, Filter Materials, Cleaning Cloths and Protective Clothing
16	**Wastes Not Specified Otherwise in the List**
16 06	Batteries and Accumulators
17	**Construction and Demolition Wastes (Including Excavations from Contaminated Sites)**
17 01	Concrete, Brick, Tile and Ceramic
17 02	Wood, Glass and Plastic
17 04	Metals (Including Alloys)
17 05	Soil (Including Excavations from Contaminated Sites), Stones and Dredging Sludge
17 06	Insulation Materials and Asbestos Containing Construction Materials
17 09	Other Construction and Demolition Wastes
20	**Municipal Wastes Including Separately Collected Fractions (Domestic and Similar Commercial, Industrial and Institutional Wastes)**
20 01	Separately Collected Fractions (Except 15 01)
20 03	Other Municipal Wastes

Municipal wastes within the scope of Waste Management Regulation are referred to domestic wastes or commercial, industrial and institutional wastes similar to domestic wastes in terms of its content or structure, which are defined with waste code of 20, in the Waste List given in Annex-4 of the Regulation and of whose management responsibility belongs to the municipality. In order to determine the amount of municipal wastes to be generated at site, the average daily municipal waste per person is calculated as 1.08 kg according to the municipal waste statistics of TURKSTAT in year 2014 (*TURKSTAT, 2014*). The estimated amount of municipal waste to be generated during the land preparation and construction phase of the Apa GES Project, based on the number of people working on site, is given below. This amount includes also separately collected fractions such as paper, cardboard, glass, metal, plastic, etc. together with biodegradable wastes:

- 25 people are planned to be employed in the field during land preparation and construction phase. Accordingly, the total amount of daily municipal waste estimated to be generated in the Project Area as a result of personnel activities is calculated as 27 kg.

Considering the information provided in Figure 9.1 is also valid for the municipal wastes to be generated within the scope of APA GES Project, it can be calculated that approximately 9 kg of kitchen wastes and approximately 7 kg of separately collectable and recyclable wastes will be generated daily during the land preparation and construction phase of the Project.

Waste vegetable oil will not be generated at site during the land preparation and construction activities as meals for the staff will be provided by catering companies. Waste tire generation and storage will not take place due to the fact that the tire changes of the construction machines and other vehicles to be used at this stage will be carried out at the facilities in the region providing service for this purpose. Besides, there will not be any significant amount of medical waste generation at site within the scope of the Project, as nearest health center (health centers in Konya Province or Cumra State Hospital) will be used for possible medical interventions in case of an unexpected accident during the activities.

Vegetation clearing, topsoil stripping and levelling works will be carried out at certain locations in order to flatten the area during the land preparation and construction phase of the Project. Cable channels will be excavated at site and cables will be placed in these channels (to underground). There will be no major (deep) excavation work within the scope of the Project, and therefore generation of excavation wastes at site is not foreseen.

Waste motor/engine oil will be generated from the oil changes of the heavy-duty construction machinery to be used during the land preparation and construction phase of the Project. Assuming that the average oil capacity of each machine is about 20 liters and that the oil changes of the machinery will be done twice during the land preparation and construction phase (once in 2 months), the total waste motor oil amount for the machinery to be used in the Project is calculated as 720 liters (about 2 liters per day). If the density of waste oil is accepted as 0.9 g/cm^3, this amount is equivalent to about 650 kilograms.

The annual amount of battery per person in Turkey is 6 and this value corresponds to 140 grams (*Ministry of Environment and Forestry, General Directorate of Environmental Management, 2009*). According to this, the annual waste battery production of 25 people to be employed during the land preparation and construction phase of the Project is calculated as 3.5 kg.

No significant impact resulting from waste generation is expected due to the nature and scale of the Project, as explained above. Therefore, the significance of the impact during land preparation and construction phase would be “low”. However, mitigation measures will be proposed in the following sections in order to prevent and/or minimize likely impacts.

9.2.2. Operation Phase

There will not be any material or chemical addition to the process during the operation of the power plant. The maintenance and repair needs of the system will also be limited. Therefore, there will not be a continuous waste generation other than the limited amount of municipal waste to be generated by the 7 persons employed in the plant during the operation phase.

There might be waste generation resulting from damaged, malfunctioned or end-of-life equipment and material that could be replaced or controlled during maintenance and repair activities to be performed periodically or in case of a breakdown. Also, provision of new equipment, pieces and other needed materials will also result generation of packaging waste. Besides, personal protective equipments, clothes and rags used during maintenance and repair activities might result a limited amount of waste generation.

Depending on the type of transformer (dry or oily) to be used at the power plant, there might be a need for transformer oil. If dry type transformer is selected, cooling will be maintained by air and oil change will not be required during maintenance works. If oily-type transformer is used, then there will be limited amount of waste oil generation as well.

Table 9.2 lists the types of wastes and their waste codes, according to the waste lists given in the annexes of the Waste Management Regulation that can be generated during the operation phase of the Project.

Table 9.2. List of Possible Waste Types to be Generated During Operation Phase

Waste Code	Definition of Waste Code
13	**Oil Wastes and Liquid Fuel Wastes**
13 03	Waste Insulation and Heat Transmission Oils
15	**Waste Packages, Unspecified Absorbents, Wipes, Filter Materials and Protective Clothing**
15 01	Packaging Wastes (Including Packaging Wastes Separately Collected by the Municipality)
15 02	Absorbents, Filter Materials, Cleaning Cloths and Protective Clothing
16	**Wastes Not Specified Otherwise in the List**
16 02	Waste Electrical and Electronic Equipment
16 06	Batteries and Accumulators
19	**Wastes Generated from Waste Management Facilities, Wastewater Treatment Plants Outside the Facility and Water Preparation/Treatment Facilities for Human Consumption and Industrial Use**
19 09	Wastes Generated from the Preparation of Water required for Human Consumption and Industrial Use
20	**Municipal Wastes Including Separately Collected Fractions (Domestic and Similar Commercial, Industrial and Institutional Wastes)**
20 01	Separately Collected Fractions (Except 15 01)
20 03	Other Municipal Wastes

The estimated amount of municipal waste to be generated during the operation phase of the Apa GES Project, based on the number of people to be employed and the average daily municipal waste per person according to the municipal waste statistics of TURKSTAT in year 2014 (1.08 kg), is given below. This amount includes also separately collected fractions such as paper, cardboard, glass, metal, plastic, etc. together with biodegradable wastes:

- 7 people are planned to be employed in the power plant during operation phase. Accordingly, the total amount of daily municipal waste estimated to be generated as a result of personnel activities is calculated as 7.6 kg.

Considering the information provided in Figure 9.1 is also valid for the municipal wastes to be generated within the scope of APA GES Project, it can be calculated that approximately 2.6 kg of kitchen wastes and approximately 1.9 kg of separately collectable and recyclable wastes will be generated daily during the operation phase of the Project.

According to existing technologies, the service life of a typical solar power plant could be around 25-30 years. For Apa GES, a 25 year service life is anticipated considering the current technology. If the decision to continue the activity by replacing the photovoltaic panels with the new ones is not made after completion of the service life of the plant, the system will be deactivated completely. Hazardous and non-hazardous wastes will be generated within the scope of dismantling of photovoltaic panels and other system components (inverters, switches, etc.) and superstructures (buildings, roads, fences, doors, etc.). There will also be a limited amount of municipal waste to be generated by the workers employed for dismantling works.

The number of personnel/workers to be employed for dismantling works will be determined within the scope of the closure plan to be prepared at the end of the service life of the power plant but it is anticipated that there will be a limited need for labor force.

No significant impact resulting from waste generation is expected due to the nature and scale of the Project. Therefore, the significance of the impact during operation phase would also be “low”. However, mitigation measures will be proposed in the following sections in order to prevent and/or minimize likely impacts.

9.3. Mitigation Measures

9.3.1. Land Preparation and Construction Phase

Wastes to be generated in the scope of project activities will be managed in accordance with the waste management hierarchy as given in Figure 9.2. In this respect, waste generation will be avoided/prevented at the source. In cases where prevention is not possible at the source, respectively; minimization of waste generation, selection of materials that will not cause generation of hazardous waste as much as possible, separate collection of wastes according to their type (hazardous, non-hazardous, recyclable, etc.), reuse of generated wastes at site as much as possible, assessment of alternatives such as recycling and energy recovery for wastes (where reuse is not possible) will be considered. The final step in the hierarchy of waste management involves the final disposal of wastes in accordance with relevant regulations, where reuse, recycling and energy recovery options are not possible.

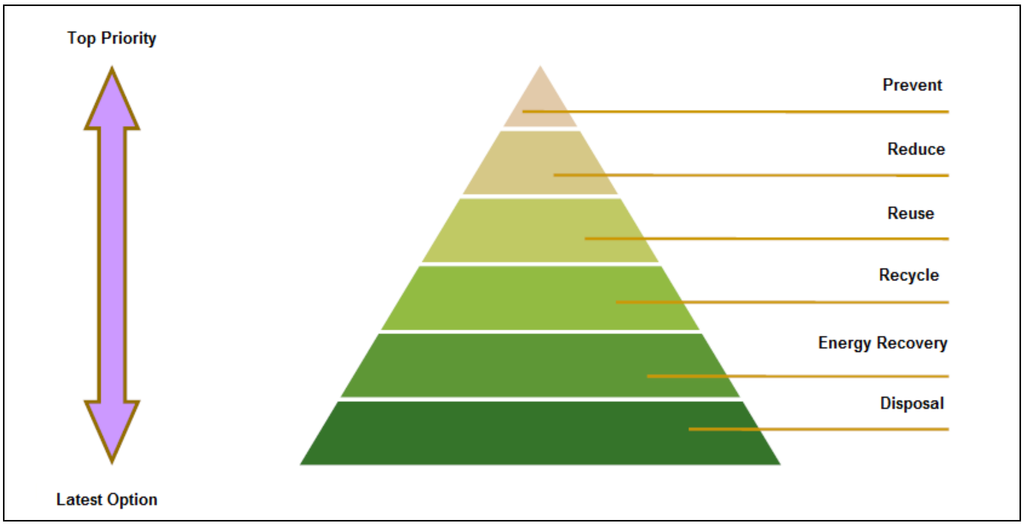


Figure 9.2. Waste Management Hierarchy

The wastes to be generated within the scope of the Project will be collected in closed containers suitable for the type of waste before the final disposal and stored in the Temporary Storage Area to be established on the site. By this means, wastes will be protected from external conditions (e.g. wind, rain, heat, etc.). Containers will be labeled appropriately for storage purposes. The general principles to be taken as a basis in the management of wastes to be generated in the plant are summarized below:

- Wastes will only be temporarily stored on site and final disposal will be carried out outside the facility.
- Waste recycling, transport and disposal will be carried out by means of licensed companies and/or related municipalities.
- Incineration or burying of wastes by any means at site and/or dumping of wastes to nearby roads or water resources will absolutely not be in question.
- All kinds of implementations that may threaten personnel or public health will be avoided in all activities involving collection, temporary storage, transport and disposal of wastes throughout the Project.
- Wastes to be temporarily stored on site will be delivered to licensed transport vehicles appropriate to the type of waste for disposal. Information related to the operations in this context will be recorded and the records will be kept in the administrative building.

Limited amount of hazardous or special wastes likely to be generated (e.g. waste electronic devices/parts, cables, filters and protective clothes, rags, packages contaminated with chemical substances such as paint/solvent or oils) within the scope of the Project will be stored in special departments in the Temporary Storage Area allocated for this purpose, in containers, separated from the non- hazardous wastes. This area will have an impermeable base/ground and will be protected from the surface flows and rain. Additionally, necessary drainage for the area will be provided. Hazardous or non-hazardous inscription, waste code, stored waste amount and storage date will be indicated/labeled on wastes temporary stored by classifying according to their properties. The reaction of wastes with each other will be prevented by the measures taken in the Temporary Storage Area. Permission regarding storage of wastes (e.g. hazardous and other special wastes), except municipal and packaging wastes, in the Temporary Storage Area will be obtained from the Konya Provincial Directorate of Environment and Urbanization.

The applicable legislation will be complied with at the time of temporary storage of wastes, transport of wastes to disposal facilities and final disposal of wastes. The wastes to be generated within the scope of the Project will be managed in accordance with the relevant legislation and the current relevant legislation on waste management is listed below:

- Regulation on the Control of Packaging Wastes
- Regulation on Control of Waste Electrical and Electronic Goods
- Waste Management Regulation
- Regulation on the Control of Waste Batteries and Accumulators
- Regulation on the Control of Waste Oils
- Regulation on the Control of Excavation Materials, Construction and Demolition Wastes
- Regulation on the Control of Waste Tires
- Regulation on the Control of Medical Wastes

9.3.2. Operation Phase

Principles regarding management of wastes, to be generated during land preparation and construction and operation phases of the Project, according to waste management hierarchy is described above. During the operation of the power plant, besides the wastes (e.g. municipal wastes, waste batteries, packaging wastes; generation of medical waste and waste oil is not foreseen) to be generated by the considerably limited amount of personnel (7 person), limited amount of non-hazardous, hazardous and/or special wastes (e.g. waste electronic devices/parts, cables, filters and protective clothes, rags, packages contaminated with chemical substances such as paint/solvent or oils, etc.) to be generated in particular periods during the operation and maintenance of the power plant will also be stored at the Temporary Storage Area to be located within the plant's border during operation phase, in separated special departments, in containers and separate from each other.

Temporary storage of wastes, transport of wastes to disposal facilities and final disposal of wastes in accordance with the applicable legislation will be the responsibility of the Project Owner during the operation phase. Accordingly, the wastes to be generated during the operation phase of the Project will be managed in accordance with the relevant legislation and the current relevant legislation on waste management is listed below:

- Regulation on the Control of Packaging Wastes
- Regulation on the Control of Waste Electrical and Electronic Goods
- Waste Management Regulation
- Regulation on the Control of Waste Batteries and Accumulators
- Regulation on the Control of Waste Oils

Municipal Wastes and Packaging Wastes

Municipal wastes (e.g. biodegradable food wastes/organic wastes and separately collected recyclable fractions such as paper, cardboard, glass, etc.) to be generated from the limited number of personnel to be employed at the plant will be initially collected and stored temporarily in separate closed containers/bins placed at suitable locations and in sufficient numbers in administrative building and within the site. The lids of the containers will be able to avoid scattering of wastes by wind effect, to prevent contact of wastes with the rain water and to avoid giving off odor that might disturb the environment.

The municipal wastes stored temporarily at site will be collected by means of transport vehicles belonging to the Municipality (or private firms with necessary permits) within the scope of the agreement to be made with Cumra Municipality prior to operation and will be disposed of in a landfill.

Non-hazardous packaging wastes to be generated by the procurement/supply of materials, parts/pieces and equipments to be required for operation and maintenance activities and to be stored in the Temporary Storage Area by collecting these wastes separately from others, will be collected by the authorized companies/institutions licensed by the Ministry of Environment and Urbanization for the collection/separation of these wastes in order to utilize according to the provisions of Regulation on the Control of Packaging Wastes.

Hazardous Wastes

The limited amount of hazardous waste, classified according to Waste Management Regulation, to be generated in certain periods during the operation and maintenance of the power plant will be separately collected from the non-hazardous wastes and stored in the Temporary Storage Area. Hazardous wastes stored in the Temporary Storage Area will be collected by licensed vehicles for final disposal or utilization (recovery/recycling) at licensed facilities in accordance with the provisions of Waste Management Regulation.

Electrical and Electronic Equipment Wastes

The limited amount of electrical and electronic equipment wastes, which are evaluated within the scope of Regulation on the Control of Waste Electrical and Electronic Goods, likely to be generated in certain periods as a result of the maintenance activities of the power plant will be stored separately from other wastes in the Temporary Storage Area. Then, according to the provisions of the Regulation, these will be collected by licensed vehicles to be utilized in processing facilities licensed by the Ministry of Environment and Urbanization.

Waste Batteries and Accumulators

The limited amount of waste batteries and accumulators likely to be generated in certain periods as a result of maintenance activities of the power plant will be separately collected from other wastes at site and stored in the Temporary Storage Area. Temporary stored waste batteries and accumulators will be collected by licensed vehicles and utilized in licensed recovery/recycling facilities in accordance with the provisions of the Regulation on the Control of Waste Batteries and Accumulators.

Waste Oils

In case of using oily-type transformer in the power plant, there will be waste oil generation due to oil change to be made at certain periods. These waste oils will be analyzed at accredited laboratories within the scope of Regulation on the Control of Waste Oils and their category will be identified accordingly. These wastes will be stored at the Temporary Storage Area according to their categories in special reserved tanks/containers without any mixing. Temporary stored waste oils will be collected by licensed vehicles and utilized in licensed recovery/recycling facilities or licensed hazardous waste disposal facilities, if recovery/recycling is not possible, in accordance with the provisions of the Regulation on the Control of Waste Oils.

Malfunctioned and End-of-life Modules

Panels and other wastes to be dismantled in the closure of the power plant will be basically disposed of in accordance with the legislation in force at that time, and the reuse or recycling alternatives of glass, semi-conductive materials and metals forming photovoltaic panels will be considered according to the available technologies. In addition to that, a “Management Plan for Malfunctioned and End-of-life Modules" will be prepared considering the need for replacement and disposal of some panels as a result of the failures that might occur during the operation of the plant. This plan will be prepared before the commencement of the power plant by researching recovery alternatives for both the semi-conductive materials of module and the glass. The subject Management Plan will be updated in parallel with technological developments throughout the service life of the Project. In the absence of a feasible alternative for the recovery of panels and any specific legislation on panel disposal, disposal of panels will be carried out in accordance with the Waste Management Regulation.

Other Wastes

Parts/Equipments having economic value (e.g. waste cables, waste metals) that might be generated during the maintenance of the power plant will be evaluated within the scope of applicable legislation. Disposal of other wastes (e.g. protective clothes, saturated or spent ion exchange resin and solutions and sludge resulting from the regeneration of ion exchangers, if used) will be carried out in accordance with the Waste Management Regulation according to their hazardous properties.

9.4. Summary of Assessment and Residual Impacts

Table 9.3 provides a summary of impact assessments made regarding waste generation. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 9.3. Summary of Impact Assessment Regarding Waste Generation

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Soil/Flora and Fauna/ Groundwater and Surface Water/Local Communities	Land preparation and construction	Waste generation	Adverse	Low	• Wastes to be generated within the scope of the Project will be managed in accordance with the waste management hierarchy. • Wastes will only be temporarily stored on site and final disposal will be carried out outside the facility. • Waste recycling, transport and disposal will be carried out by means of licensed companies and/or related municipalities. • Incineration or burying of wastes by any means at site and/or dumping of wastes to nearby roads or water resources will absolutely not be in question. • All kinds of implementations that may threaten personnel or public health will be avoided in all activities involving collection, temporary storage, transport and disposal of wastes throughout the Project. • Wastes to be temporarily stored on site will be delivered to licensed transport vehicles appropriate to the type of waste for disposal. Information related to the operations in this context will be recorded and the records will be kept in the administrative building. • Limited amount of hazardous or special wastes likely to be generated (e.g. waste electronic devices/parts, cables, filters and protective clothes, rags, packages contaminated with chemical substances such as paint/solvent or oils) within the scope of the Project will be stored in special departments in the Temporary Storage Area allocated for this purpose, in containers, separated from the non- hazardous wastes. This area will have an impermeable base/ground and will be protected from the surface flows and rain. Additionally, necessary drainage for the area will be provided. • Hazardous or non-hazardous inscription, waste code, stored waste amount and storage date will be indicated/labeled on wastes temporary stored by classifying according to their properties. The reaction of wastes with each other will be prevented by the measures taken in the Temporary Storage Area.	Low
	Operation	Waste generation	Adverse	Low	• See mitigation measures for "Land Preparation and Construction Phase". • "Management Plan for Malfunctioned and End-of-life Modules" will be prepared before the commencement of the power plant by researching recovery alternatives for both the semi-conductive materials of module and the glass.	Low

CHAPTER 10

ECOLOGY AND BIODIVERSITY

10. ECOLOGY AND BIODIVERSITY

In order to assess the possible impacts of Apa Solar Energy Power Plant Project on the species that adopted the natural habitat around the Project Area and biological environment, field studies and desktop surveys, that were carried out to identify the existing biological conditions, were utilised.

Existing conditions of flora and fauna elements (biological environment) in the Project Area were investigated by Prof. Dr. Hayri Duman (botanist - Biology Department at Gazi University) and Prof. Dr. Zafer Ayaş (zoologist-ornithologist - Biology Department at Hacettepe University) on 20.05.2016 (see Figure 10.1).

As a result of the field studies, local floristic and faunistic characteristics were determined and the habitat quality was investigated in the area.

In pursuit of the field studies, desktop studies and literature surveys were carried out and endemism and threat / protection status of the species that were identified during the field studies were identified. Thereby, the sensitivity of the Project Area and the importance of the impact of the project on the flora and fauna elements were assessed.

10.1 Baseline Conditions

The study area is located in Apa neighborhood of Cumra District within the boundaries of Konya Province in Central Anatolia Region.

The Project Area is located in the north of Apa neighbourhood where steppe vegetation is dominated, however, steppe vegetation was destroyed due to anthropogenic effects and overgrazing and lost its naturality to a large extent. In the area, stone-rocky habitats are also observed. In the Project Area, which is generally flat, the altitudes range from 1.045 to 1.075 meters and there are not many altitude differences within the area. The destroyed steppe habitat in the Project Area is surrounded by wide agricultural areas. Photographs of the habitat structure in the study area taken during the field study are presented in Figure 10.1.

Air distance between Apa Dam wetland, which is located on Çarşamba Stream and south of the Project Area, and the site is around 1 km. After the Apa Dam, Çarşamba Stream subsequently becomes an irrigation channel and reaches certain parts of Konya Plain with the purpose of agricultural irrigation. Mentioned irrigation channel passes by around 900 meters south-east of the GES site. Additionally, Aydoğdu Pond is located 11.9 kilometers South-east of the Project area and May Dam is located 12.4 kilometers north of the Project area. The Sugla Water Storage is located 39.6 kilometers south-east of the site and the Hotamıs Water Storage is 43.9 km north-east of the site. The closest natural lake to the Project Area is Beyşehir Lake, which is located around 80 km to the northeast direction.

Figure 10.1. Habitat Type of the Study Area

Internationally Recognised Areas

There are not any protected areas or Key Biodiversity Areas (KBA) defined under the relevant legislation in the Project Area and its immediate vicinity (see Chapter 11). Among the KBAs in the region shown in the map presented in Figure 10.2, the Geyik Mountain is the closest KBA to the Project Area and is located 30.9 km southwest of the site. Hotamıs Reeds is located 39.8 km north east of the site. Explanations about the mentioned KBAs are presented in the following paragraphs. The locations of the wetlands found around the Project Area are shown in the map presented in Figure 10.3.

Geyik Mountains: Geyik Mountains are the chain of mountains extending in northwest-southeast direction in Taşeli Plateau, which is located at east of Antalya. Gevne and Ulugunet creeks rise from the southern slopes of the Geyik Mountains. Balcilar stream and its branches form the eastern border of the area. North slopes of the mountain is also snowy in the summer months due to its location. Geyik Mountains constitute a boundary between Konya, Karaman and Antalya Provinces. The western parts of the KBA hold one of the most important moist habitats in the Mediterranean Region.

Hotamis Reeds: It is located at the south of Konya Closed Basin and in the South of the reeds, Karadag volcanic mountain constitutes the border.

Previously, Hotamis was one of the largest reed areas in the region before underground and terrestrial resources were moved to other areas by the State Hydraulic Works (DSI). Besides that, there was a small salt lake named Süleymanhaci in the south of the KBA. As a result of the interventions made in the water regime, the area rapidly dried starting from the mid-1990s. Therefore, only a very small reed area remained at the southern end of the area. Consequently, drying of Hotamis has caused a serious decrease in the number of water birds in Turkey. Besides these, the dried natural Hotamis Lake has been converted into Hotamis Water Storage by DSI. The Hotamis Water Storage has a great importance for the efficiency and sustainability of agricultural activities in the region. In addition, a permanent wetland will be created with Hotamis Water Storage to support the environment and natural life.

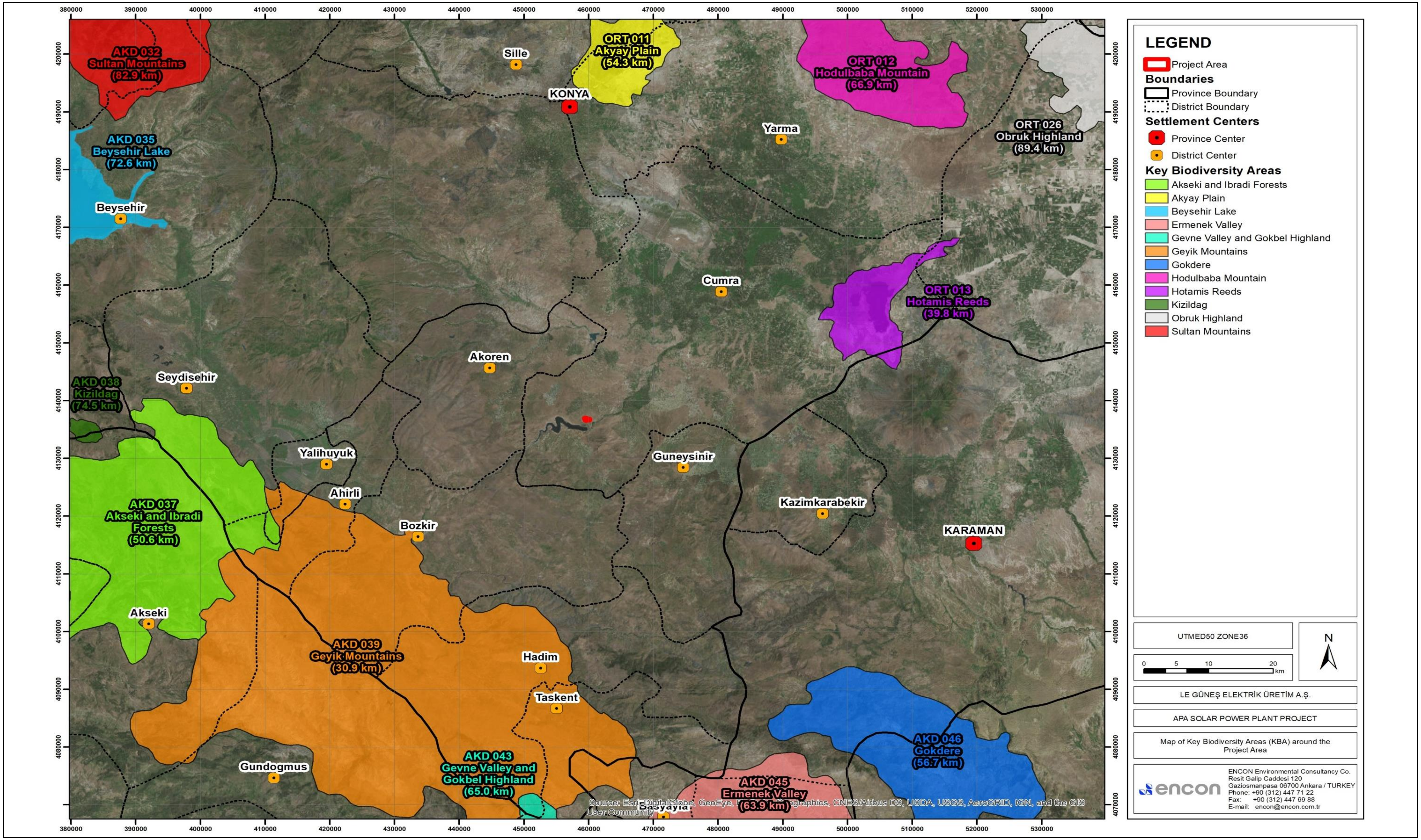


Figure 10.2. Map of Key Biodiversity Areas (KBA) around the Project Area

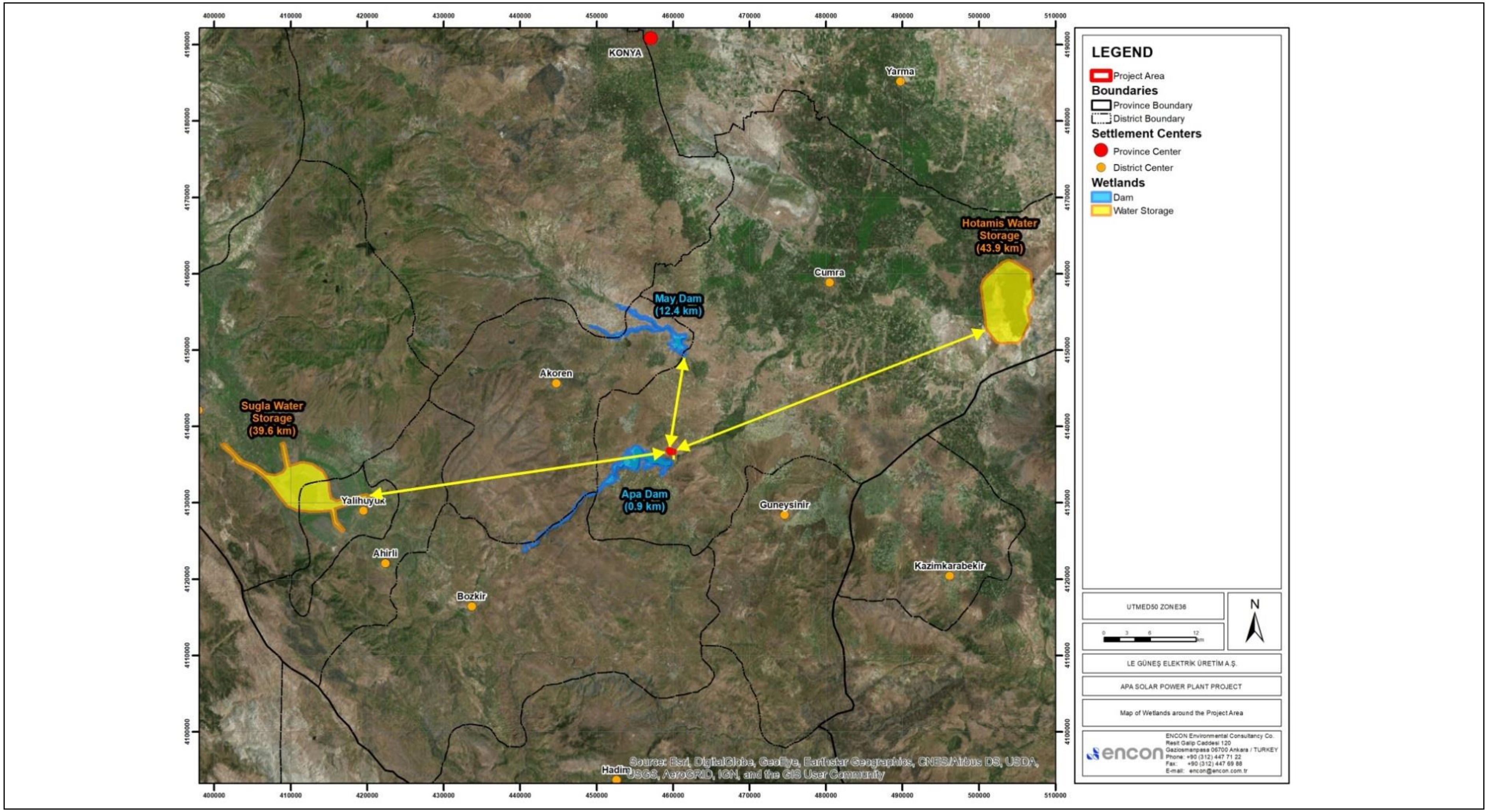


Figure 10.3. Map of Wetlands around the Project Area

10.2 Assessment Methodologies and Data Sources

Biological environmental characteristics of the Project Site were determined by terrestrial flora and fauna field studies carried out by experts on 20.05.2016. Literature review that was carried out in parallel with the field studies provided an insight on the determination of the biological properties of the Project Area.

In order to verify the conservation status of flora and fauna species in the project impact area, risk assessments for the species extinction have been made according to the designated national and international criteria. The following sources were used in these assessments:

- The International Union for Conservation of Nature; IUCN
- Red Data Book of Turkish Plants (RDTP)
- TUBIVES
- CITES
- Bern Convention
- Central Hunting Commission Decisions (CHC- 2016-2017)
- Red Data Book of Turkish Birds (Kiziroğlu, 2009)
- General Zoogeography and Turkey Zoogeography Book (Demirsoy, 2002)

Species covered in CITES are given under three different appendices according to their conservation status. Appendix I covers the species, which are under threat of extinction. Trade in the specimens of these species is not allowed except for extraordinary circumstances. Appendix II includes species, which are not threatened with extinction, but trade in specimens is restricted in order to prevent utilization incompatible with their survival. Appendix III includes species, for which other parties of CITES is applied for assistance in controlling trade and which are conserved at least in one country.

BERN Convention aims at conserving and promoting biodiversity, developing national policies for the conservation of wild flora and fauna and their natural habitats, protection of the wild flora and fauna from the planned development and pollution, developing trainings for protection practices, promoting and coordinating the researches made regarding this subject. It has been signed by 26 member states of the European Council (as well as Turkey) with the aim of conserving the wild life in Europe. Species that are protected under the Bern Convention are classified as Appendix I: Strictly protected flora species, Appendix II: Strictly protected fauna species and Appendix III: Protected fauna species.

All of the nations, which are party to the BERN Convention, have signed the Convention on Biological Diversity as well. Parties of this convention are responsible from ensuring sustainable use of resources in line with their national development trends and conserving the threatened species.

The IUCN Red List intends to draw attention to species whose populations are at risk or under threat. The IUCN places a species on the Red List only after studying its population and the reasons for its decline. Some countries pay greater attention to IUCN-listed species than Bern-listed species, since the Red List relies on more research. The 1994 (ver.2.3) and 2001 (ver.3.1) categories and criteria of the IUCN Red List are presented below in Table 10.1.

Table 10.1. IUCN Red List Categories and Criteria

IUCN Red List Categories and Criteria 1994 (ver. 2.3)		**IUCN Red List Categories and Criteria 2001 (ver. 3.1)***	
EX	Extinct	EX	Extinct
EW	Extinct in the Wild	EW	Extinct in the Wild
CR	Critically Endangered	CR	Critically Endangered
EN	Endangered	EN	Endangered
VU	Vulnerable	VU	Vulnerable
LR	Lower Risk		
	cd: conservation dependent	NT	Near Threatened
	nt: near threatened	LC	Least Concern
	lc: least concern		
DD	Data Deficient	DD	Data Deficient
NE	Not Evaluated	NE	Not Evaluated

** IUCN Red List Categories and Criteria have been formed by means of extensive reviews for developing more transparent, more open and easy to use systems in the recent years. In this respect, corrections were made and adopted by IUCN Council in February 2000 and revised Categories and Criteria (IUCN Red List Categories and Criteria, version 3.1) were published in 2001.*

In determining threat statuses of flora species identified within the study area Red Data Book for Turkish Plants (Ekim et al., 2000), which was prepared in accordance with 1994 IUCN Red List Categories and Criteria was utilized.

The hunting statuses of fauna species within the study area were determined based on 2016-2017. Resolutions of the Central Hunting Commission (CHC) of the General Directorate of Nature Conservation and National Parks, Directorate of Hunting and Wild Life. According to CHC 2016-2017 Resolutions fauna species are evaluated in three categories:

Table 10.2. CHC Lists

List	**Description**
Appendix I	Includes game animals which are protected by the CHC
Appendix II	Includes game animals which are allowed to be hunted in seasons predefined by CHC

In the determination of national threatened categories belonging to amphibians, reptile and mammals, General Zoogeography and Turkey Zoogeography (Demirsoy, 2002) were used.

The categories determined by Demirsoy (2002) can be listed as follows: Endangered (E), Extinct (Ex), Uncertain (I), Data deficient (K), Common, abundant (nt), Out of danger (O), Rare (R), and Vulnerable (V).

In addition, the national threatend status of bird species identified in the study area is evaluated in the categories given in Table 10.3 according to the Red Data Book of Turkish Birds (Kiziroglu, 2009).

Table 10.3. National Threat Categories for Bird Species (*Kiziroğlu, 2009*)

Category A:	
A.1. 2.	**(CR)** Critically endangered and breeding species in Turkey
A.2.	**(EN)** Endangered and breeding species in Turkey
A.3.	**(VU)** Vulnerable and breeding species in Turkey
A.3. 1.	**(D)** Declining, vulnerable and breeding species in Turkey
A.4.	**(NT)** Near threatened. Breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
A.5.	**(LC)** Least Concern. Breeding species that are widespread in Turkey
A.6.	**(DD)** Not Evaluated. Breeding species which have not been evaluated in Turkey
A.7.	**(NE)** Critically endangered and non-breeding species in Turkey
Category B:	
B.1. 2.	**(CR)** Critically endangered and non-breeding species in Turkey
B.2.	**(EN)** Endangered and non-breeding species in Turkey
B.3.	**(VU)** Vulnerable and non-breeding species in Turkey
B.3. 1.	**(D)** Declining, vulnerable and non-breeding species in Turkey
B.4.	**(NT)** Near threatened, non-breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey
B.5.	**(LC)** Least Concern, non-breeding species that are widespread in Turkey
B.6.	**(DD)** Data Deficient, non-breeding species on which there is deficient information in Turkey
B.7.	**(NE)** Not Evaluated, non-breeding species which have not been evaluated in Turkey

10.3 Significance Criteria

The impact of project activities on ecological components is related to the size of the impact and the vulnerability of the receptors. For terrestrial flora and terrestrial fauna (amphibians-reptile-bird-mammal) species, the size of the effects and the significance of the effects according to the matrices presented below have been determined for each groups in accordance with the criteria determined according to the ecological sensitivities of the species. It is known that the features of each step in the systematic classification of species are different from each other and accordingly the shapes and dimensions of the influence from the Project will vary within themselves. The general criteria to be used in determining the impact dimension and the general criteria to be used in determining impact severity are described in detail in the following sections.

The IFC Performance Standard 6 (IFC, 2012), Biodiversity Conservation and Sustainable Living Revenue Natural Resource Management rules were used to identify Critical Living Area in the study area. IFC criteria for identifying Critical Habitats include:

- Criterion 1: Habitats important for critical and/or endangered species;

- Criterion 2: Habitats of significant importance to endemic and/or restricted species;
- Criterion 3: Habitats containing significant intensive species or migrating species and/or indigenous species in the global sense;
- Criterion 4: Highly threatened and/or unique ecosystems;
- Criterion 5: Key evolutionary processes.

Based on these criteria, sensitivity criteria for ecological components within the scope of the project have been determined as following sections.

10.3.1 Terrestrial Flora Studies

A flora inventory was prepared in consideration of field studies and literature records for the study area. Field studies were carried out on 20.05.2016 to determine the flora species and vegetation characteristics in the area. Flora species in the study area were determined by direct observation and sampling. Collected specimens were then examined in the laboratory for the identification of species and subspecies. In addition, studies conducted in the field in previous years have also been used to prepare the flora inventory. During the field studies, "relative abundance" was determined and recorded for each plant species with habitat characteristics. In addition, the habitat types of the study area were determined according to the method of sociological units of vegetation, and the cases of vulnerability, rareness and protection were identified depending on construction and operation periods.

Methodology

A field study to the area was organized in May 2016 in order to determine the flora of the area, vegetation structure and ecological condition (see Figure 10.4). The field study period is the most suitable vegetation period for the activity area.

Figure 10.4. Terrestrial Flora Studies

Flora list was prepared in accordance with the phylogenetic order in the Turkish flora and families under each group are also listed according to the phylogenetic order in the Turkish flora (Appendix-1, Table 1.1).Species are listed with their author names, local

Turkish names (if available), phytogeographic regions, endemism, threat categories for endemic and rare species, habitats and their relative abundance in the area.

Samples collected in the area were identified according to the “Flora of Turkey and the East Aegean Islands” by P.H. Davis after they were preserved as herbarium material (Davis, 1965-1988).

In evaluating the threat/protection status of species Turkish Red Data Book (TRDB), which is based on IUCN (International Union for Conservation of Nature) Red List classifications are used. In addition, Turkish names of species identified from the field have been determined using the work prepared by Turhan Baytop *(Baytop, 1994).*

Findings

The Central Anatolia Region is one of the well-known flora regions. The entire area in which the Project Area is located belongs to the Iran-Turan plant geographical region. As a result of the field studies, 94 species and sub species belonging to 26 families were detected. 8 of the species detected in the field are endemic for our country. Endemic species are listed below;

- *Astragalus acicularis*
- *Astragalus podperae*
- *Astragalus mesogitanus*
- *Cousinia iconica*
- *Anthemis fimbriata*
- *Nepeta congesta,* var. *Congesta*
- *Phlomis nissolii*
- *Asphodeline rigidifolia*

Cousinia iconica and *Anthemis fimbriata* are "regional endemics" and others are "widespread endemics". Photographs of some endemic species identified are presented in Figure 10.5.

Threatened Status and Endemisms of Plants

The surrounding area of Konya has rich and interesting floristic features. Despite having steppe habitat structure, the number of endemic species remained at a very low level due to overgrazing and excessive anthropogenic activity in the planned GES field. This result is normal since the Project Area is both close to settlements and is under heavy grazing pressure. For this reason, the vast majority of endemics detected from the area are widespread and cosmopolitan. Regional endemic *Cousinia iconia* and *Anthemis fimbriata* detected from the area are classified as "VU" according to RDBTP, *Astragalus acicularis, Astragalus podperae, Astragalus mesogitanus, Nepeta congesta var. Congesta, Phlomis nissolii, Asphodeline rigidifolia* are listed as "Least Concern, LC" according to RDBTP.

Anthemis fimbriata

Astragalus acicularis

Cousinia iconica

Phlomis nissolii

Asphodeline rigidifolia

Figure 10.5. Some Endemic Species within the Project Area

Vegetation

Detection of the vegetation of the Project Area was carried out in May 2016. The size of the sample parcels, that constitute the basis for the vegetation study, was determined on the basis of the minimal area "smallest area". The size of sample parcels was taken as 100 square meters for steppe vegetation. The construction of the tables of the sample parcels and the analysis of the sintakson were carried out according to the Braun Blanquet method (Braun-Blanquet, 1932). The plant assemblage that was found in the field and the upper sintaksons to which this association belongs were evaluated by taking into consideration the work done in the past both in the area and surrounding area (Çetik, 1985, Güner et al., 2014). Nomenclature of detected plant associations was made according to ICPN (n) (Weber et al., 2000).

Although the project area and its surroundings are under overgrazing and anthropogenic pressures, the degraded step vegetation type develops in the area. Since the steppe vegetation in this area has a homogeneous structure, only one plant community has been detected from the area. This plant community and the upper sintaksons to which this association belongs are given below.

Class : *Astragalo-Brometea* Quezel 1973
Order : *Onobrychido armenae-Thymetalia leucostomi* Akman, Ketenoğlu, Quezel 1985
Alyans : *Phlomido armeniaca-Astragalion microcephali* Akman, Ketenoğlu, Quezel & Demirörs 1984
Community: *Astragalo acicularis- Thymetum sipylei* Çetik 1982 (see. Table 10.4.)

This plant community is very common in the surroundings of Central Anatolia region and in Aegean and Mediterranean regions facing Central Anatolia region. The floristic composition of the plant community varies more or less from region to region. In the Project Area, this community is severely degraded due to overgrazing and anthropogenic effects. The co-ordination of a single stratified structure varies between 40% to 50% and the size varies between 10cm to 50 cm. The overlap of the community varies which have monolayer structure between 40% to 50% and the size varies between 10cm to 50 cm.

Table 10.4. *Astragalo acicularis- Thymetum sipylei* (*Çetik 1982*)

Example Parcel No.	**1**	**2**	**3**	**4**	**Class**
Space (m^2)	100	100	100	100	
Height	1070	1075	1070	1070	
Direction	-	-	-	-	
Slope °	5	5	5	0	
Grass overlapping (%)	50	50	40	45	
Grass height (cm)	10-50	10-50	10-20	10-30	
Bedrock	limestone	limestone	limestone	limestone	
Characterstic species *of Astragalo acicularis-Thymetum sipylei* community					
Astragalus acicularis	1.2	1.2	2.2	2.2	V
Astragalus podperae	2.2	1.1	1.1	2.2	V
Thymus sipyleus	2.1	2.2	2.2	2.2	V
Characterstic species *of Phlomido armeniaca-Astragalion microcephali* alyans					

Example Parcel No.	1	2	3	4	Class
Astragalus microcephalus	2.2	2.1	3.2	11	V
Marrubium parviflorum	12	12	12	12	V
Teucrium chamaedrys	.	11	11	11	IV
Characterstic species *of Onobrychido armenae-Thymetalia leucostomi* orders					
Anthemis tinctoria	1.1	22	12	12	V
Astragalus mesogitanus	22	12	12	.	IV
Lappula barbata	11	.	.	12	III
Noaea mucronata subsp. *mucronata*	22	.	1.2	.	III
Onosma tauricum	1.2	1.2			
Paronychia kurdica subsp. kurdica	1.2		1.2		
Characterstic species *of Astragalo-Brometea* classes					
Festuca valesiaca	12	12		12	IV
Bromus tomentellus	1.2	1.2	1.2		IV
Stipa holosericea	1.2		1.2	1.2	IV
Scabiosa argentea	1.2	1.2	1.2		IV
Participator Species					
Euphorbia macroclada	22	22	22	12	V
Phlomis nissolii	12	12	12	12	V
Eryngium campestre	11	11	11	.	IV
Reseda lutea	.	+1	11	11	IV
Carduus nutans	11	.	.	.	II
Satureja cuneifolia	.	11	.	.	II
Minuartia hamata	.	11	.	.	II
Ajuga chamaepitys	.	.	11	.	II
Cichorium inthybus	.	.	+1	.	II
Inula heterolepis	.	.	.	22	II
Picnamon acarna	.	.	.	12	II
Sanguisorba minor	.	.	.	12	II

Ecological Structure

The ecological structure studies were carried out with the field works carried out in May 2016. The ecosystem structure of the field has been evaluated in detail in consideration of the vegetation structure developed in the Project Area during the field studies.

Accordingly, the most important resource of the Project Area is the steppe vegetation of Iran-Turan. This type of vegetation constitutes whole Project Area. The area where this habitat is located lost its habitat characteristic to a large extent due to overgrazing. Plant species that are not preferred by animals in habitat became predominant.

Ecosystem Features

During the determination of the ecological structure, the ecosystem types are classified by using the code generated for each class by adhering to the physical and floristic structure, climatic and topographic characteristics of the vegetation cover, and to the hierarchical classification system developed by UNESCO. Accordingly, only the Terrestrial Ecosystem exists in the Project Area.

Terrestrial Ecosystem: The terrestrial ecosystem in the Project Area is represented by the herbaceous ecosystem. This herbaceous ecosystem observed in the Project Area is the mainland limestone since it developed under the influence of Mediterranean climates. In the region where the ecosystem is located, semi-arid cold Mediterranean Bioclimatic type prevails.

A. Herbaceous Ecosystem

Class: Terrestrial
Physiognomic Class: Herbaceous
Physiognomic Sub-Class: -
Physiognomic Group: Terrestrial
Formation: Limestone
Community: ***Astragalo acicularis- Thymetum sipylei***

It is the single type of ecosystem in the Project area. This plant community is distributed throughout the Project Area. The dominant species of the community are *Festuca valesaca, Bromus tomentellus, Thymus sipyleus, Astragalus acicularis, Astragalus microcephalus, Stipa holosericea.* A total of 8 endemic species, 2 of which are regional endemic, are distributed within this community.

Habitat Types, Classes, Distribution and Situation in the Project Area: EUNIS habitat type in the project area is;

E1.2E: Irano-Anatolian step: It is the single habitat in the Project Area. This habitat is also observed in the high mountainous layers of Central Anatolia, Eastern Anatolia and Mediterranean.

10.3.2 Terrestrial Fauna Studies

The main objectives of terrestrial fauna studies are identification of the areas that are likely to be affected during the construction and operation phases of the Project (project activities and impact areas) and the terrestrial fauna elements (amphibians, reptiles, birds and mammals) in those areas, identification of the biological activities of the species in question in the area (such as reproduction, nutrition, accommodation etc.) and assessment on the appropriate mitigation measures by identifying possible impacts from project activities. Fauna studies and reports include mammals (Mammalia), birds (Aves), reptiles (Reptilia), and amphibia groups. Within the scope of this report, the assessment of birds (Aves) will be given under a separate heading.

The Project Area demonstrates the Central Anatolian steppe habitat feature in general. There are not too many altitude differences in the field. Most of the area is being used for grazing by local people. In the vicinity of the area, there are also heterogeneously introduced cultivated lands. The area comprises more of habitats suitable for breeding, feeding and sheltering for terrestrial vertebrate fauna elements when these features are considered.

Methodology

The principles and methods based on faunistic studies are summarized below.

- Fauna studies cover all habitats that generate a suitable nutrition, sheltering and breeding areas for terrestrial fauna types in the Project Area and the immediate vicinity outside of the Project Area. Additionally, study area was further expanded in cases where there may be a different fauna structure due to variant topography and / or vegetation structure.

- A field study was conducted in May 2016 in order to identify fauna elements (see Figure 10.6) and real (direct field observations) and actual data were collected.

- In addition to this, literature data, field observation records of the previous years that were carried out in the near territory and survey data of the locals were utilized.

Figure 10.6. Terrestrial Fauna Studies

- In the identification of animal species, direct observations were utilised as well as the existence of relevant habitats, traces and signs of animals.

- Presence of habitats suitable for fauna species, nests, nestlings, pellets and tracks of species (especially for the determination of birds and macro mammals), excrete and food wastes (especially for the determination of mammals), skin-horn, shield and bone remains were checked and evaluated during the faunistic studies.

- For the identification of reptiles and small mammal species, observations and and materials of dead animals found in nature (especially dead reptile individuals and / or skin, shield remains) and the literature data on fauna elements of this area, museum materials collected before, animal specimen was a source for the lists prepared beforehand by mounted animal materials by local people and amateurs were all used as a source.

- Satellite views and 1 / 25.000 scale maps were utilized in faunistic studies.

- Moreover, in order to identify the altitudes and geographical coordinates, Global Positioning System (GPS) was utilized.

- Field work was started early in the morning and continued until sunset.

- Data on biotopes, biogenetic conservation areas, endemic species, endangered species and wildlife habitats were collected and evaluated. Threatened categories of fauna elements were assessed according to national and international sources.

- Fauna studies and reports include mammals (Mammalia), birds (Aves), reptiles (Reptilia) and two lives (Amphibia) groups. Aquatic habitats are not available in the area. Therefore, aquatic fauna elements are not deployed in the field.

- In the species list prepared, scientific names of the species in Turkish and in English, national and international, status of threatened categories and probability of influence are presented.

- Kiziroğlu 2009, Demirsoy 1996-2002 and Central Hunting Commission Decisions dated 2015-2016 have been used as sources for fauna elements and national threatened categories.

- IUCN Red List, Bern Convention and CITES were utilized as sources during the determination of international threatened categories for fauna elements.

Photographs of some species were taken during the fieldwork and included in the report.

Findings

During the field studies, 78 terrestrial vertebrate species (19 mammals, 50 birds, 8 reptiles and 1 amphibian) in total were identified. Findings concerning fauna groups are summarized below. The list of animal species that have been identified (taxon names and family names in latin, genus names in Turkish and English in systematic order), national (Demirsoy for amphibians, reptile and mammal species, Kiziroğlu for birds, 2008-2009) and threatened categories according to international criteria (IUCN Red List, Bern Convention, CITES), Central Hunting Commission Decision, protection statutes according to 2015-2016, for each animal class, it is shown in Appendix-1, Table 1.2, Table 1.3 and Table 1.4. A "legend" is also given for the abbreviations and symbols used in the tables.

Amphibians (Class: Amphibia)

The studies carried out in order to determine the amphibians' species (salamanders and frogs), nest-egg-juvenile (tadpole) -adult of the amphibians species were seeked. In this context, the bottom of the stones and the water ripples around the temporary creeks was checked and the individuals found were caught by a spoonnet without harming. The species of individuals caught were identified and recorded. After this process, the individuals were released back to the nature. In the field studies, *Bufotes Variabilis* (see Figure 10.7) has been identified around rocky areas in the existing Project Site (Appendix-1, Table 1.2).

According to the Bern Convention, *Bufotes Variabilis* is listed in Appendix List-2. This amphibian species is found in wet and moist areas and in the steppe and stony areas in its environment, it is exposed over large areas and is not endangered. According to IUCN; this species is listed under "LC: Least Concern" category and is not in the threatened category. This species is exposed over large areas in the western palearctic zoogeographic region in Turkey.

Figure 10.7. *Bufotes variabilis*

Bufotes variabilis is evaluated as "nt: not threatened" according to the national threatened categories (Demirsoy, 1996-2002) and they are not included in any danger category. It has been observed that this species exist also out of the Project Area.

Reptiles (Class: Reptilia)

Field studies were carried out in steppe and rocky-stone habitats that have appropriate living conditions for reptiles to identify reptile species (turtles, lizards, snakes) in the study area. The study was concentrated on terrestrial environments and rocky areas, especially the fields where habitat losses are fully visible (areas that will remain under the panels). In these areas, nest-egg-juvenil-adults of reptiles were sought. In this context, reptiles were controlled in steppe and rocky-stone habitats, and the individuals found were observed and recorded.

Regarding the field studies, records obtained from interviews with local residents, and literature records, a total of 8 reptile species were identified in the area. The reptile species and their presence in the Project Area and out of the area, national and international threatened categories, endemism, registered areas, and existence in alternative areas, relative population abundance and data collection methods are shown in Appendix-1, Table 1.2.

Testudo graeca, *Ophisops elegans*, *Trachylepis aurata, Eirenis modestus, Elaphe sauromates* were identified from the observations made in the field and *Typlops* *vermicularis, Dolichopis caspius* and *Malpolon monspessulanus* were identified from literature, habitat suitability and survey data. Photographs of some reptiles identified are shown in Figure 10.8.

Malpolon monspessulanus	*Ophisops elegans*
Testudo graeca	*Trachylepis aurata*

Figure 10.8. Some Identified Reptile Species

It is quite difficult to make a precise assessment of the "population densities" of the reptile species identified. It is necessary to observe and count the species population throughout the year in order to determine the population density. For this reason, a "relative" assessment of the population densities of reptile species in the Project Area was made by only taking into account the number of individuals observed during the field study and the information obtained from the local community. Accordingly, it has been assessed that the most abundant reptile species in the Project Area are *Ophisops elegans*, and other reptile species are rare and / or rarely abundant.

All reptile species identified are species protected by the Bern Convention (Appendix-1, Table 2.2). In this context, the species of reptiles in Turkey also appear to be protected under this contract. The 5 reptile species identified in the territory are found in Annex 2 of the Bern Convention; 3 species are listed in Annex 3 (Appendix-1, Table 1.2).

According to IUCN; only *Testudo graeca* is in the category "VU: Vulnarable" (Appendix-1, Table 1.2). However, this turtle species is a wide-spread reptile species found in every region except for the Eastern Black Sea region in our country. Other reptile species are not in any danger category. According to IUCN, these species are in the category of "LC: Least Concern", which is a widespread type in country-wide and western Palearctic zoogeographic region.

All reptile species detected in the Project Area are evaluated as "not threatened" according to the national danger categories (Demirsoy, 2002) and there are not any species found as “threatened” in the area in this context.

Mammals (Class: Mammalia)

Studies to identify the mammal species in the study area were conducted in all habitats in the Project Area and in the vicinity of the Project Area. During these studies, more suitable habitats were searched for nutrition, sheltering and breeding of the mammals in the region. Traces and signs of the mammals were also utilised in these areas. Moreover, local people were interviewed (especially those who hunts) and the literature data were also utilised.

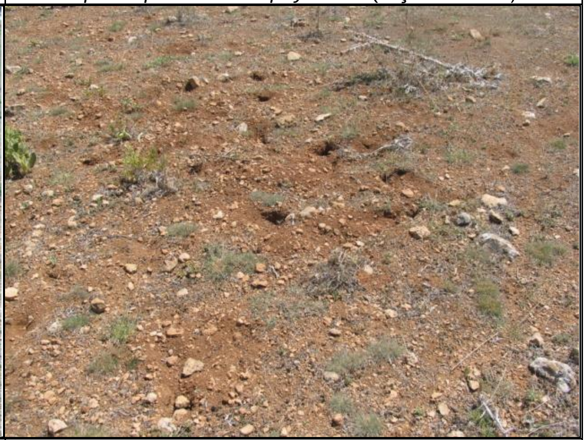
A total of 19 mammal species were identified in the project sites according to field studies, data obtained from interviews with local people and literature records. The national and international threatened categories, endemisms and data collection methods of these mammal species are presented in (Appendix-1, Table 1.3) and photographs of individuals and/or traces of some mammalian species are shown in Figure 10.9.

Some of the mammal species identified is those protected by the Bern Convention. In this context, the species of mammals in Turkey (with some exceptions) also appear to be protected under the Convention. There are no mammal species in Annex 2 of the Bern Convention, 4 species of mammals identified in the area. 4 mammal species are in Annex 3 (protected fauna species). The remaining 11 mammal species are not in the Bern categories. According to IUCN, there is a mammal species in the Project Area (CR, EN, VU) that enters the endangered categories on a global scale. According to literature and habitat suitability, this mammal species which is likely to be in the Project Area is *Vormela peragusna* and its distribution in our country is generally followed by the spread of ground squirrels. Among the other mammal species detected in the field, *Spermophilus xanthophyrmnus* and *Mesocricetus brandti* are in the category of "NT: Near Threatened" which is close to danger, according to IUCN. Other mammalian species that are detected (eg, including the *Erinaceus concolor* with limited mobility) are in the "LC: Least Concern" category according to IUCN, which is a widely diffused species of Turkey's general and western Palearctic zoo-geographical region.

Spermophilus xanthophyrmnus

Spermophilus xanthophyrmnus (Dışkı ve Yuva)

Nannospalax nehringi (Yuva)



Microtus guentheri (Yuva)

Figure 10.9. Some Identified Mammal Species, Nest and Traces

- ***Vormela peragusna*** It has been evaluated as a critical mammal species within the Project Area. According to IUCN in this category, the threatened categories is VU. No record of this species has been obtained in the Project Area. But it is known that the main food source is ground squirrels and other rodents. In addition, the ground occupies the chambers of the squirrel and acquires a home. It is thought that the species is spreaded in the area when the squirrel cages in the area, habitat suitability and the specialist's other field experiences are considered.

- ***Spermophilus xanthophyrmnus*** This species has been evaluated as a critical mammal species for the Project Area. According to IUCN in this category, the threatened categories is NT. A large number of individuals (adult-young) and / or nests belonging to this species have been recorded in the Project Area. In particular, the population of Spermophilus xanthophyrmnus is determined by the observations of adult-young individuals and numerous nesting holes, which are intensively populated in the Project Area. In the field studies conducted, the population of this species was found to be about 30 individuals / km2.

  This species spreads from Central and Eastern Anatolia in Turkey to the Western part of Armenia and to Northern Western Iran, and lives on steep slopes over 800 meters in altitude with short grassy vegetation just like in the Project Area. It is one of the mammal species that exhibits hibernation behavior in our country. They spend their winter hibernation from the end of August to the middle of February. They go on breeding period after they are alert. In this context, it has been assessed that this project area could be used as a wintering area as well as a breeder.

According to IUCN, populations have declined by 20-25% in the last 10 years and are in the NT category. It is located in the critical category just below the VU category and just above the NT (A2c). So it is almost a species with a sensitive category. According to the literature studies, the study conducted between 1999-2001 reveals that an area of 4 hectares can be found in an average of 123 individuals.

- ***Mesocricetus brandti** ,* is another species of mammal that is considered critical for the Project Area. Although it is not in the danger categories according to IUCN, it is in the NT category. Hamsters have semi-excavated legs and generally live solitary. They are distributed among the agricultural areas in the Palearctic region, on steep and semi-arid areas.They are in danger because of excessive agricultural struggle in agricultural areas. Mesocricetus, belonging to the subfamily Cricetinae, has a wide distribution in the Palearctic region. The genus Mesocricetus is represented by five species (*Mesocricetus nigriculus, Mesocricetus auratus, Mesocricetus raddei, Mesocricetus newtoni and Mesocricetus brandti*). Only *M. auratus* and *M. brandti* are distributed in Turkey. *M. auratus* is only rare in Turkey and near Kilis on the Syrian border. The expansion of *M. Brandti* extends from the Central Anatolian Stepland, where the Project Area is located, to the southern part of Iran. Though the spread is wide, it is a very rare species. Turkish hamster is a protected species on a global scale and classified as NT according to current IUCN protection criteria.

  The conversion of step habitats into agricultural land is the main reason for the decline in hamster populations. In the last 10 years, population numbers are thought to have decreased by 20% due to agricultural struggle and loss of habitat. In life cycle many hibernation behaviors are observed in most of the months throughout the year. They emerge from hibernation between the end of February and the beginning of March. They breed 2 or 3 times during their active period and give birth to an average of 10 offspring for each abdomen. In Central Anatolia, it is thought that they enter hibernation once again in mid-August.

  It was identified by observing the nest holes that the population may be low and the species may breed in the project area. In the field studies conducted, the population density of this species was found to be around 1 or 2 nest/km^2. In this context, it has been assessed that this project area could be used as a wintering area as well as a breeding area. Therefore, during any activity to be carried out on these habitats, the species will either be in breeding season or during winter hibernation. The activity will not allow the species to move off and the population may disappear.

There is not any hollows and caves available for the bats in the Project Area, which can be used as a breeding-settlement-drowning area. For this reason, even though they are specified as critical (V) species at national scale, it is assessed that there will not be any negative impact on their population.

The same condition also applies to *Canis lupus*. The existence of wolf species was determined from the survey that was conducted with shepherds in the Project Area. According to the information received, it has been evaluated that in the Project Area wolves are observed very rarely (1-2 individuals) in winter months. The Project Area is also not suitable as a breeding area for wolves. This situation shows that wolves use the Project Area as a wandering site or transit area.

According to the Central Hunting Commission list, there are 15 mammal species listed iin Annex-1, 1 species in Annex-2 and 2 mammal species in Annex-3.

10.3.3 Ornithology Studies

Within the scope of the study, bird species that may be seen within the Project Area and its vicinity, status of these species, whether they are native or immigrants, whether there are habitats used by birds, existence of any kind of habitats used for the purpose of feeding, sheltering, overnight stay, long-term accommodation, wintering or breeding regularly or frequently, intensely or above average by birds that are "native" or "immigrant" in the Project Area; in addition any possible impacts from the project activities on the natural habitats that are being used for different purposes by local and migratory species, if any adverse impact is in question, then the measures and precautions to be taken to ensure that these potential impacts can be removed completely or as much as possible, are all assessed.

Birds are found at the top of the food pyramid. They are kind of species of animals that are affected by the adverse environmental conditions and leave the area in the first place and quickest way possible and escape to the alternative areas. Since they are active animals, birds are used as indicator species for the monitoring of ecological changes. For this reason, fauna surveys focus on birds. Population densities, diversity of species and habitat usage patterns are investigated in detail in order to determine the fundamental conditions.

Studies conducted to determine bird species in the Project Area have been carried out in a very large area, including the hills that contain similar habitats in the vicinity and the flatlands between these hills, taking into account the birds' ability to fly. In these areas, nest-egg-juvenile-adults of birds were searched. In this context, bird species were observed using binoculars (Nikon 12x40). The observed bird species were recorded without capturing them and photographs of some species (Canon 7D-SRL, 400 mm telephoto) were taken (see Figure 10.10).

Circaetus gallicus

Buteo rufinus

Falco tinnunculus

Delichon urbicum

Muscicapa striata

Saxicola rubetra

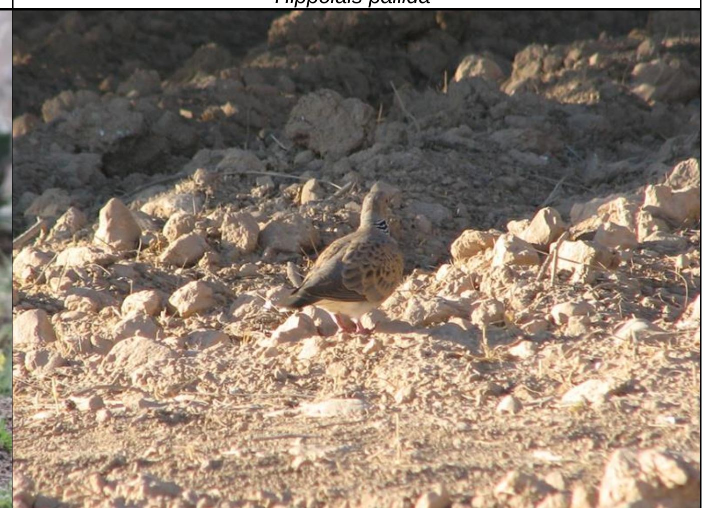
Upupa epops

Hippolais pallida

Coracias garrulus

Fringilla coelebs

Oenanthe oenanthe



Streptopelia turtur

Figure 10.10. Examples of Identified Bird Species

Findings

Project Area forms a breeding and sheltering habitat for mostly small Passeriformes due to dominant mountain steppes and stony-rocky habitats. It has also been observed that non-passeriformes species also use the habitat for nutrition and transit purposes. Thus, the population of non-passeriformes species is relatively small and these species are considered as vagrant species for the field.

Besides, predatory birds (hawlk, kestrel) are usually recorded on the Project Area while walking and / or hunting (circling and flying). There were no active and / or previously used nests in the Project Area belonging to these predatory birds. This gives an idea that the Project Area is not being used for breeding purposes by predatory birds.

Some of the bird species observed in the Project Area are the species found in a certain period of the year (spring-breeding and / or autumn-migration) and are generally bird species that leave the area in the autumn. It has been determined that the Project Area and the air space on the project area is not n the migration route of large migratory birds with long winged floats (see Figure 10.11). Particularly in the field observations made during the spring period, only individuals belonging to *Buteo rufinus*, *Falco peregrinus* and *Falco tinnunculus* (one each) were observed while searching for food in the Project Area. It is an unpreferable transit area for migratory birds due to the fact that there are not any suitable steppe habitats, (permanent) wetlands (such as river-lake) and nutrient-rich steppe areas for migratory birds in the Project Area and its immediate vicinity. No bird flocks that use the area as wintering and stopover area during migration or use the area for long term wintering were observed.

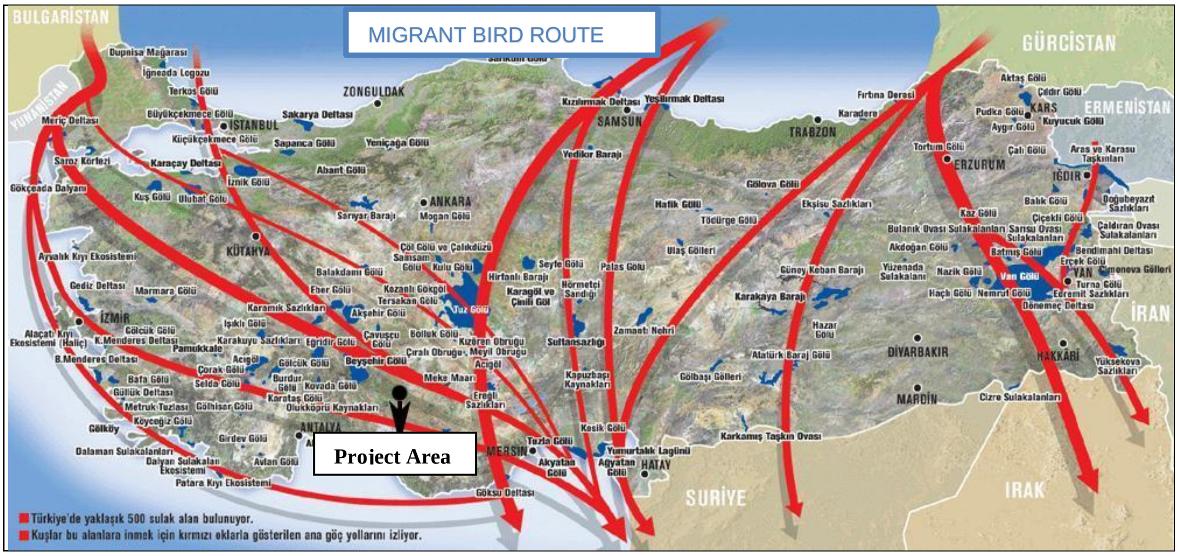


Figure 10.11. Location of Migrant Bird Route and Project Area in Turkey

According to field studies conducted in the Project Area, list of identified bird species and systematic categories are presented in Table 1.4 in Appendix-1. A total of 50 birds belonging to 8 orders and 24 bird families have been defined during the observations. Of the 50 bird species observed, 19 (38%) were non-passeriformes and 31 (62%) were passeriformes. This shows that the habitats are mostly preferred by the passeriformes exist on the ground. Photographs of some bird species identified in the Project Area are presented in Figure 10.10.

The national and international protection status of the birds identified in the Project Area is given in Table 1.4 of Appendix-1. No birds classified as in danger and / or threatened by the IUCN Red List have been identified in the Project Area. Only the *Coracias garrulus* is NT (near threatened) bird species according to IUCN. Only one (1) individual was observed in the field in April and it was evaluated that the individual used the area as a transit area during migration. There is no observation recorded for breeding of that species in the Project Area.

24 of the bird species identified in the study area were listed as fauna species that are strictly protected in Annex 2 of the Bern Convention. In addition, 20 species, with a few exceptions but including most of the protected fauna species not listed in Annex 2, have been listed in Annex 3 of the Bern Convention. The remaining 6 species are not included in any protection class of the Bern Convention. From this point of view, 44 of the 50 bird species detected in the area are protected species by the Bern Convention criteria. However, according to the Bern Convention, 90% of the Turkish ornitofauna seems to be species that need protection. The reason of this is why the Bern Convention aims to protect the species of birds precisely against the risk of population decrease of European bird species.

Based on the Central Hunting Commission Decisions (2015-2016), 35 of the birds identified in the area are under the protection of the Ministry of Forestry and Water Affairs and are prohibited of hunting throughout the year. The hunting of seven of the species identified has been prohibited by the Central Hunting Commission throughout the year. The hunting of five of the identified bird species is limited to the pre-determined seasons by the Central Hunting Commission.

National red list categories (Kiziroğlu, 2008-2009) of the birds identified in the field is shown in Table 1.4 of Appendix-1. According to this, 31 bird species in the Project Area are in the danger categories (A.1.2.-A.2-A.3). However, Kiziroğlu (in 2008-2009) evaluated 300 bird species out of 460 bird species found in Turkey fauna as different status of danger categories. The protection at source approach was based on all of Europe. However, these species are widely spread species in many parts of Turkey. Endemic bird species were not identified in the Project Area.

Based on observations in the area and previous studies conducted, it can be commented that the population density of bird species is very low and population of most of the species except for some bird species is between 1 and 10.

10.4. Potential Impacts and Mitigation Measures

Within the scope of the Apa GES Project, the impacts on the biological environment, due to land preparation and construction activities, are limited to the Project area and should be managed properly. Since Apa GES will be a facility to be installed and operated with photovoltaic technology, it is expected that the only water usage in the facility will be due to cleaning activities. The facility, when in operation, will use water twice a year and there will be a water requirement of 55 m^3 (corresponding to an average of 300 liters / day or 0.003 liters / second). Due to the fact that the amount of water needed will be transported from the market periodically, it is not expected to observe direct impact on groundwater or surface water resources. Pure water will be used and no chemical or heat transfer fluid will be added to the washwater.The process of facilities based on photovoltaic technology does not require cooling, like condensed solar power plants (CSP) (BirdLife South Africa, Smit, Hanneline A., 2012), therefore cooling water usage is not an issue here.

The possible effects depend on the ecological characteristics of the site, the sensitivities of the species and the extent to which they are sensitive to the effects. The project has only interactions with terrestrial flora and fauna elements since there is no aquatic habitat in the Apa GES Project Area and the Project has no interaction with off-site water resources (Apa Dam, Carsamba Stream) and the Project does not contain artificial water constructions. In addition to this, necessary precautions will be taken in line with the views of State Hydraulic Works 4th Regional Directorate for the field preparation and construction phase regarding the protection of the dry creek bed within Apa GES Project Area.

The effects of the project on terrestrial flora and fauna elements due to land preparation and construction activities and the measures to be taken against these effects are presented under the following headings.

10.4.1. Potential Impacts of Construction and Operation Phases

Terrestrial Flora

In line with the studies carried out in May 2016, 94 species and subspecies taxa belonging to a total of 26 families were identified in the area as a result of field studies. Eight of the species detected in the field are endemic for Turkey. Two of the endemic species identified are (*Cousinia iconica, Anthemis fimbriata*) in the threatened category according to Red Data Book of Turkish Plants is "VU", others are wide spread endemic and the threatened category is "LC". Both *Cousinia iconica* and *Anthemis fimbriata*, which are locally endemic, are distributed in similar habitats in the Afyon and Eskişehir areas, especially in Konya Closed Basin.

Since most of the flora species identified in the Project Area is cosmopolitan, the endemic species are generally widespread species, and the regional endemic species are distrubuted in similar habitats, possible impacts will be reduced on flora species in the Project. Population of the identified regional endemic species will not seriously decrease as they are distributed both within and out of the affected area from the project activities.

The entire Project Area shows a degraded steppe habitat type feature. Hence, the diversity of habitat and ecosystem cannot be mentioned for the Project Area. The area is only Iran-Turan step habitat and this type of habitat is one of the most common habitat types of Turkey. Due to overgrazing and anthropogenic effects, this habitat type has also been highly damaged and in many places the rocks have rised to the surface and turned into a stone steppe habitat. Because of this, the habitat in the area is not sensitive and rare and there is no protection priority. Since the naturality of the area is largely distorted, the ecological aspect is considered as an ideal area for SPP activity.

Terrestrial Fauna

The Project Area is not a protected area. There are no natural lakes and permanent rivers in the region, and the majority of the area contains steppe and rocky-stony habitats. Since the Project area is located at a high altitude, it is assessd that the area is not a suitable place for nutrition, breeding and rearing of fauna elements. The site is under anthropogenic effects such as field hunting and grazing.

The impacts on terrestrial fauna types within the Apa GES Project will mainly be observed during the land preparation and construction phase. As part of the construction works, the Project Area will be surrounded by suitable methods (e.g fence) and this will limit the entrance of wildlife species during the operational phase. Potential impacts of the project on fauna species are listed below:

- Existing habitats within the Project Area cannot be used by some fauna species during the lifetime of the Project,
- Impacts on terrestrial fauna species due to vegetation clearing and vegetal soil removal activities on vegetation cover and habitat change during the site preparation phase of the Project,
- Disturbance of some of the fauna species and leaving the area due to the dust and noise that will occur during the project activities (eg vegetal soil exfoliation, leveling, construction, vehicle traffic) even if they will be carried out within a relatively short period of time during the project's land preparation and construction phase,
- Loss of some fauna species with limited mobility during herbage stripping and leveling activities.

The possible impacts on terrestrial fauna species due to project activities and the necessary measures / recommendations to prevent and / or mitigate these effects are presented below.

10.4.2. Mitigation Measures

Terrestrial Flora

The measures to be taken against the possible effects of the planned Project on the continental flora elements are as follows:

- Before the land preparation phase, definite work areas, where the activities (eg vegetation clearing, vegetal soil stripping, leveling and construction) will be carried out and where permanent structures (units and roads) will be established, will be determined.
- The topsoil will be rubbed with appropriate methods from the designated areas before the construction activities (land preparation phase) and will be stored on the vegetal

soil storage area reserved in the east of the site so that the soil will preserve its productivity. Topsoil will be spreaded over the working fields after the completion of the construction activities and the restoration of the plant cover will be provided.

- The distance between the panels will be around 3 to 6 meters depending on the ground structure/ slope.

Mammals

Species of mammals detected in the study area may be affected in various ways by the Project activities. Although the species identified are widespread in this region and / or Turkey and / or Western Palearctic region and even if they are not endangered species on a global scale, again for the persistence of natural life and protection of the ecological balance, taking the necessary precautions will reduce the impacts and ensure that the impacts are taken to a level that can be tolerated in terms of natural life.

Measures to be taken for the protection of *Spermophilus xanthophyrmnus* and *Mesocricetus brandti* (breeding and wintering mammals of the NT category according to IUCN), which are considered critical for the Project Site in terms of fauna, are described in the following sections.

The *Vormela peragusna,* categorized as VU according to IUCN, is assessed to have a population of a few individuals in the area. It is expected that this will be the first species to leave the area during land preparation and construction activities since this species does not hibernate, is timid and has a higher mobility than other species in the area. In addition, the species prefer ground squirrel as a food source. Ground squirrel population around the Project Area and in the vicinity was observed. Therefore, individuals belonging to this species will prefer alternative suitable areas in the surrounding area.

During land preparation and construction works of the project, there will be habitat (for mammals) losses / restriction on the sites where the facilities will be established in the Project Area. However, there are alternative suitable habitats for the identified mammal species in the immediate vicinity of the Project Area. Since species with high mobility are able to escape to nearby habitats, there will not be any losses of species. In order to reduce the impacts of habitat losses, land preparation and construction activities will be planned by taking into account the breeding season (April-May) and the necessary time and energy for individuals to escape to appropriate alternative areas outside the Project Area will be provided.

On the other hand, collection of hedgehog (*Erinaceus concolor*), who has less mobility than others and transfer of these collected individuals to the territory where there will be no impact by constructional and operational activities will ensure the effects on the population of this species are eliminated. Other than this, all field personnel will be informed about the need to transfer the individuals belonging to these species to the alternative areas.

Mitigation Measures for Critical Mammals

The reasons for (*Spermophilus xanthophyrmnus* and *Mesocricetus brandi*) being evaluated as critical species in terms of fauna in the Project Site are explained in the relevant section. The specific measures to be taken for the mentioned two critical species are described below.

- *Spermophilus xanthophyrmnus* and *Mesocricetus brandti* are the species that reproduce and hibernate in the Project Area. Therefore, these species will not leave the area during the year. These species hibernate from the end of month August to the middle of month February, about 40-100 cm below the ground. At the end of month March, they emerge from hibernation in the beginning of month April then they start their reproductive activity in their nests under the ground in the middle of month April. Therefore, during any activity to be carried out on these habitats, the species will either be in breeding season or during winter hibernation. The activity will not allow the species to move off and the population may disappear. For this reason, studies will be undertaken to determine the abundance of populations of individuals of these species, especially on the planned construction sites, before site preparation and construction activities begin.

- Individuals of critical mammal species, whose abundance of populations have been identified before the site preparation and construction phases, will be transferred to similar suitable alternative areas with high ecological carrying capacity outside the Project Area, by catching traps before operations begin.

  The study plans for the two critical mammal species are mentioned below.

  Spermophilus xanthophyrmnus:

- To conduct relative abundance studies of populations as spatial-temporal before catching; to identify relative abundance of population of species,

- To conduct the snaring actions before and after the breeding season (February or August) in order to protect the juvenils; release of the individuals in case of encountering teat females during snaring actions in other months,

- To transport the entire population either at the beginning of breeding or the ending of breeding awhen the young individuals begin to feed, since the populations of the species live in colony (at least 20-50 pairs) (the whole colony should live together as a strategy developed against hunters),

- To mark the captured individuals with paint or ear marking so that they can be monitored on appropriate habitats,

- To select the suitable habitat so that there will be nests of ground squirrels previously and that the individuals do not spend time to dig nests again,

- To allow them to enter the existing nests and then design breeding or wintering nests themselves,

- To catch them with Tomahawk-type traps and ensure that the captured individuals are fed and kept in a non-hot area (see Figure 10.12)

- To transfer the individuals to suitable habitats when the number of individuals exceeds 5.

Figure 10.12. Tomahawk Trap for *Spermophilus xanthophyrmnus*

Mesocricetus brandti:

- Screening of hamster nests, which shows a more characteristic behavior than other rodent species, is carried out in agricultural areas and sides, and steppe areas; (Note: individuals belonging to this species are known to be very vigorous animals and can not tolerate the presence of other rodent species in their immediate surroundings, rodents usually prefer to make nests with a few holes; but the hamsters make nest with one hole and the nest shows a descent by making a 90^{o} opening up to 20-35 cm),

- Marking of the nests which observed by researchers who has a distance of three meters by GPS,

- Determination of whether or not the detected nests are active by placing plants in the nest entrance (it is assessed that if the nest is opened the next day, then the nest is active),

- Provision of samples and itinerary:
    - Trapping will be done by utilising one-door foldable live capture traps (Sherman traps), (see Figure 10.13)
    - Using peanut butter as feed in traps; using steel brands to mark numbers (Monel # 1 fingerling fish tag) (marking process is carried out for the permanent identification of individuals so that the samples can be viewed in the nature) to both ears of captured hamsters
    - Recording the branded individuals to include information such as the brand number, age (estimated), sex, body weight, breeding status and location of the capture (Garmin's GPS III Plus Personnel Navigator) (The age of the hamsters caught can be determined by observing the body size and sex organs, while the sex determination is done by examining the anal-genital distance which is shorter than that of the males. This distance also provides information on age),
    - Measuring body weight by using a hand weigher (Persola Spring Scale); taking notes on reproductive status including testicular swelling in men, state of the nipples in females and the distance in the genital organ.

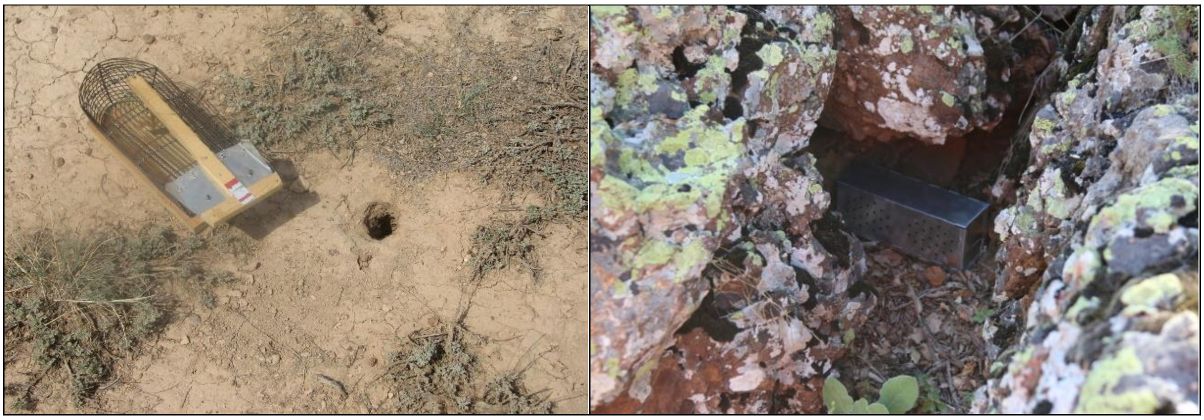


Figure 10.13. Sherman traps *for Mesocricetus brandti*

- Transfer of Obtained Samples:
    - Sampled Turkish hamsters should be left in a nearby area which shows similar habitat characteristics and less intense in terms of the same species
    - Selecting morphologically similar nests and releasing the samples to the immediate vicinity of the Project Site,

Amphibians

It is estimated that the population of the identified *Bufotes variabilis* may also be at a very low level and that they do not reproduce on the field due to the lack of suitable wetland and permanent fluid and / or stable aquatic habitats in the study area. For this reason, it is not expected that the habitat losses will occur during the preparation and construction phase and will not have a significant effect in this respect. It is expected that more humid environment will occur during the operation phase especially in areas where the administrative building will be established. For this reason, it is possible to have more suitable habitats for this species during the operation period.

Reptiles

Reptile species determined in the study area are non-endangered species that are wide spread in the region, Turkey and western Palearctic region. However, necessary mitigation measures will be taken to preserve the continuity of natural life and the ecological balance.

Habitat losses / shrinkage of these species will be due to land preparation and construction works in the areas where the panel area and other facilities in the project area will be established. However, in the immediate vicinity of these areas, there are alternative suitable habitats for these species and it is possible for them to move to these habitats in the immediate vicinity of the individual. For this reason, extinction is not a case for the species/ population. Land preparation and construction activities will be planned so that the breeding periods (May-June) of species will be considered and the effects of habitat losses / contraction will be reduced. Construction activities will be planned accordingly to provide the necessary time and energy for individuals to move to appropriate alternative areas outside the construction site. In addition, *Testudo greace* (VU), which has low mobility, needs to be transferred from construction areas to natural habitats before the start of the activities. Thus, the effects on the population of the species will be eliminated. Other than this, all field personnel will be informed about the need to transfer the individuals belonging to these species to the alternative areas.

Birds

There are no substantial area for the birds in the Project Area and its vicinity. One of the important sites in the broad Project Area is Hotamis KBA, which is approximately 43.9 km away from the site and is quite far from the Project impact area. The bird species identified in the study area are widely distributed in this region, Turkey and Western Palearctic region and are not endangered species. Moreover, no bird species that is of critical importance was observed.

Due to land preparation and construction activities that will be carried out in the study area, habitats belonging to domestic bird species will be shrinking. These habitats are generally for feeding and nesting, especially for passerformes birds. However, in the immediate vicinity of these areas there are alternative suitable habitats for these species and it is possible that they can move to these habitats in close proximity. For this reason, extinction is not a case for the species/ population. On the other hand, for the persistence of natural life and protection of the ecological balance, taking the necessary precautions will reduce the impacts and ensure that the impacts are taken to a level that can be tolerated in terms of natural life.

In order to reduce the impacts of habitat losses, land preparation and construction activities will be planned by taking into account the breeding season (April-May) and the necessary time and energy for individuals to escape to appropriate alternative areas outside the Project Area will be provided. Other than this, all field personnel will be informed about the need to transfer the individuals belonging to these species to the alternative areas.

Voltage transmission lines for the connection of the power plant to the national electricity network, (kV), will be installed within the scope of a separate project by TEIAS. The project owner will provide the necessary support for the planning and construction of the line as well as the appropriate design for the birds (e.g prevention for collision and electric currents).

Evaluation in terms of Migration Route

As it is known, some of the most important bird migration routes of the Western Palearctic region pass over Turkey (see Figure 10.11). In addition to these migration routes, there are main and secondary migration routes. The Apa GES Project Area is not located on the main or secondary migration route. The nearest migration route follows a route from the north of the Beysehir Lake to the Hotamis KBA, 20- 30 km north of the area. Therefore, it has been determined that the Project Site is not used as recreational, feeding, overnight, breeding area by local and immigrant forms. It has also been identified during studies that migrant forms did not fly collectively through the Project Area or from the immediate vicinity. An ornithological montoring plan is not required because the project site and its immediate vicinity do not host immigrant and / or critical birds and there are no sensitive habitats to accommodate these species.

Comparison of the Effects of Photovoltaic and Concentrated Solar Power Plants (CSP) on Birds

Photovoltaic and Concentrated Solar Power Plants (CSP) are energy production systems that exhibit fundamental technological differences. Photovoltaic technology involves direct conversion of solar radiation into electrical energy through panels made of semiconductor materials, CSP technology is used in thermal power plants which focus on sunlight and convert the heat to electricity by means of turbines. CSPs, such as nuclear or coal-powered power plants, require cooling and fluid use, while photovoltaic power plant systems do not. Comparisons of system alternatives based on both technologies were given in detail in Chapter 4. A photograph showing an example CSP is presented in Figure 10.14.

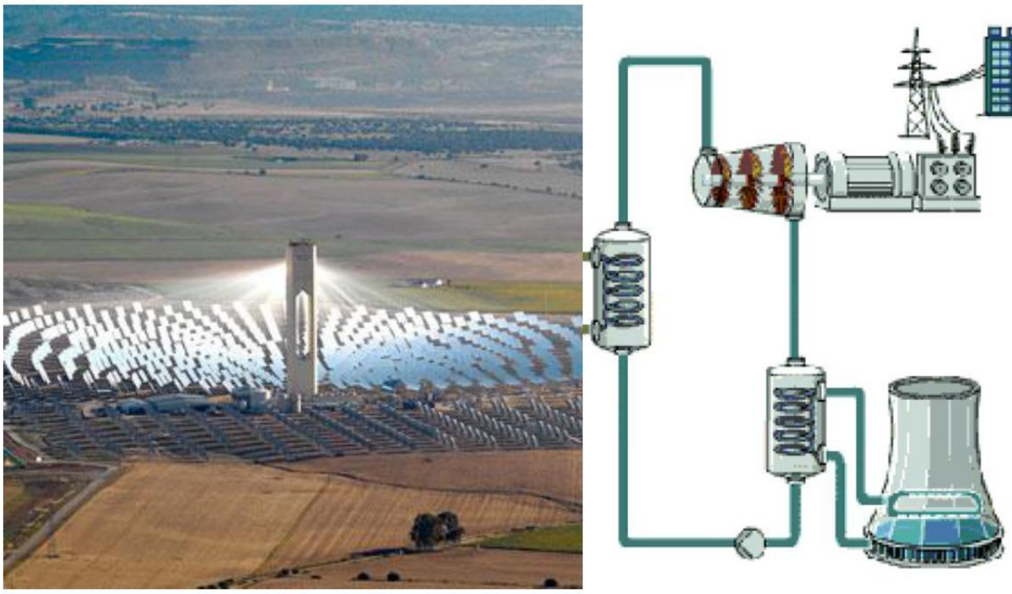


Figure 10.14. An Example of a Concentrated Solar Power Plant (CSP) (Parabolic Mirrors Concentrating Sunlight at the Center Receiver)
(Source: BirdLife Güney Afrika, Smit, Hanneline A., 2012)

The effects of CSP systems on bird species and the possible effects of photovoltaic systems have been extensively investigated in the guidance document issued by Bird Life South Africa (Guidelines to Minimize the Impacts of Birds of Solar Facilities and Associated Infrastructure in South Africa). Many of the effects (eg collisions, burns, etc.) that may be caused by the components (eg tower, mirror etc.) in the CSP systems as clearly stated in this document do not apply to photovoltaic GES because these components do not exist in the photovoltaic systems. Key assessments done under this scope are summarized below:

- Components such as central receiver towers, focus points and heliostats that are not exist in photovoltaic plants in CSP plants present a collision risk for certain species of birds. However, since the Apa GES will be based on photovoltaic technology, such risks will not be of concern under the Project (BirdLife South Africa, Smit, Hanneline A., 2012).

- Reflective surfaces exist in CSP plants can be attractive for birds. These surfaces may be confused with large water bodies (with similar effects as windows) and can cause disorientation to flying birds, resulting in injury and/or death. The guidance document issued by Bird Life South Africa notes that this effect type does not apply to photovoltaic plants, and that the risks are raised in CSP plants where flat heliostats are used (*BirdLife South Africa, Smit, Hanneline A., 2012*). When compared to facilities based on CSP technology, the reflectivity properties of the photovoltaic panels are much lower and therefore the probability of the photovoltaic panels to be similar to the water masses is very low since systems in which photovoltaic technology is used are designed to absorb sunlight instead of reflecting it (*IFC, 2015*).

- In photovoltaic plants, there is no such effect like burning of birds by entering the the central receiver and focal point and by hitting the mirror which is heated up (BirdLife South Africa, Smit, Hanneline A., 2012).

- Photovoltaic plants do not have evaporation ponds that are needed for CSP plants and where waters containing chemical are transferred. For this reason, the effects which can be seen like birds' contact with pools in CSP plants, when the required precautions are not taken, are not the case for photovoltaic plants (BirdLife South Africa, Smit, Hanneline A., 2012).

- Birds will be likely to roost/perch/nest on the photovoltaic panels (if these are fixed in one angle) and associated infrastructure. Unlikely,it is not possible in thr CSP plants due to disturbance caused by the overall operation of the solar facility (*BirdLife South Africa, Smit, Hanneline A., 2012*). In order to prevent the bird species in the region to disturb the activities stated and to ensure safe operating conditions, training will be given to the operational staff and such bird species will be removed from the field appropriately.

Considering the components and functioning of the photovoltaic plants, there is no negative effect on the bird species and therefore monitoring studies are not required during the operation phase.

<u>General Evaluation of Terrestrial Fauna Species</u>

The fauna surveys carried out in the areas near the Project Area show that a large part of the terrestrial animal species identified in the Project Area are also present in the alternative areas. Accordingly, population losses of the estimated fauna species that are predicted to be in the area are not considered to pose a significant risk to the taxonomic status and populations of non-critical animal species.

It can be said that all of the animal species identified in the project area, based on the biological studies carried out in the alternative areas which are the areas close to the project site, also exists in alternative areas. The anthropogenic impact (grazing and hunting activities) observed in the Project Site and its surroundings, under the existing conditions, restricts the natural life and diversity of the species in the area and causes the fauna species to adhere to anthropogenic effects to some degree. The absence of permanent water systems (streams, lakes, etc.) in the project area does not support the development of any aquatic life. However, there are suitable alternative habitats to fauna species that use surface water resources for irrigation needs close to the Project Area.

On the other hand, the dust suppression measures described will be meticulously taken, as dust propagation during land preparation works can have an effect on invertebrates, particularly those feeding from flowers. Similarly, the construction of Project units will lead to the influence of the habitat in the projection areas. Since large mammal species use these areas only as a feeding habitat, they are expected to leave the area and move to alternative living environments in the vicinity during the course of site preparation and construction.Reptiles and amphibians are expected to be least affected by such effects like dust and noise. When the hazard status, vulnerability in the area, population conditions in the project area and population and possible effects of the project are considered, monitoring of the identified terrestrial fauna species during construction and operation periods was assessed to be unnecessary.

10.4.3. Impact Assessment on Biological Environmental Components

The impact of project activities on ecological components is related to the size of the impact and the vulnerability of the recipient. For terrestrial flora and terrestrial fauna (amphibian-reptile-bird-mammal) species, size and significance of the effects according to the matrices presented below have been determined in accordance with the criteria determined according to the ecological sensitivities of the species. It is known that the features of each step in the systematic classification of species are different from each other and accordingly the shapes and dimensions of the influence from the Project will vary within themselves. Sensitivities of terrestrial flora and fauna species determined within the Project Area are explained in detail in the report.

Endemism conditions and danger categories for terrestrial flora species according to Red Book for Turkish Plants (EN, CR, VU) determine sensitivity within the scope of impact assessment. If an endemic flora species is a regional endemic and in the danger categories according to Red Book for Turkish Plants (EN, CR, VU), the severity of the effect / sensitivity of the recipient will be considered as "serious". However, if the species spread in the surrounding habitats, the severity of the effect will be mitigated and treated as "moderate". In this context, although the danger categories of endemic *Cousinia iconia* and *Anthemis fimbriata* according to Red Book for Turkish Plants are found to be "Vulnurable, VU", the sensitivity of the recipient to these two species is considered as "Moderate" because they are spreaded in similar habitats in Afyon and Eskişehir, especially in Konya Closed Basin. Other endemic species identified in the area are *Astragalus acicularis, Astragalus podperae, Astragalus mesogitanus, Nepeta congesta*, var. *congesta*, *Phlomis nissolii, Asphodeline rigidifolia*, and the categories of danger of these species according to Red Book for Turkish Plants are "Least Concern, LC" because they are widely distributed. Therefore, the sensitivity of the recipient is considered "light" for these species. The impact on the terrestrial flora species within the scope of the project will take place in the project area and the size of the impact is considered as "limited". Accordingly, the significance of the impact of the Project on the regional and widespread endemic flora species identified in the field has been identified as "low" (see Table 10.5).

Table 10.5. Assessment of Terrestrial Flora Impact

Impact Issue	Species	Magnitude of Impact	Severity of Impact			Significance of Impact
			High (3)	Medium (2)	Low (1)	
Dissapear of endemic terrestrial flora species	Widespread endemics: *-Astragalus acicularis* *-Astragalus podperae* *-Astragalus mesogitanus* *-Nepeta congesta, var. Congesta* *-Phlomis nissolii* *-Asphodeline rigidifolia* and other non-endemic	Restricted (C)	If the endemic species are regionally distrubuted and the hazard category to ENT is EN, CR, VU and if it does not show up in similar habitats in the environment	If endemic species are widely distributed and the hazard category for Red Book for Turkish Plants is EN, CR, VU or is not a hazard category (EN, CR, VU) of regional spread endemic species; regional spreading species are spreading in similar habitats around	If there is no endemic species, or if the widely distributed endemic species are not in accordance with the Red Book for Turkish Plants hazard category (EN, CR, VU).	Low (C1)
	Regiona endemics: *-Cousinia iconica* *-Anthemis fimbriata*		If the endemic species are regional spread and the hazard category to ENT is EN, CR, VU and if it does not show up in similar habitats in the environment	If endemic species are widely distributed and the hazard category for Red Book for Turkish Plants is EN, CR, VU or is not a hazard category (EN, CR, VU) of regional spread endemic species; regional spreading species are spreading in similar habitats around	If there is no endemic species, or if the widely distributed endemic species are not in accordance with the Red Book for Turkish Plants hazard category (EN, CR, VU).	Low (C2)

Different sensitivity criteria have been determined for each class in assessing the impact factor for terrestrial fauna components identified within the scope of the project. In this context, when considering reptiles and amphibians, the sensitivity criteria are determined according to the IUCN danger categories (EN, CR, VU) and the extent of spread in the region. There are no species that can be described as sensitive in amphibian species found in the Project Area. According to IUCN, *Testudo graeca* from Reptile species, is classified as "Vulnurable, VU". However, since this species is a wide-spread reptile species in every region except the Eastern Black Sea region, the seriousness of the effect is considered as moderate. The impact on reptile species will be realized within the Project Area, and the size of the effect will be considered as "limited". Accordingly, the effectiveness of reptile species (including *Testudo graeca*) is considered as "low" (see Table 10.6).

Table 10.6. Assessment of Reptiles Impact

Impact Issue	Species	Magnitude of Impact	Severity of Impact			Significance of Impact
			High (3)	Medium (2)	Low (1)	
Reptiles	*Testudo graeca*	Restricted (C)	If the species is a listed in categories EN, CR, VU according to IUCN with a range and a limited distribution	If the species is a listed in categories EN, CR, VU according t IUCN; If the species is listed in categories EN, CR, VU according to IUCN or the mobility is limited	According to IUCN, if the species is not in any danger category and it is widely spread and its mobility is not limited	Low (C2)
	Other reptile species		If the species is a listed in categories EN, CR, VU according to IUCN with a range and a limited distribution	If the species is a listed in categories EN, CR, VU according t IUCN; If the species is listed in categories EN, CR, VU according to IUCN or the mobility is limited	According to IUCN, if the species is not in any danger category and it is widely spread and its mobility is not limited	Low (C1)

IUCN categories (EN, CR, VU) and the situation of using the project area as breeding and feeding areas were taken into consideration in determining the severity levels of the effects on mammalian species. Mammalian species will have a tendency to escape from the field during Project activities because they have mobility skills. However, if the Project Area is used by these species for reproduction or nutritional activity, it is thought that the activity effects will lead to sensitivity. Within this scope, three species (*Vormela peragusna, Spermophilus xanthophyrmnus* and *Mesocricetus brandti*) among the mammal species detected in Apa GES Project area are evaluated as critical. *Vormela peragusna* is classified as "Vulnurable, VU" according to IUCN as mentioned in previously and is thought to use the Project area as a nesting area. In addition, the species preferres the most common mammal species, ground squirrel as food source. There are alternative habitats in the area for this species and it will be possible to move to these areas when the activities start thanks to its ability of mobility. *Spermophilus xanthophyrmnus* and *Mesocricetus brandti* are classified as "Near threatened: NT" category according to IUCN. *Spermophilus xanthophyrmnus* population is highly intense in the area and breeding of adult-young individuals and numerous nesting holes in the area were observed. It is thought that *Mesocricetus brandti* could use the Project Area as a wintering area as well as a breeding area. Therefore, during any activity to be carried out on these habitats, the species will either be in breeding season or in winter hibernation. When all these are taken into consideration, there will be an impact on mammal species within the Project Area and the size of the effect is evaluated as "limited". The severity of the effect and the impact assessment matrix for mammalian species are shown in Table 10.7.

Table 10.7. Assessment of Mammals Impact

Impact Issue	Species	Magnitude of Impact	Severity of Impact			Significance of Impact
			High (3)	Medium (2)	Low (1)	
Mammal	*Vormela peragusna* *Spermophilus xanthophyrmnus* *Mesocricetus brandti* *Erinaceus concolor*	Restricted (C)	If the species is listed in any of the categories EN, CR, VU according to IUCN, and the field are used for reproduction and feeding activities and there are no alternative habitats in the vicinity and the mobility is limited	İf the species listed in EN, CR, VU categories according to IUCN and do not use the field for reproduction and nutrition activities any more, or according to IUCN, if it is not in one of the categories of EN, CR, VU, but uses the area for reproduction and nutrition activities; or According to IUCN, mobility is limited even if it is not in any danger category	If it is not in any danger category according to IUCN and the area is not used for reproductive and nutrition activities and the mobility is not limited	Low (C2)
	Other mammal species		If the species is listed in any of the categories EN, CR, VU according to IUCN, and the field are used for reproduction and feeding activities and there are no alternative habitats in the vicinity and the mobility is limited	İf the species listed in EN, CR, VU categories according to IUCN and do not use the field for reproduction and nutrition activities any more, or according to IUCN, if it is not in one of the categories of EN, CR, VU, but uses the area for reproduction and nutrition activities; or According to IUCN, mobility is limited even if it is not in any danger category	If it is not in any danger category according to IUCN and the area is not used for reproductive and nutrition activities and the mobility is not limited	Low (C1)

For the bird species identified in the project area, the use of the area for breeding or wintering purposes, or the migration route of the area for migrating birds were all evaluated to determine the severity level of effects on the birds in the IUCN categories (EN, CR, VU). Some of the bird species observed at the planned SPP project site are bird species that exist in a certain period of the year (spring-breeding and/or autumn-migration) in the area and are generally bird species that leave the area in the fall. It has been determined that the airspace above the Project Site is not on the migration route of the migratory large birds that are flooded by the long wing. The Project Site and its vicinity are an undesirable transit area for migratory birds due to the fact that there are not suitable steppe habitats (permanent), wetlands (river-lake) and nutrient-rich steppes for migratory birds. There are no bird flocks that use the area as accommodation area during migration, and wintering area in winter months, and also birds that have been wintering for long periods of time have not been observed. The impact on bird species within the scope of the project will take place within the project area and the size of the impact is considered as "limited". For birds, the size of the effect is determined to be "light". As a result, the Project impacts are considered as "low" when the significance of the effect on bird species are considered. The severity of the effect and the impact assessment matrix for species of birds are shown in Table 10.8.

Table 10.8. Assessment of Birds Impact

Impact Issue	Species	Magnitude of Impact	Severity of Impact			Significance of Impact
			High (3)	Medium (2)	Low (1)	
Birds	Bird species	Restricted (C)	If the species listed in EN, CR, VU categories according to IUCN, the area is used over the migration route and the area is used for reproduction and wintering activities	If the species listed in EN, CR, VU categories according to IUCN, the area is not used over the migration route and the area is not used for reproduction and wintering activities	If it is not in any danger category according to IUCN, the area is not used over the migration route and the area is not used for reproduction and wintering activities	Low (C1)

For the determination of severity levels of impacts on terrestrial habitats and ecosystems, the presence of sensitive habitats and rare ecosystems that contain species that are critically assessed, and the natural state of the vegetation structure are taken into consideration. Considering the vegetation structure exist in the Project Area, the ecosystem structure has been evaluated in detail during field works. Accordingly, the most important resource of the Project Area is the Iran-Turan steppe vegetation. This type of vegetation is the entirety of the Project Area. The area where this habitat is located has lost most of its habitat characteristic due to overgrazing. Plant species that are not preferred by animals in habitat have become dominant. In this context, since the impact on existing habitats and ecosystems will be limited to the Project Area, the size of the impact is determined to be "limited". Considering the degraded nature of the area, the severity of the impact for terrestrial habitats and ecosystems is assessed as "light". As a result, the significance of the Project on the existing habitat structure is considered "low" (see Table 10.9).

Table 10.9. Assessment of Terrestrial Habitats and Ecosystem Impact

Impact Issue	Species	Magnitude of Impact			Severity of Impact
		High (3)	Medium (2)	Low (1)	
Terretrial Habitats and Ecosystems	Restricted (C)	If there are sensitive habitats and rare ecosystems that contain critically assessed species, and if conservation of their natural structure involves such things as forest, step, dune, lake	If there are no sensitive habitats and rare ecosystems that contain critically assessed species, and if conservation of natural structure involves forest, step, dune, lake, etc.	If there are no sensitive habitats and rare ecosystems that contain critically assessed species, and if conservation of natural structure involves forests, step, sand dunes, lakes, or if the natural structure is deteriorated, used as an agricultural area or pasture	Low (C1)

10.4.4. Summary of Assessment and Residual Impacts

Table 10.10 provides a summary of ecology and biodiversity assessments. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 10.10. Summary of Ecology and Biodiversity Assessments

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Ecology and Biodiversity	Land preparation and construction	Geniş ve bölgesel yayılışlı endemik flora türlerinin yok olması	Adverse	Low	• Prior to the land preparation phase, definite working areas will be set up where activities (eg vegetation clearing, vegetation removal, leveling and construction) and permanent structures (units and roads) will be established. • The vegetable soil will be rubbed with appropriate methods from the designated areas before the construction activities start (site preparatory stage) and will be stored on the Vegetal Soil Storage Area which is separated to the east of the field, provided that it will not lose its efficiency. Vegetable soils will be restored to the working fields with the completion of the construction activities and the restoration of the plant cover will be provided. • A distance of 3 to 6 meters will be left between the panes depending on the ground / slope. • Land preparation and construction activities will be planned to take into account the breeding periods (April-May) of the species and to be made tentative to provide the necessary time and energy for individuals to escape to appropriate alternative areas outside the Project Area.	Low
		Testudo graeca	Adverse	Low	• All field personnel will be informed about the transfer of species to alternative lands by collecting when they are encountered with individuals belonging to these species.	Low
		Other reptile species	Adverse		• Individuals of critical mammal species whose abundance of populations have been identified before the site preparation and construction phase will be transferred to similar suitable alternative areas with high ecological carrying capacity outside the Project Area, by catching traps before operations begin. • The hedgehog (Erinaceus concolor) with low mobility needs to be collected from the study fields before the activities begin. The transfer of these collected individuals to the territory where there will be no activity / effect on the construction and operation phase will ensure that the effects on the population of this species are eliminated.	
		Vormela peragusna	Adverse			
		Spermophilus xanthophyrmnus	Adverse			
		Mesocricetus brandti	Adverse			
		Erinaceus concolor	Adverse			
		Other mammal species	Adverse			
		Birds	Adverse			
		Terrestrial habitats and ecosystems	Adverse			

CHAPTER 11

PROTECTED AREAS, LANDSCAPE AND VISUALITY

11. PROTECTED AREAS, LANDSCAPE AND VISUALITY

11.1. Protected Areas

11.1.1. Baseline Conditions

In order to identify and evaluate the protected areas within the Project Area and its immediate vicinity, desktop studies and literature researches were carried out by using the databases of the relevant institutions within the scope of the Project. For this purpose, sensitive area list available in Annex 5 of the EIA Regulation was used as reference. This list covers areas that need to be protected in accordance with international conventions that Turkey is contracting party and nationally declared protected areas. As can be seen from the evaluations in the following paragraphs, the nearest protected area is Fosil Ardic Nature Monument, located about 5.2 kilometers east of the site.

Utilized main data sources within the scope of the desktop studies, but not limited to, are listed below:

- Database of Ministry of Forestry and Water Affairs (*http://geodata.ormansu.gov.tr*)
- Database of Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks (*http://www.milliparklar.gov.tr*)
- Database of Ministry of Culture and Tourism, General Directorate of Cultural Heritage and Museums (*http://www.kulturvarliklari.org/kve*)
- Konya Governorship, Konya Provincial Environmental Status Report for year 2014
- Map of Prohibited and Open Hunting Areas in Konya Province for years 2016-2017

Protected Areas in accordance with National Legislation

Areas required to be protected in accordance with the legislation of the country defined under Annex 5 (Sensitive Regions) of the EIA Regulation are listed in the following items and the evaluations related to the indicated areas are presented therein.

<u>National Parks, Nature Parks, Nature Monuments and Nature Conservation Areas defined in Article 2 and 3 of the National Parks Law</u>

Beysehir Lake National Park is the only national park in Konya Province and it is located 80 km northwest of the Project Area.

There are 3 nature parks in Konya Province. The closest one to the Project Area is Akyokus Nature Park and it is located 58 km north of the Project Area. The other two nature parks in the Province are Kocakoru Nature Park (about 68 km to the Project Area) and Yakamanastir Nature Park (about 79 km to the Project Area).

Akgol Eregli Sazligi Nature Conservation Area, the only nature conservation area in Konya Province, is located 95 km east of the Project Area, at the Konya-Karaman Province Border.

There are 5 nature monuments in Konya Province and the closest one is Fosil Ardic Nature Monument and it is located 5.2 km east of the Project Area.

The other nature monuments are Titrek Kavak Nature Monument, Meke Lake Nature Monument, Agili Ardic Nature Monument and Derebucak Nature Monument.

Wildlife Protection Areas, Wildlife Development Areas and Wild Animal Nestling Areas determined in accordance with the Land Hunting Law

Map of prohibited and open hunting areas for years 2016-2017, prepared by Ministry of Forestry and Water Affair, General Directorate of Nature Conservation and National Parks, is presented in Figure 11.1. As could be seen from the map, the only wildlife development area (WDA) in Konya Province is Antalya Cevizli Gidengelmez Mountain WDA that is located about 55 km southwest of the Project Area. There are various hunting areas in the Province as well as prohibited hunting area (see Figure 11.1).

Areas defined as Cultural Property, Natural Property, Protected Site and Protected Area according to 2863 numbered Law on Protection of Cultural and Natural Properties dated July 21 1983, Article 3, Paragraph 1, Clause (a) (Definitions); Sub-clauses 1, 2, 3 and 5; and areas identified and registered in the same Law and amendments

Zengibar Castle Ruins Area (First and third degree Archeological Protected Site) is identified as the nearest protected site to the Project Area according to 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area approved by MoEU. The protected site/area is located near Ulupinar and Hacilar neighborhoods in Bozkir District and about 25 km southwest of the Project Area.

Aquacultural Production and Breeding Sites within the scope of Aquaculture Law

May, Altinapa and Sille Dams, Karagol (crater), Izvit Stream and Aksehir Lake are completely prohibited hunting inland waters in Konya province.

Closest natural lake to the Project Area is Beysehir Lake, which is located 80 km northwest of the Project Area. The closest pond to the Project Area is Aydogmus Pond, which is located 13 km southeast of the Project Area. The closest dam in operation to the Project Area is Apa Dam, which is located about 1 km south of the Project Area. The Dam is in operation since 1962 and it is used for irrigation purposes. Drinking and potable water resources of the Konya Province as surface water resources are Altinapa Dam and Beysehir Lake (*website of 4th Regional Directorate of State Hydraulic Works*).

Areas defined in Air Quality Assessment and Management Regulation

According to the 7th Article of Air Quality Assessment and Management Regulation, zones and sub-zones for air quality identification are listed in Annex-1 of Memorandum 2013/37. With the relevant circular, Turkey is divided into various regions and sub-regions. With this distinction, the Ministry tried to determine the pollution profile of the provinces. The list in Annex-III of the circular is divided into two groups according to the pollution profile of provinces substances: "high pollution potential cities" and "low pollution potential cities". Pollution profiles of provinces were carried out within the 2012-2013 winter season air quality data and air quality bulletins received from air quality monitoring stations connected to the national air quality monitoring network. According to this, the Konya Province is in the list of "high pollution potential".

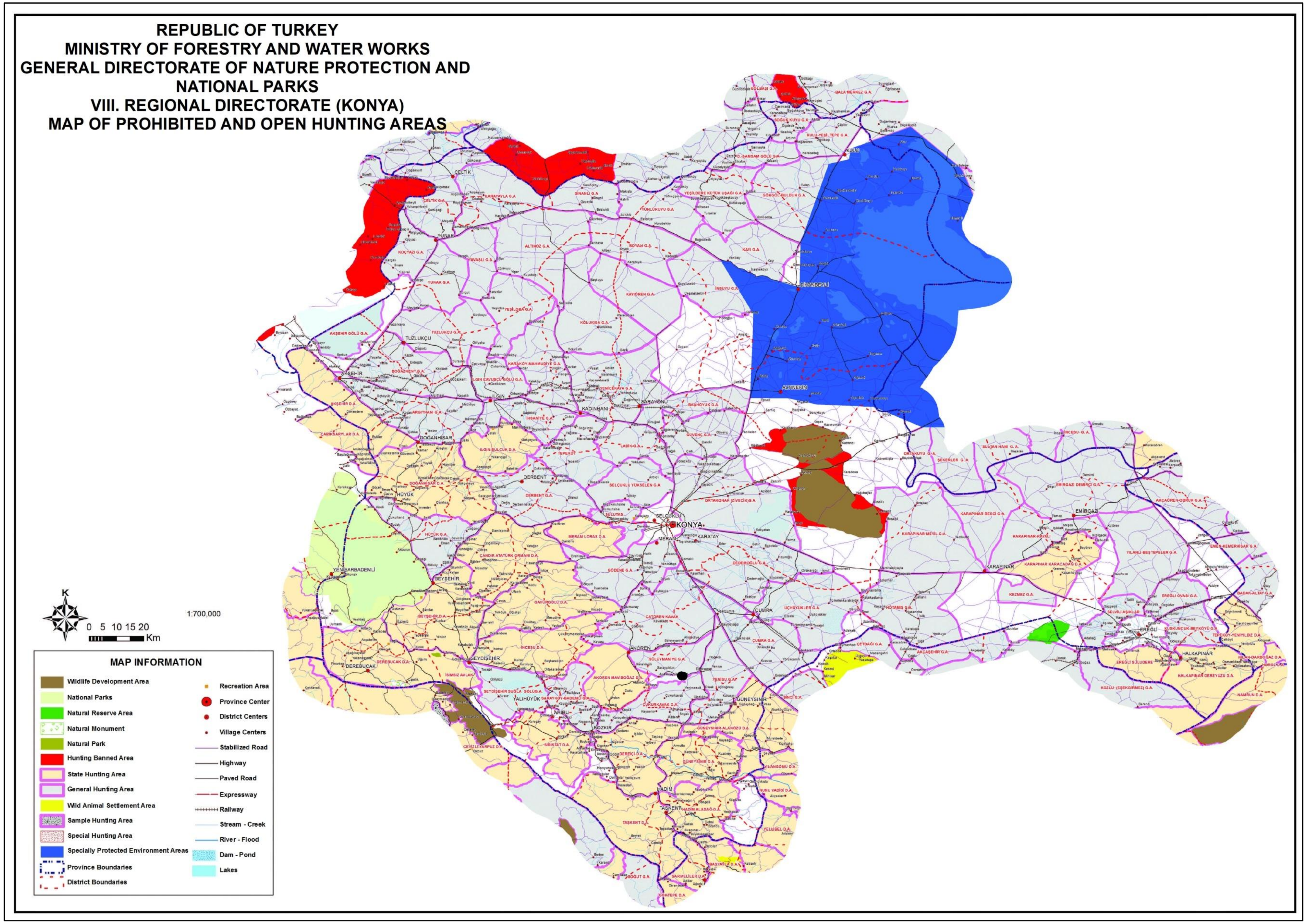


Figure 11.1. Prohibited and Open Hunting Areas in Konya Province (2016-2017)

Air quality of Konya Province has been studied in detail and comprehensive action plans covering years between 2013 and 2019 with the evaluations of all positive and negative/adverse scenarios have been prepared within the scope of IKONAIR Project that was a two years study executed by MoEU, Dutch Environment and Public Health Institute (RIVM), Konya Metropolitan Municipality and Provincial Directorate of Environment and Urbanization and completed in 2012. In line with this, Province Regional Environment Council put into force the Konya Air Quality Actions Plans with its decision numbered 2013/2. Konya Air Quality Action Plans are composed of 20 different actions comprising reduction and prevention of pollutant emissions sourced from heating, traffic and industry (*Konya Governorship, 2015*).

Areas identified and declared as Special Environmental Protection Areas by the Cabinet of Ministers in accordance with the 9th Article of Environment Law

The only special environmental protection area in Konya Province is Slat Lake Special Environmental Protection Area and it is located about 127 km north of the Project Area.

Areas defined in Pasture Law

Areas defined as forest-shrub in Konya Province covers an area of 540,189 ha in total and this corresponds to 14% of the total area of the Province (*Konya Governorship, Provincial Directorate of Environment and Urbanization, 2015*). The Project Area is located in pasture land and the area is subjected to 4342 numbered Pasture Law. Change of land allocation purpose is approved with the consent of Konya Governorship dated 26.10.2016.

Areas designated in accordance with the Regulation of the Wetland Conservation

There are 12 wetland areas in Konya Province. These are; Beysehir Lake, Aksehir Lake, Bolluk Lake, Cavuscu Lake, Cirali Lake, Kizoren Pothole, Aci Lake, Kozanli Gokgol, Kulu Duden Lake, Meke Lake, Meyil Lake and Eregli Lake (*Konya Governorship, Provincial Directorate of Environment and Urbanization, 2015*). There are 2 RAMSAR areas in Konya Province; Kizoren Pothole and Meke Maar (crater lake) which are located at about a distance of 100 km to the Project Area.

Other Protected/Restricted Areas

In addition to presented information above, the areas listed below (also listed in Annex 5 of the EIA Regulation) do not exist in the Project Area:

- Areas in accordance with the 17th, 18th, 19th and 20th Articles in the Water Pollution Control Regulation
- Protected areas within the scope of Bosporus Law
- Forest Areas within the scope of Forest Law
- Areas subject to construction ban in accordance with the Coastal Law
- Areas designated in accordance with the Law on the Vaccination of Pesticides and Improvement of Olive Cultivation
- Areas subjected to construction ban and areas of which their present characteristics should be protected according to Approved Environment Plans (areas of which their natural characteristics should be protected, biogenetic reserve areas, geothermal areas, etc.)

- Agricultural Areas: Agricultural development areas, irrigated areas, potentially irrigated areas, areas with land use capability class of I, II, III and IV, rainfed agricultural lands classified as I and II and specific product plantations areas
- Wetlands: Natural or artificial, permanently or temporarily, standing water or flowing, freshwater, hard or salt water, all the wetlands have importance for the organisms especially for aquatic birds, sea depth range below six meters during the low tide, swamp, reeds and turbaries and ecologically wetlands on their coastal sides
- Lakes, rivers, groundwater operation sites
- Areas important for endemic species that is endangered or potentially endangered or important for scientific researches, biosphere reserve, biotopes, biogenetic reserve areas, areas have unique characteristics for geologic and geomorphologic formations

According to the literature study and site investigation carried out for the APA GES Project Area by Konya Regional Council for the Protection of Cultural Assets, there are not any movable-immovable cultural assets identified within the scope of Article 3 and Article 6 of 2863 numbered Law on Protection of Cultural and Natural Properties.

In order to identify the cultural assets and protection areas in the vicinity of the Project Area, the database of cultural heritage of Turkey (*http://kve.ulakbim.gov.tr*) has been queried. As the Project Area is located about 55 km south of Konya city center, in the vicinity of south border of the Province, cultural assets have been searched in district basis (i.e. by considering Cumra district of Konya Province). The identified immovable cultural assets are listed in Table 11.1.

Table 11.1. Inventory of Immovable Cultural Assets in Cumra District

Asset Subtype	Number in Cumra District	Database Recorded at
Archeological Protection Area	58	KTBKVE*
Mosque	12	VGM*
Fountain	2	VGM
Religious (Mosque)	5	KTBKVE
Natural Protection Area	1	KTBKVE
Natural Asset	2	KTBKVE
Industrial and Commercial (Water Tank)	1	KTBKVE
Administrative	2	KTBKVE
Ruins (Ancient Road)	1	KTBKVE
Bridge	4	VGM
Cultural	7	KTBKVE
Civil Architecture Sample	4	KTBKVE
Total	**99**	

**KTBKVE: Records of Ministry of Culture and Tourism, VGM: Records of General Directorate for Foundations.*

Protected Areas in accordance with International Conventions

Areas required to be protected in accordance with the international conventions to which Turkey is a party and defined under Annex 5 (Sensitive Regions) of the EIA Regulation are listed in the following items and the evaluations related to the indicated areas are presented therein.

Protected areas in accordance with the Convention for the Protection of Wetlands with International Importance as Particularly Water Birds Living Environment (RAMSAR Convention)

There are 2 RAMSAR areas in Konya Province; Kizoren Pothole and Meke Maar, which are located at about a distance of 100 km to the Project Area.

Other Protected/Restricted Areas

There are no areas within the context of below mentioned protected/restricted areas;

- Mediterranean Monk Seal Living and Reproduction Areas, I. and II. Conservation Zones defined in Important Sea Turtle Reproduction Areas from the protected areas in accordance with the Convention for the Protection of the Wildlife and Habitats of Europe (BERN Convention)
- Areas protected under the Convention on the Protection of the Mediterranean from Pollution (Barcelona Convention)
- Areas designated as Special Protection Area in Turkey in accordance with the Protocol on the Protection of Special Protection Areas in the Mediterranean
- Fields on the list of 100 Coastal Historic Sites with Joint Prevention in the Mediterranean published by the selected United Nations Environment Program in accordance with the Geneva Declaration
- The coastal areas that are the living and feeding environment of Native Species of Hazardous Dangers to the Mediterranean included in 17th Article of the Geneva Declaration
- Cultural, historical and natural areas that are protected by the Ministry of Culture under Cultural Heritage and Natural Heritage status according to the 1st and 2nd articles of the Convention for the Protection of the World's Cultural and Natural Heritage
- European Landscape Contract

11.1.2. Potential Impacts and Mitigation Measures

The primary aim in project development is not to have any significant impact on any protection area or area of environmental, social and cultural importance mainly through proper site selection. As mentioned in above information on protected areas around the Project Area and in Konya Province, there are no protection areas within the Project Area. The Project Area consists of pasture land and the nearest protected area is Fosil Ardic Nature Monument, located about 5.2 kilometers east of the Project Area. In this regard, it has been demonstrated that there is no significant potential impacts on protected areas that are assessed. Protected areas around the Project Area are also shown in Figure 11.2.

However, as required with Article 4 of Law on the Conservation of Cultural and Natural Properties (2863 Numbered Law), chance find procedure will be implemented during land preparation and construction works. In this context, related Civilian Authority or Museum Directorate will be informed latest in three days in case of finding any movable or immovable cultural asset by chance during construction works. Construction works will also be stopped at that time. In case of result of any damage on protected areas or cultural assets due to the Project during construction and operation phases, the damage will be compensated by the Project Owner.

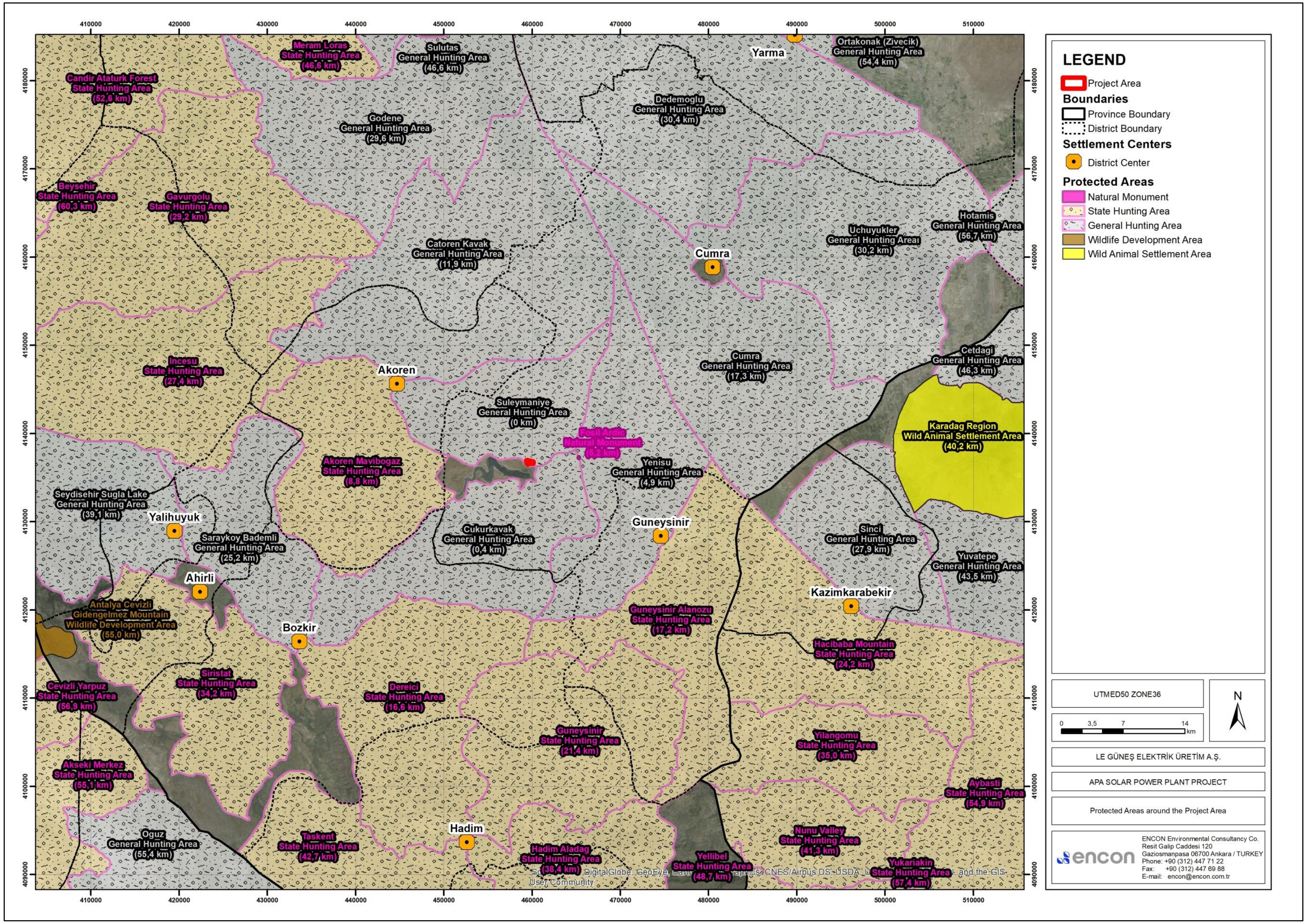


Figure 11.2. Protected Areas around the Project Area

11.2. Landscape and Visuality

11.2.1. Baseline Conditions

Identification of landscape features around the Project Area is based on field studies (field research, biological studies and photographing) and desk-based studies. Unique or featured landscape areas searched around the Project Area with desk-based studies first. Then the Project Area and its immediate vicinity observed and photographed with field studies. Except these studies, The Solar Glare Hazard Analysis Tool (SGHAT), developed by Sandia National Laboratories (operated by Sandia Corporation for the US Department of Energy), was used to determine glint/glare effects that could occur within the scope of the Project.

As mentioned in previous sections, the Project Area consists of pasturelands of Apa neighborhood. Landscape of the Project Area and its vicinity has not any unique features. Closest featured area to the Project Area is the Apa Dam, due to its recreational features. As can be seen in Figure 11.2, there is not any national park, nature park or any other featured areas.

According to biological studies conducted for the Project, the only habitat type is Irano-Anatolian Step Habitat (EUNIS Habitat Type Classification) in the Project Area. However, the habitat has been lost its features due to excessive grazing in the area. Species that are not preferred by pasture animals become dominant in the habitat.

Since the Project Area has not any unique features, it does not present any visual amenity. Project Area and its vicinity are presented between Figure 11.3 and Figure 11.6.

Figure 11.3. Project Area (Towards North)

Figure 11.4. West Part of the Project Area (Towards Southeast)

Figure 11.5. View of Apa Neighborhood from East of the Project Area (Towards Southwest)

Figure 11.6. View of Reservoir of Apa Dam

11.2.2. Potential Impacts

As mentioned before, there is not any unique landscape or visually important area in the vicinity of the Project Area. In this regard there are no significant potential impacts on landscape.

Possible visual impacts of the Project will be glint/glare impact in addition to visibility of the Project components. The visibility of the Project components will be limited due to their limited height. Therefore, visual impacts of the Project will be limited to immediate vicinity and insignificant. The glint/glare impact is about reflection of sunlight and their impact on the reaching points. Therefore, visual impacts will be assessed in terms of glint/glare impact of the Project.

Glint/glare impact occurs as a result of direct sunlight on the panels or formation of an image/light on the panels due to a bright sky. The glare and glint are not the same every period in a year but they depend on variables such as the geographical location of the Project, the seasonal orbits of the sun, the technology used in the project and the potential receptors around the Project (settlements, roads, airports, etc.). Since systems using photovoltaic technology are designed to absorb irradiation (*IFC, 2015*), the impact of glint/glare on systems using photovoltaic panels is low compared to systems using other solar energy technologies.

Photovoltaic technology will be used in APA GES Project. The Solar Glare Hazard Analysis Tool (SGHAT), developed by Sandia National Laboratories (operated by Sandia Corporation for the US Department of Energy), was used to assess glint/glare impact that could occur within the scope of the Project.

SGHAT is an internet based analysis program (*https://share.sandia.gov/phlux*). Within the scope of the evaluation, the panel features, the area where the panes will be placed and the possible receptors around the Project Area were entered to the program (see Figure 11.7).

The information regarding six possible receptors, locations of which are shown on the satellite image given in Figure 11.7, is presented in Table 11.2. Identified points were determined considering that they represent the settlement in the vicinity of the Project Area (Apa neighborhood), the roads around and the recreation areas.

According to the analysis performed through the program for determining the light reflection risk at the points presented in Table 11.2, glare impacts were not detected at points 1, 2, 4, 5 and 6. However, the program pointed to the possibility of observing light reflections (glaring) at point 3 at certain time periods. The time periods foreseen by the program in this context are shown in the graphic presented in Figure 11.8. According to program outputs, there is a possibility that the glaring might occur in late March - early April and in September in a limited time in the early morning (between 05:00-07:00). The predicted glaring corresponds to the possibility of creating "after-image" which is medium level from the 3 levels defined by the program. In line with all evaluations, the severity of the impact is defined as “low” due to the limited number of passengers using the road (which is identified as point 3) and the possibility of occurrence of glare impact only in the early morning hours in a period of 2 months per year.

Figure 11.7. Locations of Identified Receptors for Solar Glare Hazard Analysis

Table 11.2. Information Regarding Locations Identified as Possible Receptor

No	Receptor Description	Distance to Plant Border	Direction According to Plant
1	Apa Neighborhood Center/Square	350 m	Southeast
2	The Road around the Plant	160 m	South
3	The Road around the Plant	130 m	Southwest
4	Recreational Facilities near Apa Dam	1 km	Southeast
5	The Closest part of Apa Neighborhood	160 m	South
6	Higher agricultural Areas in south	2 km	South

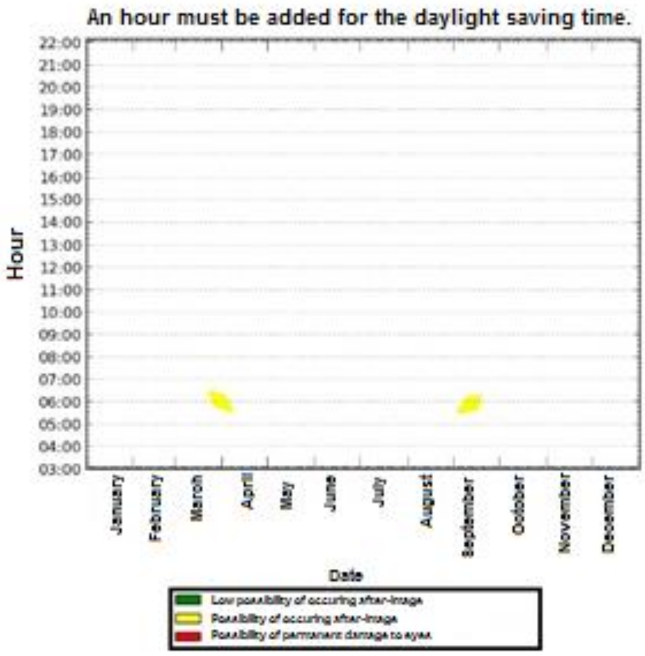


Figure 11.8. Program-Specified Glare Impact Graph in the Possible Receptor Point of No 3

11.2.3. Mitigation Measures

As explained in previous sections, the Project will not have significant impact on landscape. However, there are some good practices to be implemented within the scope of the Project. Stripped topsoil will be spread to the site after the completion of construction works and natural vegetation cover grow will be ensured during operation phase under control (preventing shadow effects on solar panels). Tall plants and trees will not be used since they can shadow solar panels and can reduce efficiency of the power plant.

As also explained in previous sections, there is only a possibility of a limited glare impact at one point during limited time periods, where impact severity of impact has been defines as “low”.

In today's technology, non-reflective materials that do not cause glint and glare impacts are used in panel production. In panel selection within the scope of Apa GES Project, the glint and glare impacts will be minimized by choosing panels produced with materials that reduce glint and glare. In addition, the measures to be taken at the necessary issues will be evaluated if there are any complaints that may arise from the local people or users of point 3 following the operation of the plant. For this purpose, firstly, the actual status of the limited impact predicted at the point will be observed. In case an impact is detected, the usage status of the subject ancillary road during the impact periods (end of March-beginning of April and in September; between 5:00-7:00) will be visually monitored in the first year of the operation. If a significant impact is detected, the potential impact will be managed by creating vegetative or artificial image screens or by taking other methods appropriate to the day's technology.

Rehabilitation after Closure Phase on Landscape

After the Project completed its operational life time, if there is no planning for use of the site for similar purposes (energy production, other industrial activities), the site will be returned to the state of the pre-project land use (pasture), with necessary restoration/rehabilitation works by Project Owner. In other words, the reuse of the site for pasture purpose will be possible with the closure and rehabilitation activities to be performed after the service life of the Project. Pasture Land Rehabilitation Project prepared for the Project Area has already been approved by the Provincial Directorate of Food, Agriculture and Livestock on 24.11.2016. The provisions of the contract dated 23.12.2016 and signed between the Project Owner and the related authority will be complied with in the rehabilitation of the site to pre-project land use conditions (former quality and capacity).

In addition, a plan will be prepared (after the closure decision of the power plant taken) describing the closure activities to be carried out and how the rehabilitation will be performed by the Project Owner in accordance with the conditions of the day. Closure activities will be performed in accordance with this plan.

<u>Land Reclamation</u>

In the solar power plant projects, the project area is provided before the land preparation and construction phase without causing any permanent and irreversible impacts on the existing land use and is used throughout the operation period. Hence, it is possible to return the land to its former use at the end of the operation period (*Maidstone Borough Council, January 2014*).

The rehabilitation activities at the end of the service life (25 years) of the Apa GES Project will include dismantling of panels, inverters and panel mounts/legs and removal of structural elements such as administrative offices, security cabins, transformer stations and drainage channels. Following the removal of these units from the area for reuse/recycling or disposal, the topography in the area will be adapted to its natural form. The cables embedded in the soil will be left in the channels if it is suitable for the land use purposes after the closure. Thus, there will not be any excavation-filling works in this context.

In the scope of existing ground/soil evaluations, it is planned to place a significant part of the panel legs by using pressure pile driving machine and to apply concrete only in stone and rocky zones. If the panel legs are placed by using the pile driving machine, the impacts of dismantling of panel legs on soil environment during the closure phase will be minimized. Besides, after the completion of removal/dismantling activities at concrete applied locations and removal of the demolition wastes from the site, the restoration of the site will be provided in accordance with a plan describing the closure and rehabilitation works to be prepared by the Project Owner (after the closure decision of the power plant taken) and the site will be abandoned to be compatible with former and adjacent land use and landscape features.

<u>Other Activities</u>

Wastes will be generated within the scope of dismantling/removal of photovoltaic panels and other superstructures and equipments during the closure phase of the Project. In this context, besides photovoltaic panels and other equipments, generation of limited amount of excavation waste, debris and scrap metal, etc. will also be possible similar to construction phase.

Panels and other wastes to be dismantled in the closure phase will be disposed of in accordance with the legislation in force at that time. The reuse or recycling alternatives of glass, semi-conductive materials and metals forming photovoltaic panels will be considered according to the available technologies. The establishment of solar power plants in Turkey is still in its development stage. However, as service life of many power plants in Europe and America is expected to be completed in the coming years, research on technologies for the recycling of panels and the recovery of precious components forming the panels such as metal and glass continues at a rapid pace. (*Massachusetts Clean Energy Center, June 2015. Floor Mounted Photovoltaic Systems*). It seems likely that the recycling/recovery alternatives will be became definite within the service life of Apa GES Project. In this way, the closure of the Project could be achieved without any environmental impacts/problems by disposal of the panels to be used within the scope of the Project in accordance with the technology of the day and the legislative requirements.

On the other hand, if thin-film solar cells are preferred as photovoltaic technology in the Project, dismantling will be carried out by methods that do not cause any damage leading to metal emissions in the cells and will be disposed of accordingly during closure activities. The actions to be taken in the event of a possible damage will be covered within the scope of the plan to be prepared for the rehabilitation and closure of the site. Besides photovoltaic panels and other equipments, limited amount of excavation waste, debris, scrap metal, etc. to be generated during closure phase will be disposed of in accordance with the legislation in force at that time. Since all superstructures will be dismantled and disposed appropriately during closure, there will be no project structure that can be observed by the receivers/receptors after the closure and it is not expected to have a visual impact of the Project.

CHAPTER 12

SOCIO-ECONOMIC ENVIRONMENT

12. SOCIO-ECONOMIC ENVIRONMENT

In this chapter, potential impacts of Apa Solar Power Plant Project on socio-economic environment of the region are assessed. For the assessment of impacts on socio-economic environment, desktop and field studies were performed. The chapter includes baseline conditions of the socio-economic environment, potential social impacts of the Project, mitigation measures, and summary of assessment and residual impacts. Environmental cost-benefit analysis of the Project is also described within the scope of this chapter.

12.1. Baseline Conditions

12.1.1. Economy

Konya province has an important position in Turkey in terms of both agriculture and industrial production. The province, which is known as "granary" from the old times, has also taken the title of "industrial city" thanks to the industrial sectors that produce in different fields. As a matter of fact, Konya exports to nearly 130 countries, and at the same time it is a province that prominent in different fields such as industry, tourism and transportation (*Chamber of Konya Industry Web site, www.kso.org.tr*).

Organize Industrial Zones (OIZ) started to be established in Konya in the 1960's and the last two of the 3 OIZs established in different periods were combined and originate to the Konya Organized Industrial Zone (KOIZ). The important indicators representing the positions of Konya province in Turkey in terms of industrial and agricultural production potential are summarized below (*Mevlana Development Agency, www.konyadayatirim.org.tr*):

- The province is in the first place in Turkey in the production of salt, sugar and flour.
- It is in the 14th place in Turkey with exports of approximately 1.5 billion USD in 2014.
- It is in the 6th place in Turkey with 1,543 exporting companies.
- There is an advanced industrial infrastructure with 9 OIZs and 2 Technology Development Zones.
- Within the scope of patent registration, it is in the 7th place in Turkey with 38 registered.
- It is in the 6th place in Turkey with 2,026 registered in trademark registration.

As of 2013, Konya is the 2nd place in Turkey with respect to the low unemployment rate (4.7%). Considering that the unemployment rate in Turkey is 9.7% in the same period, it is understood that the unemployment rate in the province is quite low. Although the province is in a significant position in terms of the unemployment rate, province is quite backward in terms of employment rate and labor force participation rates in Turkey. As a matter of fact, province is in 44th place in Turkey in the participation rate in labor force (48.4%) and province is in 41th place in Turkey in the employment rate (46.2%).

The Konya province in which the project area is located is in the 20th place in Turkey according to the "Socio-economic Development Ranking of Provinces (*SEGE, 2011*)" survey, and the Konya province is one of the 13 provinces that enter the 2nd stage developed provinces class. The indicators regarding the level of development in Konya are given in Table 12.1.

Table 12.1. Indicators for Development Level of Konya Province *(TurkStat, 2013)*

Development Indicator	Turkey	Konya	Rank of the Province Among the Country
Total Electricity Consumption per Capita, 2012 (KWh)	2,577	2,586	24
Crop Production Value per Capita, 2013 (Million TL)	1,206	4,983	2
Level of Happiness by Provinces*, 2013 (%)	59.0	65.6	21
Number of Automobiles per Thousand People (2013)	121	130	21
Daily Water Consumption from Municipality per Capita, 2012 (Liter)	216	199	41
Number of Hospital Beds per Hundred Thousand People (2012)	265	331	68

Note: Level of happiness by provinces is the proportion of surveyed population who declared that they are happy.

Neighborhood Level Economic Data

In order to obtain information about the socioeconomic conditions of the region within the scope of APA GES Project planned to be realized, an interview was held on 26.05.2016 with the headman (Mukhtar) of Apa neighborhood. The photographs of the interview are presented in Figure 12.1. The information obtained within the scope of the interview is presented in this section.

Figure 12.1. Social Field Study, Headman Interview

Apa neighborhood is located in a region which is generally irrigable land and favorable for agriculture and animal husbandry. Thanks to the Carsamba Stream passing through the settlement area, 10% of total agricultural land is formed by irrigable land in the neighborhood where irrigated farming can be carried out. There are 18 wells that some of them are drilled by the own resources of the farmers in the neighborhood where there is also irrigation cooperative. Along with the development of irrigation facilities, there has been a remarkable development in the diversity and productivity of the products grown in the neighborhood in the remaining 20 years. Nowadays, irrigated agricultural products are mainly beans, chickpea, beet, lentil and corn while other products such as sunflower, melon, watermelon and tomato are also grown in the neighborhood. According to information obtained from the Headman, the average agricultural land size per household in the neighborhood is 45 decare.

Livestock activities are carried out beside agriculture which is the primary income source of households located in the neighborhood. As a matter of fact, there are approximately 3,000 bovine and nearly 10,000 ovine animals throughout the neighborhood. Livestock activities are usually carried out in the form of grazing, while at the same time the fattening is also carried out. In the neighborhood where the milk cooperative is located, an average of 5,000 tons of milk is collected per month. Apart from the livelihoods mentioned above for household, pension is also an important source of income. As a matter of fact, nearly 100 households in the neighborhood receive a pension. Almost all of these people have retirement pensions from agricultural social security organization for artisans and the self-employed.

In certain seasons of the year, seasonal workers from Mersin and Urfa regions come to the neighborhood for harvesting products such as beans, chickpea and beet. These workers live in tents in an area which is close to the neighborhood for about 2 months. According to information obtained from the Headman, no hostility has ever occurred between people living in the neighborhood and the seasonal workers.

Apa Dam constructed on the Carsamba Stream is located within the boundaries of the neighborhood. The dam, which is in operation since 1962, is used for irrigation purposes and is also used by local people for fishing activities. Fishing activities are not at large scale but just contribute to the household economy.

12.1.2. Population

The population of Konya province, where the Project Area is located, is 2,130,544 in 2015 (*TurkStat, 2015).* With this value, Konya province is in the 7th place in Turkey in terms of population size. Figure 12.2 shows the population change of Konya province between years 1927 and 2015. When the graph is examined, it is seen that the population (except after 1990) tends to increase continuously.

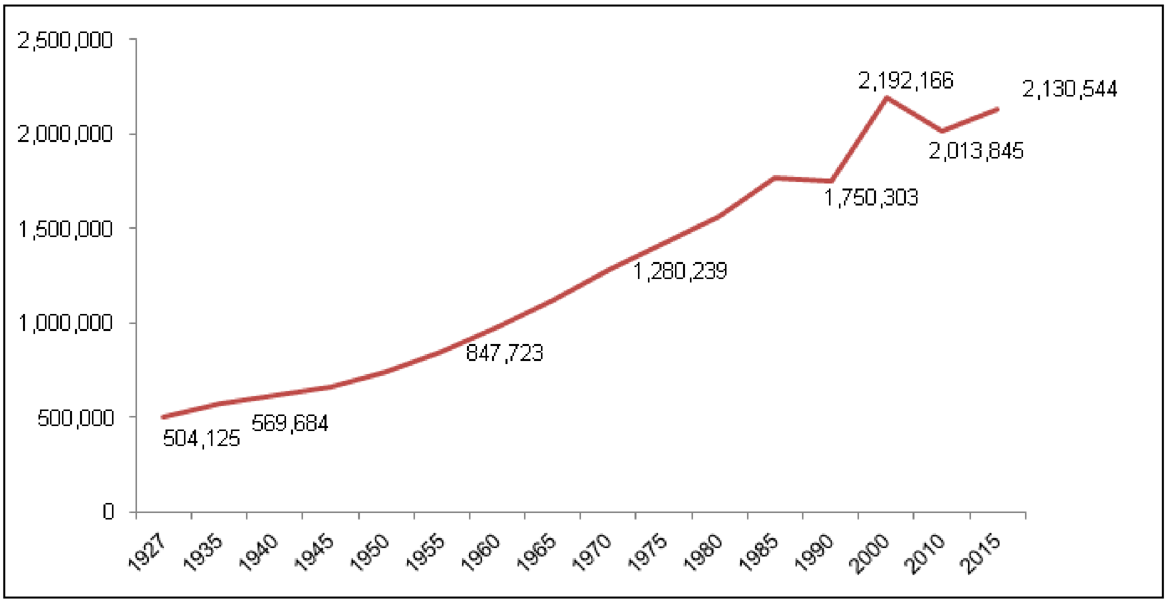


Figure 12.2. Population Change of Konya Province by Years *(TurkStat, 2015)*

All of the population of Konya province live in province and district centers. The Province's highest populated district is the Selcuklu district (604,706) and the least populated district is the Kavaklidere district (1,512). The population of the Cumra district, where the Project Area is located, is 65,152. Cumra district is in the 7th place among all the districts in terms of population size. The gender-based population information in the districts of Konya province is given in Table 12.2.

Table 12.2. Gender-based Population Information in the Districts of Konya Province (*TurkStat, 2015*)

District	Total	Man	Woman
Ahirli	4,545	2,187	2,358
Akoren	6,409	3,104	3,305
Aksehir	94,159	46,194	47,965
Altinekin	14,171	7,115	7,056
Beysehir	71,370	35,311	36,059
Bozkir	27,006	13,209	13,797
Celtik	9,864	4,984	4,880
Cihanbeyli	53,551	26,615	26,936
Cumra	65,152	32,464	32,688
Derbent	4,441	2,149	2,292
Derebucak	6,807	3,404	3,403
Doganhisar	17,069	8,176	8,893
Emirgazi	8,939	4,444	4,495
Eregli	139,173	68,948	70,225
Guneysinir	9,636	4,824	4,812
Hadim	12,820	6,396	6,424
Halkapinar	4,412	2,189	2,223
Huyuk	15,899	7,714	8,185
Ilgin	55,484	27,513	27,971
Kadinhani	32,670	16,431	16,239
Karapinar	49,098	24,567	24,531
Karatay	302,392	152,111	150,281
Kulu	49,283	24,415	24,868
Meram	343,384	170,749	172,635
Sarayonu	26,450	13,067	13,383
Selcuklu	604,706	297,745	306,961
Seydisehir	64,028	32,048	31,980
Taskent	6,420	3,162	3,258
Tuzlukcu	6,754	3,280	3,474
Yalihuyuk	1,512	747	765
Yunak	22,940	11,278	11,662
Total	**2,130,544**	**1,056,540**	**1,074,004**

When the population structure of Konya province is examined, it is seen that the ratio of male population is 49.6% and that of female population is 50.4%. These ratios are similar to the rates of 50.2% male and 49.8% female population, which is the population structure of Turkey in general. In Cumra District the male and female population ratios were determined as 49.8% and 50.2%, respectively.

When the age distribution of the population of the Province is examined, it is seen that the age range with the highest population is "15-19" age group with 9.3%, but the population is also concentrated in "5-9" and "10-14" age groups. Comparison of population pyramid of Turkey with Konya province is shown in Figure 12.3. As can be seen from the graph, the population pyramids show great similarities but the significant difference is observed at "15-19" age group. As the province has an intense population under age 20 compared to average of Turkey in general, the province with its current population structure will be a province having a young population above the average of Turkey in the future.

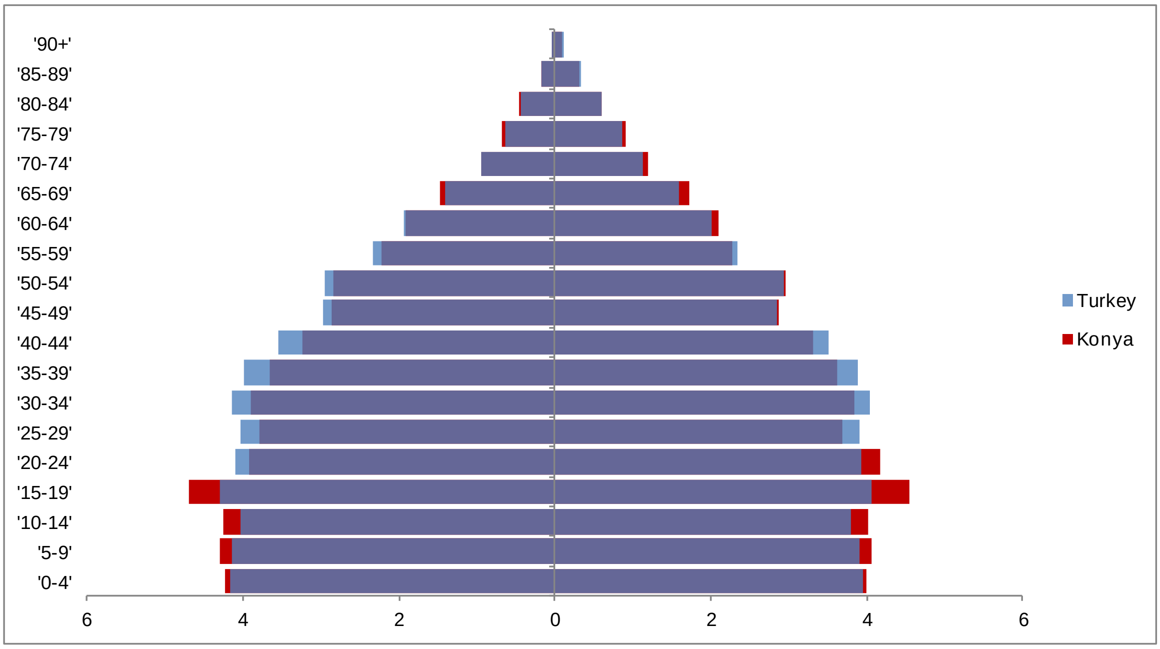


Figure 12.3. Comparison of Population Pyramid of Konya Province and Turkey *(TurkStat, 2015)*

According to the TurkStat data for 2015, Konya province with an age dependency ratio of 50.3 is above the average ratio of Turkey (47.6). Considering that the dependency ratio is the ratio of the population who are not at working age (0-14) and population who are not able to work (65+) to the active population that can work (15-64), the dependent population of 50.3 shows that 50.3 people correspond to each 100 people at 15-64 age group living in Konya province. In Konya province, the active population that can work constitutes 66.5% of the total population and is below the average of Turkey (67.8%).

Considering the population growth rates in the districts of Konya province, it is understood that the increase rates of district population are generally negative (-). The population growth rates between the years 2014 and 2015 in the districts of Konya province are given in the map showing the district boundaries in Figure 12.4. As can be seen, the vast majority of the districts in the province (20 districts) have negative growth rates (-). Among the districts, Selcuk district has the highest ratio with the population growth rate (‰ 33.7); Yalihuyuk district has the lowest ratio with the lowest population growth rate (‰ -97.0). The population growth rate in Konya province is calculated as ‰ 10.3 in 2015.

When fertility rates in Konya province is evaluated, it is seen that the value which was 2.11 in 2010 has increased to 2.17 in 2015. This rate is similar to the average fertility rate of Turkey (2.14) calculated by TurkStat in the same period.

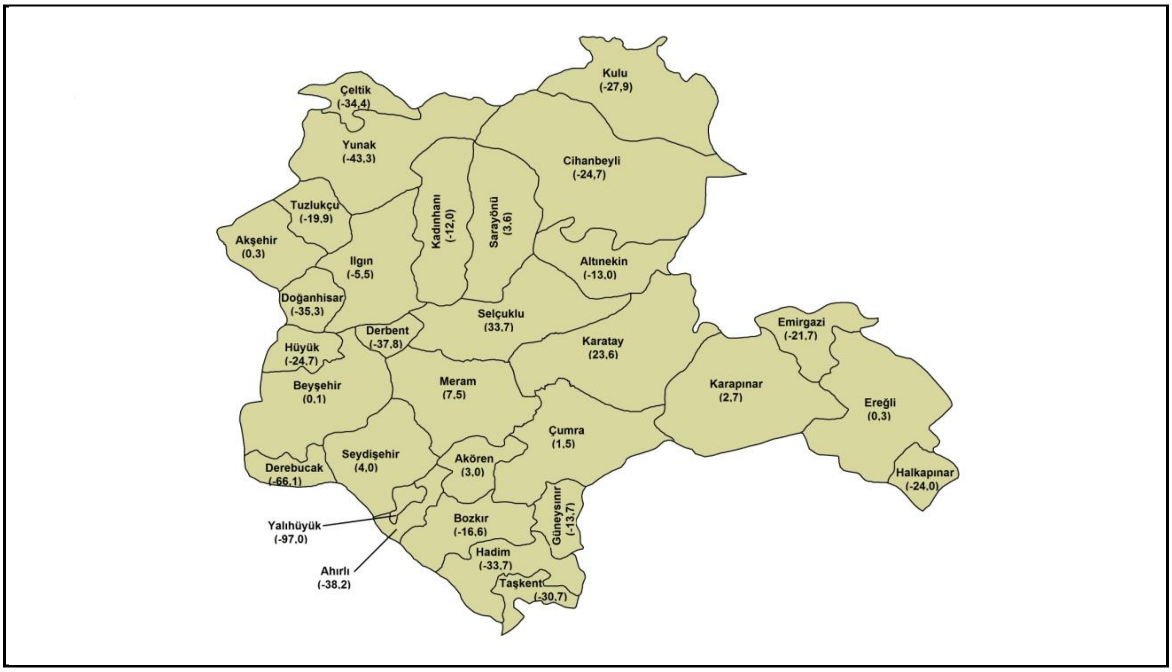


Figure 12.4. Population Growth Rates of Districts of Konya Province between 2014 and 2015 (‰)

Another remarkable data about Konya province is the median age[1]. The median age of Konya province is 30.2 and it is below the average of Turkey (31.0). Yalihuyuk district has the highest median age in the province with 53.7 and Karatay district has the lowest median age in the province with 27.3. The median age of the province is 30.9 for women and 29.5 for men. At the same time, the median age of the Cumra district, where the Project Area is located, is 29.9. Figure 12.5 shows the graph of the median age ratios of the province.

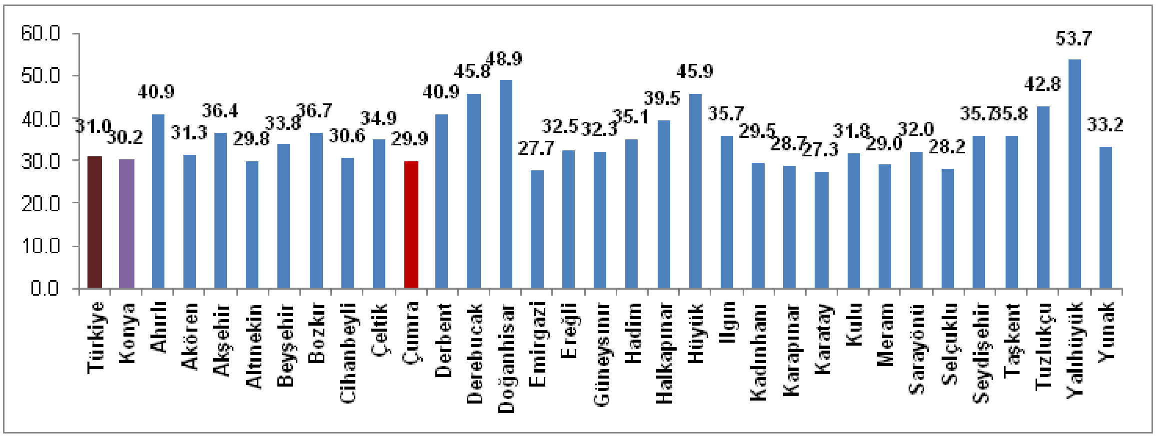


Figure 12.5. Median Age Ratios of Konya Province and its Districts (*TurkStat,, 2015*)

[1] *Median Age: Age of the person that corresponds to the middle when people of the population are ranked from oldest to youngest (TurkStat).*

When the surface area information of Konya province and its districts is examined, it is understood that Cihanbeyli is the largest district in Konya province. As a matter of fact, the district covers 9.1% of the total surface area of the province. However, besides having a large surface area, the number of people per km^2 in the district is only 3 and with this rate, Cihanbeyli district has the lowest population density in the province. Selcuklu district has the highest population density with 313 per km^2. Table 12.3 gives the surface area and population densities of the districts. As can be seen, the population density of the province is only 52 people per km^2.

Table 12.3. Surface Areas and Population Densities of Konya Province and its Districts (*HGK, 2014*)

District	Surface Area (km^2)	Ratio to Provincial Surface Area (%)	Number of People per km^2
Ahirli	325	0.8	14
Akoren	640	1.6	10
Aksehir	895	2.2	105
Altinekin	1,312	3.2	11
Beysehir	2,054	5.0	35
Bozkir	1,105	2.7	24
Cihanbeyli	3,702	9.1	3
Celtik	640	1.6	84
Cumra	2,089	5.1	31
Derbent	359	0.9	12
Derebucak	451	1.1	15
Doganhisar	482	1.2	35
Emirgazi	798	2.0	11
Eregli	2,214	5.4	63
Guneysinir	482	1.2	20
Hadim	1,165	2.9	11
Halkapinar	605	1.5	7
Huyuk	443	1.1	36
Ilgin	1,636	4.0	34
Kadinhani	1,568	3.8	21
Karapinar	2,623	6.4	19
Karatay	2,832	6.9	107
Kulu	2,234	5.5	22
Meram	1,822	4.5	188
Sarayonu	1,620	4.0	16
Selcuklu	1,931	4.7	313
Seydisehir	1,458	3.6	44
Taskent	457	1.1	14
Tuzlukcu	704	1.7	10
Yalihuyuk	94	0.2	16
Yunak	2,101	5.1	11
Total	**40,841**	**100.0**	**52**

The Project Area is located within the borders of Konya Province, Cumra District, Apa neighborhood. The population of Apa neighborhood is 732, together with Yenimescit village (*TurkStat, 2015*). According to information obtained from the Headman, the number of households in the neighborhood is 280, and the average household size is calculated as 2.6 accordingly.

12.1.3. Urban and Rural Land Use

Konya province is located at the south of Central Anatolia Region. The province is the largest province of Turkey in terms of surface area and it has a surface area of 41,067 km². Province covers about 5.27% of the country.

A large part of Konya province is located in the "Konya Closed Basin". Small sections of Aksaray, Nigde, Nevsehir, Ankara, Karaman and Isparta provinces are also located in the Konya Closed Basin. The agricultural land size of the province in 2015 corresponds to 67.7% of the total province (*TurkStat, 2015*). This ratio, which shows how important agricultural production is for the province, also shows the potential contribution of the province to the economy of the country. Although the province has a significant potential for arable land size, only 14% of these arable land can be irrigated. It is targeted to increase this ratio to 21.3% within the scope of the Konya Plain Project conducted by the Ministry of Development.

The Project Area is located on block no 165 and parcel no 2 (165/2). This parcel was registered as pasture but allocation purpose change of the parcel approved by the Konya Governorship. Total size of this parcel is 44.14 hectares and 26.17 hectares of the parcel will be used within the scope of the Project (as a result of the application, new title deed has been arranged for the area with the characterization of Solar Power Plant Area on 31.01.2017 - having a parcel no of 165/45 and an area of 26.19 hectares). There are 63 different pasture parcels registered in Apa neighborhood. Ten of these parcels correspond to area of influence of the Project (area around Project Area having 1 km radius). The total area of these 10 parcels is 329.95 hectares and the area of these parcels within the area of influence is 233.88 hectares.

According to the information received from the Headman of the Apa neighborhood, which is the closest settlement to the Project Area, the total land size of the neighborhood is approximately 50,000 decare. The Headman stated that the majority of this 50,000 decare land is agricultural land but he could not specify the land use distribution of the whole area. Irrigable land constitutes 10% of total agricultural land. The Headman stated that irrigation facilities were relatively inadequate and stated that effective water usage could not be realized due to the debts of the irrigation cooperative in the neighborhood.

12.2. Potential Impacts

In addition to the potential environmental impacts of the planned Apa GES Project, it is also important to manage the potential social impacts of the Project. It is possible that there might be indirect socio-economic impacts on the existing users of the land due to the allocation purpose change of the existing use of pasture in accordance with the relevant legislation within the scope of the Project. In order to assess the possible impacts on this issue, the pasture areas in Apa neighborhood has been investigated. Within this scope, a list of the parcels registered as pasture in Apa neighborhood was taken from Konya Provincial Directorate of Food, Agriculture and Animal Husbandry and the information regarding the listed parcels was obtained through the Parcel Query Application of the General Directorate of Deed and Cadastre. The information obtained in this context is given in Table 12.4. Pasture lands/areas within the area of influence of the Project and located in Apa neighborhood are shown in Figure 12.6.

As can be seen from the information presented in Table 12.4, there are 63 parcels registered as pastures in Apa neighborhood and the total size of these parcels is 1,482.77 hectares. 10 of the 63 parcels coincide with the area of influence. The total area of these 10 parcels is 329.95 hectares and the area of these parcels within the area of influence is 233.88 hectares. Apa GES Project Area (26.17 hectares) corresponds to 11.19% of the pasture lands in the area of influence and 1.76% of the total pasture lands registered in Apa neighborhood.

Table 12.4. Pasture Lands Registered to Apa Neighborhood and Sections those Lands within the Area of Influence of the Project

Immovable ID No	Province	District	Neighborhood/Village	Block	Parcel	Title Deed Area	Quality	Location	Title Deed Area Remaining in the Area of Influence
52329304	Konya	Cumra	Apa	149	49	693,058.28	Pasture	-	-
52329305	Konya	Cumra	Apa	149	54	144,057.75	Pasture	-	-
52329306	Konya	Cumra	Apa	149	58	138,029.73	Pasture	-	-
52329307	Konya	Cumra	Apa	150	14	61,847.46	Pasture	-	-
52329308	Konya	Cumra	Apa	150	18	86,222.72	Pasture	-	-
52329309	Konya	Cumra	Apa	150	21	164,334.27	Pasture	-	-
52329310	Konya	Cumra	Apa	150	33	1,015,714.80	Pasture	-	-
52329311	Konya	Cumra	Apa	150	47	269,987.96	Pasture	-	-
52329312	Konya	Cumra	Apa	150	49	66,277.79	Pasture	-	-
52329313	Konya	Cumra	Apa	151	1	459,355.80	Pasture	-	-
52329314	Konya	Cumra	Apa	151	12	66,053.68	Pasture	-	-
52329315	Konya	Cumra	Apa	152	1	389,016.19	Pasture	-	-
52329316	Konya	Cumra	Apa	153	1	14,342.12	Pasture	-	-
52329317	Konya	Cumra	Apa	154	1	1,108,388.85	Pasture	-	-
52329319	Konya	Cumra	Apa	154	24	5,044.74	Pasture	-	-
52329321	Konya	Cumra	Apa	156	1	18,285.12	Pasture	-	-
52329322	Konya	Cumra	Apa	160	1	32,209.86	Pasture	-	-
52329323	Konya	Cumra	Apa	162	5	15,345.73	Pasture	-	-
52329324	Konya	Cumra	Apa	162	18	6,067.83	Pasture	-	-
52329325	Konya	Cumra	Apa	164	65	575,318.05	Pasture	-	-
52221465	Konya	Cumra	Apa	165	1	24,295.12	Pasture	Baglar	24,275.99
52221466	Konya	Cumra	Apa	165	2	441,355.85	Pasture	Baglar	441,008.19
52329326	Konya	Cumra	Apa	165	29	1,195,601.29	Pasture	-	1,194,659.48
52329327	Konya	Cumra	Apa	165	43	74,050.69	Pasture	-	36,400.58
52329328	Konya	Cumra	Apa	167	91	19,148.58	Pasture	-	-
52329329	Konya	Cumra	Apa	167	96	65,218.25	Pasture	-	-
52329330	Konya	Cumra	Apa	168	39	4,034.11	Pasture	-	4,034.11
52329331	Konya	Cumra	Apa	168	52	184,477.53	Pasture	-	-
52329332	Konya	Cumra	Apa	179	5	9,789.29	Pasture	-	-
52329333	Konya	Cumra	Apa	180	1	944.83	Pasture	-	-
52329334	Konya	Cumra	Apa	191	1	13,400.53	Pasture	-	-
52329380	Konya	Cumra	Apa	191	16	46,398.35	Pasture	-	-
52329381	Konya	Cumra	Apa	191	30	1,445.85	Pasture	-	-
52329382	Konya	Cumra	Apa	192	39	46,856.22	Pasture	-	-
52329383	Konya	Cumra	Apa	192	142	53,593.55	Pasture	-	-
52329336	Konya	Cumra	Apa	192	150	116,885.30	Pasture	-	-
52329337	Konya	Cumra	Apa	192	163	64,179.54	Pasture	-	-
52329338	Konya	Cumra	Apa	193	14	52,644.32	Pasture	-	-
52329339	Konya	Cumra	Apa	193	73	1,464,855.33	Pasture	-	-

Immovable ID No	Province	District	Neighborhood/Village	Block	Parcel	Title Deed Area	Quality	Location	Title Deed Area Remaining in the Area of Influence
52329340	Konya	Cumra	Apa	193	242	110,748.57	Pasture	-	-
52329341	Konya	Cumra	Apa	194	12	2,105,525.66	Pasture	-	-
52329343	Konya	Cumra	Apa	194	37	154,279.99	Pasture	-	-
52329403	Konya	Cumra	Apa	194	68	19,287.16	Pasture	-	-
52329379	Konya	Cumra	Apa	194	196	113,913.52	Pasture	-	-
52329384	Konya	Cumra	Apa	194	199	73,133.61	Pasture	-	-
52329385	Konya	Cumra	Apa	194	249	267,918.32	Pasture	-	-
52329386	Konya	Cumra	Apa	195	19	5,405.61	Pasture	-	-
52329387	Konya	Cumra	Apa	198	10	36,740.60	Pasture	-	-
52329388	Konya	Cumra	Apa	198	11	13,566.27	Pasture	-	-
52329389	Konya	Cumra	Apa	198	39	20,259.42	Pasture	-	-
52329390	Konya	Cumra	Apa	198	63	215,117.53	Pasture	-	-
52329391	Konya	Cumra	Apa	198	83	113,424.81	Pasture	-	-
52329392	Konya	Cumra	Apa	198	118	6,378.55	Pasture	-	-
52223982	Konya	Cumra	Apa	199	1	261,419.69	Pasture	Baglar	4,410.62
52329393	Konya	Cumra	Apa	199	131	295,811.71	Pasture	-	-
52329394	Konya	Cumra	Apa	199	132	1,014,870.20	Pasture	-	368,186.72
52329395	Konya	Cumra	Apa	199	136	130,100.99	Pasture	-	-
52224300	Konya	Cumra	Apa	234	1	69,642.89	Pasture	Baglar	46,821.44
52224308	Konya	Cumra	Apa	235	1	107,512.72	Pasture	Baglar	107,428.03
52224391	Konya	Cumra	Apa	236	46	106,737.12	Pasture	Baglar	106,653.04
52329397	Konya	Cumra	Apa	291	27	211,336.97	Pasture	-	-
52329398	Konya	Cumra	Apa	299	2	36,970.35	Pasture	-	-
52329399	Konya	Cumra	Apa	299	23	129,424.03	Pasture	-	-
Total (m^2)						**14,827,659.55**			**2,333,875.01**
Total (ha)						**1,482.77**			**233.88***

Source: Konya Provincial Directorate of Food, Agriculture and Livestock, 2016; https://parselsorgu.tkgm.gov.tr/.
** The total title deed area of the parcels within the area of influence is 3,299,519.68 m^2 (3,299.52 hectare).*

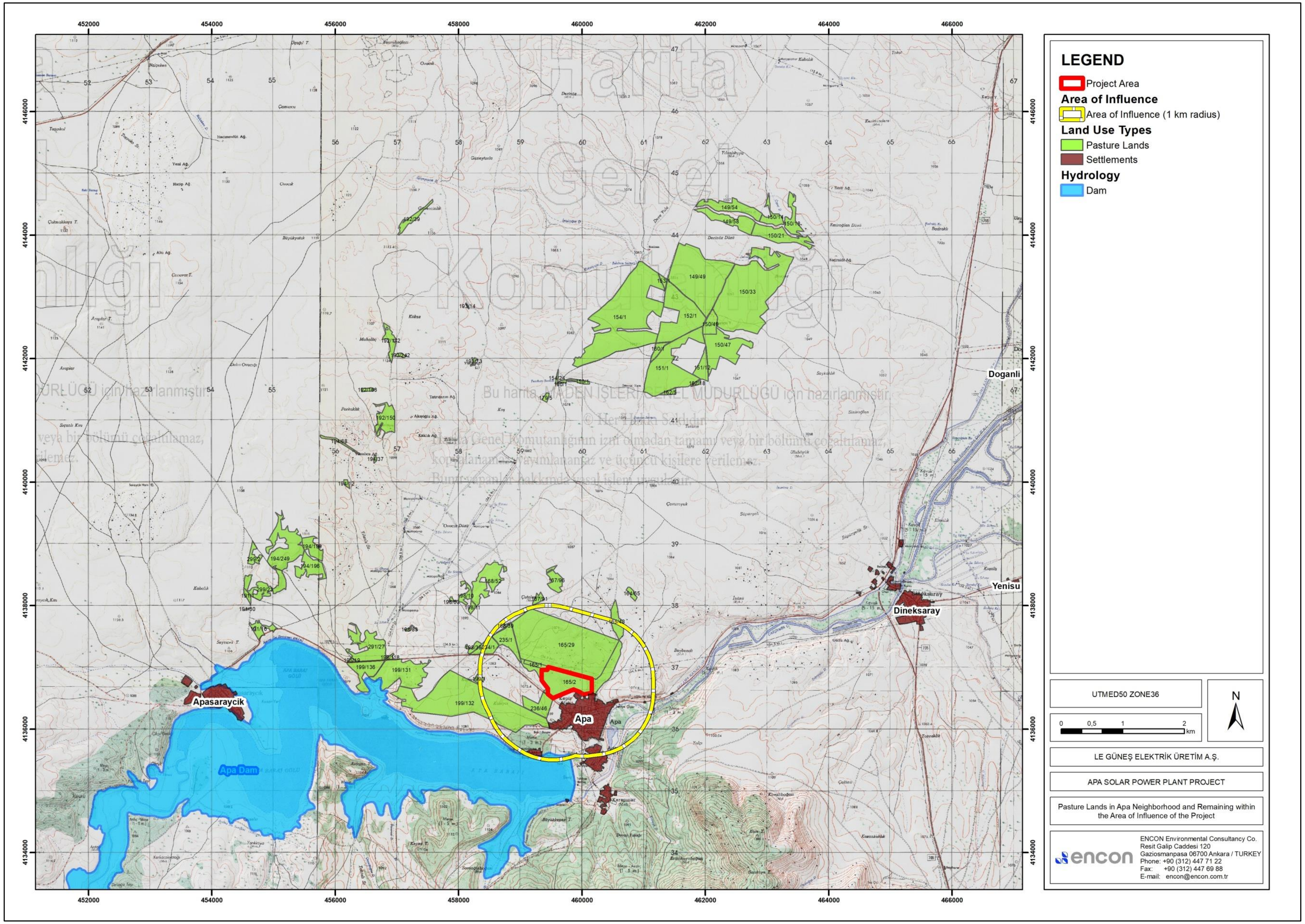


Figure 12.6. Pasture Lands in Apa Neighborhood and Remaining within the Area of Influence of the Project

Two types of impacts related to each other could be observed due to the use of pasture lands within the scope of the Project. One of them is the reduction of the total area of pasture lands within the settlement and area of influence, and the other one is the socio-economic impacts due to the likely impact on livestock activities as a result of reduction of pasture lands. Magnitude of mentioned impacts is defined as “local” as these impacts will be observed within the area of influence of the Project. The severity of the impact (sensitivity) to be occurred by the reduction of pasture lands will be related to how much pasture lands could be used as an alternative within the area of influence. Taking into account the results of the analyzes in the previous paragraphs, it was determined that the size of the pasture lands to be used within the Project corresponds to 11.19% of the pasture lands within the area of influence (area around Project Area having 1 km radius). Accordingly, the severity of the impact due to the reduction of the pasture lands has been identified as “medium”. The severity of the socio-economic impacts due to the likely impact on livestock activities has been determined by considering the place of livestock activities among the livelihoods of the households in the settlement. In the socio-economic survey conducted with the Headman of Apa neighborhood, it was obtained that the primary source of income for the Apa neighborhood is agriculture, and the secondary source of livelihood is livestock. Accordingly, the severity of the possible socio-economic impacts has been identified as “medium”. Therefore, the significance of impacts that might occur by the reduction of pasture lands and the impact on livestock activities is assessed as "medium" (see Table 12.5).

Table 12.5. Assessment of Social Impacts

Impact Issue	Magnitude of Impact	Severity of Impact			Significance of Impact
		High (3)	Medium (2)	Low (1)	
Reduction of pasture lands	Local (B)	If the project-based lost of pasture land is more than 25% of the pasture lands within the area of invfluence of the Project	If the project-based lost of pasture land is between 10% and 25% of the pasture lands within the area of invfluence of the Project	If the project-based lost of pasture land is less than 10% of the pasture lands within the area of invfluence of the Project	Medium (B2)
Socio-economic impacts due to the likely impact on livestock activities	Local (B)	Livestock activities are the primary source of livelihood for the households in the settlement	Livestock activities are among the livelihoods for the households in the settlement	Livestock activities do not have a significant share of livelihood in the settlement	Medium (B2)

On the other hand, the parcel to be used within the scope of the Project is important as it is the closest pasture to the Apa neighborhood. However, the total size of the mentioned parcel is 44.14 hectares and 20.97 hectares of this parcel (47.5% of the total area of the parcel) is outside the Project Area. After the 26.17 hectares of the parcel, which coincide with Apa GES Project Area, is surrounded by fence, the current land uses (e.g. livestock activities) will continue in the remaining part of the parcel (that is outside the Project Area) and in other pasture parcels in the vicinity.

According to the Pasture Law No. 4342 and the related provisions of the Pasture Regulation published in connection to this law; any other activity cannot be carried out without changing the land allocation purpose in pasture lands. Within this scope, application for the change of land allocation purpose of the pasture qualified immovable/land required for APA GES Project has been made through EMRA on 02.06.2016 to the Konya Governorship, Provincial Directorate of Food, Agriculture and Livestock (according to sub-clause (ğ) of first sub-article of Article 14 of the Pasture Law No. 4342). Change of land allocation purpose has been approved with the consent of Konya Governorship dated 26.10.2016. 20 years grass price, which is determined by Province Pasture Commission, for the allocation purpose changed area has been paid to the relevant pasture revenues account by the Project Owner. In addition, the guarantee requirements determined by the Provincial Pasture Commission are provided for bringing the site to its former quality and capacity at the end of the investment. Pasture Land Rehabilitation Project prepared for the Project Area has already been approved by the Provincial Directorate of Food, Agriculture and Livestock on 24.11.2016. The provisions of the contract dated 23.12.2016 and signed between the Project Owner and the related authority will be complied with in the rehabilitation of the site to pre-project land use conditions (former quality and capacity).

On the other hand, there will be a limited level of direct employment opportunities in the construction, operation and closure phases of the Project. During the land preparation and construction phase of the Project, 25 persons are planned to work on site in average. Since the plant is planned to be operated by the remote management system during the operation phase, only 7 security personnel (6 shifts and 1 backup) are planned to continuously work on site.

In addition to direct employment opportunities, additional benefits will arise from the local/regional provision/supply of equipment/materials needs and ancillary service needs (operation and maintenance, panel cleaning, food, security, insurance, etc.) within the scope of Project.

Project-based population movement/migration is not expected as the level of employment of the Project is relatively limited and personnel/workers are planned to be provided primarily from the local/region. Therefore, it would be unlikely that the educational, cultural or social infrastructure of the Apa neighborhood, having a population of 732 (together with the Yenimescit neighborhood affiliated to the Apa neighborhood) (*TurkStat, 2015*), will be impacted from this limited number of people employed in the Project. As nearest health center (health centers in Konya Province that is about 70 km away or Cumra State Hospital that is about 35 km away and used also by inhabitants of Apa neighborhood for their health needs) will be used for possible medical interventions in case of an unexpected accident during the activities, it is not expected that there will be a significant project-based pressure/impact on the local/regional health infrastructure.

12.3. Mitigation Measures

In case the necessary permissions are taken and pasture lands in the Project Area are allocated to Apa GES for electricity generation, the use of pasture lands will be temporarily changed depending on the construction of project units and operation of the solar power plant during the service life of the Project. It is expected that the anticipated change to be occurred in Project Area will be long term but be reversible at the end of the service life of the Project when the project technology, characteristics of the units and the activities to be carried out is taken into consideration. The rehabilitation of the Project Area pursuant to Pasture Law and Pasture Regulation will be ensured in accordance with the approved Pasture Land Rehabilitation Project and the provisions of the contract signed with the Provincial Directorate of Food, Agriculture and Livestock.

At the beginning of the operation phase of the Project, the Project Owner will establish a grievance mechanism appropriate to the scale of the Project and ensure the functionality of this mechanism throughout the service life of the Project. By this way, the local people will be able to forward their possible project-based complaints to the Project Owner.

12.4. Environmental Cost-Benefit Analysis

In the feasibility studies, the income inputs of the Project were basically calculated as electricity sales and additionally carbon sales. Electricity sales revenue was foreseen approximately 61.7 million USA dollar for the 25 years service life of the Project. In addition, project-based annual carbon reduction incomes in the feasibility studies are calculated according to the following formula. In this calculation, the total carbon reduction coefficient is assumed to be 0.55 ton-CO_2/year and the carbon sales fee is assumed to be 3.37 Dollar/ton:

- Annual Average Carbon Sales Revenues (Euro/year) = Total Production (MWh/year) x 0.55 (Total Carbon Reduction Coefficient Ton-CO_2) x 3.37 (Carbon Sales Fee (Dollar/Ton-CO_2)
- Annual Average Carbon Sales Revenues (Dollar/year) = 26,200 MWh/year x 0,55 Ton-CO_2 x 3.37 Dollar/Ton-CO_2
- Annual Average Carbon Sales Revenues (Euro/year) = 48,500 Dollar/year

In the predicted electricity generation at the power plant (MWh/year), a certain reduction in the annual rate is expected over the 25 years service life. Considering this reduction, 1 million dollar revenue is expected in carbon sales over the 25 years service life. According to this, during the service life of the Project, the total income mainly from the electricity sales and the carbon sales in addition to this are calculated as 62.7 million USD in total.

The operation costs are calculated to be around 255,000 USD per year within the scope of the Project. This price, which is a cost for the power plant, will benefit the national economy with license fees and system usage fees to be paid to the state. Apart from this, items such as the fees to be paid mainly within the scope of operation and maintenance services, personnel fees, insurance will also contribute to the local economy with the expenditures to be made in the region. In this context, the total operation cost was calculated as 7.6 million USD during the 25 years service life.

In addition, a total of 6 million USD, which will be paid to the state over the 25 years of service life on taxable income, will provide benefit at the national level through the Corporate Tax.

In terms of environmental costs, 20 years grass price has to be paid regarding the use of pasture land within the Project Area, after the change of allocation purpose by the Governorship in accordance with Article 8 of Pasture Regulation. In this context, 20 years grass price, which is determined by Province Pasture Commission, has been paid to the relevant pasture revenues account by the Project Owner

12.5. Summary of Assessment and Residual Impacts

Table 12.6 provides a summary of social impact assessments. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 12.6. Summary of Social Impact Assessment

<table>
<tr><th>Affected Ecosystem Component</th><th>Project Phase</th><th>Definition of Potential Impact</th><th>Type of Impact</th><th>Impact Significance Before Mitigation</th><th>Measures to be Taken</th><th>Significance of Residual Impacts</th></tr>
<tr><td rowspan="2">Local Communities</td><td rowspan="2">Land preparation and construction</td><td>Reduction of pasture lands</td><td>Adverse</td><td>Medium</td><td rowspan="2">• Pasture Land Rehabilitation Project prepared in order to bring the site to its former quality and capacity at the end of the investment has already been approved by the Provincial Directorate of Food, Agriculture and Livestock. The rehabilitation of the Project Area at the end of the operation phase (bringing the site to its former quality and capacity at the end of the investment) will be ensured in accordance with the approved Pasture Land Rehabilitation Project and the provisions of Pasture Law and Pasture Regulation. Additionally, the provisions of the contract signed between the Project Owner and the related authority will be complied with.
• At the beginning of the operation phase of the Project, the Project Owner will establish a grievance mechanism appropriate to the scale of the Project and ensure the functionality of this mechanism throughout the service life of the Project. By this way, the local people will be able to forward their possible project-based complaints to the Project Owner.</td><td>Low</td></tr>
<tr><td>Socio-economic impacts due to the likely impact on livestock activities</td><td>Adverse</td><td>Medium</td><td>Low</td></tr>
</table>

CHAPTER 13

LABOR AND WORKING CONDITIONS

13. LABOR AND WORKING CONDITIONS

This section presents application of IFC Performance Standard PS2 for the APA GES Project.

As stated in the former sections, it is planned that 25 persons will work on site in average during the land preparation and construction phase of the Project. The plant will be operated by remote management system during the operation phase, employing 7 security personnel (6 working in shifts and 1 backup). Despite that the work force during the operation phase will be lower, there will be OHS issues to be managed during maintenance activities.

On the overall, as guided by Performance Standard 2 of IFC, labour and working conditions for the construction and operation phase include the issues listed below:

- Working Conditions and Management of Worker Relationship
- Protecting the Work Force
- Occupational Health and Safety
- Workers Engaged by Third Parties and the Supply Chain

Commitments on labour and working conditions are concluded with a range of mitigation measures for managing labour-related risks and impacts. Table 13.1 presents a summary of impacts and associated mitigation measures.

The legal frame for the chapter can be drawn with two major national laws relevant to the Project:

- The Labour Law (Act. No. 4857) which regulates the relations between an employer and an employee;
- Occupational Health and Safety Law (Law No: 6331) which regulates management of all occupational health and safety issues

Turkish Labor Law and related regulations covers the basic principles of international labor standards and the IFC PS 2 in the issues of equal treatment of employees, restrictions on the working age and employment of children, avoidance of forced labor and ensuring occupational health and safety at the workplaces. Monitoring of the implementation is essential to ensure full compliance of the activities with the relevant legislation.

Turkey has ratified a broad range of International Labour Organisation (ILO) Conventions including the following:

- Forced Labour Convention
- Minimum Age (Industry) Convention (Revised)
- Labour Clauses (Public Contracts) Convention
- Protection of Wages Convention
- Right to Organise and Collective Bargaining Convention
- Equal Remuneration Convention
- Social Security (Minimum Standards) Convention
- Abolition of Forced Labour Convention
- Discrimination (Employment and Occupation) Convention

- Equality of Treatment (Social Security Convention)
- Workers' Representatives Convention
- Minimum Age Convention
- Human Resources Development Convention
- Tripartite Consultation (International Labour Standards) Convention
- Occupational Safety and Health Convention
- Termination of Employment Convention
- Occupational Health Services Convention
- Safety and Health in Construction Convention
- Safety and Health in Mines Convention
- Worst Forms of Child Labour Convention
- Protection Framework for Occupational Safety and Health Convention

13.1. Working Conditions and Management of Worker Relationship

LE Gunes Elektrik Uretim A.S. (shortly referred as “Project Owner”) has in place a corporate Human Resources Policy and Employment Procedure.

Project Owner will provide workers with documented information that is clear and understandable, regarding their rights under national labor law; including collective agreements, their rights related to hours of work, wages, overtime, compensation, and benefits as of start up of working relationship and when any material changes occur.

In case of employing migrant workers, Project Owner will ensure that they are treated in equivalent terms and conditions as non-migrant workers carrying out similar work.

Accommodation will be provided in a manner consistent with the principles of non-discrimination and equal opportunity. Workers’ accommodation arrangements will not restrict their freedom of movement or of association.

Project Owner will not discourage workers from electing worker representatives, forming or joining workers’ organizations of their choosing, or from bargaining collectively, and will not discriminate or retaliate against workers who participate, or seek to participate, in such organizations and collective bargaining.

Project Owner will pay particular concern on principles of non-discrimination and equal opportunity. In this respect, Project Owner will not make employment decisions (i.e. recruitment and hiring, compensation, wages and benefits, working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices) on the basis of personal characteristics unrelated to job requirements. Wages, work hours and other benefits shall be as per the national Labour Law.

Project Owner will provide a grievance mechanism for workers to raise workplace concerns. The Company will inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them.

13.2. Protecting the Work Force

Project Owner will ensure measures to prevent child labour and forced labour. In this respect, children under 18 years of age will not be employed during construction and operation stages.

13.3. Occupational and Community Health and Safety

Construction stage of the Project includes assembling works for equipment and the use of duty vehicles in this scope. A range of possible health and safety risks in solar power plant projects can be listed as fall from height, electric shock, traffic accidents, incidents resulting from heavy duty vehicles (*IFC, 2015*). No activities of working with hazardous substances or with potential risks of major accidents (i.e. major emission, fire, explosion) will be carried out during the construction stage of the Project.

During the operation phase, the plant can be managed by the remote monitoring system on continuous basis, thereby there is normally no personnel interference with the power plant equipment. However, there are typical risks resulting from electrical systems in the power plant (i.e. electric shock, fire).

The Project Site is located in the 5th degree earthquake zone which represents the lowest earthquake risk in Turkey Earthquake Zones Map. For this reason, it is unlikely for a depression to occur at the scale that could cause damage or destruction in the Project units in the area. Still, the facility is designed and built by taking necessary ground safety precautions, considering site-specific geological-geotechnical survey results. The potential consequences of any possible damage or destruction are not likely to have consequences (i.e. emissions, explosion, leakage) outside of or on the premises that would negatively impact community health and safety.

Photovoltaic panels in solar energy plants create electrical and magnetic fields (equivalent to a power frequency of 60 hertz), which is referred to as "extremely low frequency ELF", similar to electrical appliances and cabling systems in many households and buildings today. This EMF level is well below the frequencies (30,000 hertz and above) generated by mobile phones, radios and microwave ovens. Furthermore, the magnetic fields formed by PV panels are static fields where the current remains stable with respect to time, and do not cause any harm on human body.

It is not foreseen that the very low frequency EMF formed by photovoltaic systems and components to be used in Apa GES will have an effect outside the plant. In addition, there is no possibility of heating of the panels and any impact, such as fire or overheating, on the environment or surroundings due to this phenomenon.

OHS Management Plan for APA GES will comply with Turkish Legislation inclusive of:

- Regulation on Occupational Health and Safety (Official Journal of 09.12.2003; No: 25311)
- Regulation on Occupational Health and Safety in Construction Works (Official Journal dated 05.10.2013; No: 28786)
- Regulation on the Use of Personal Protective Equipment in Workplaces (Official Journal dated 25.04.2013; No: 28628 – amended: 24.04.2017; No: 30047)
- Regulation on the Procedures and Principles of Occupational Health and Safety Trainings of Employees (Official Journal dated15.05.2013; No: 28648)

Despite low level of risks, OHS Plan for the construction phase will include the measures listed below in order to prevent accident risks:

- All Project staff and the Project Owner will be ensured to comply with the environmental policy and health and safety policies.
- In order to minimize the risks and hazards that may arise from natural or human error situations (e.g. natural disasters, accidents, equipment malfunctions etc.) on human health and safety, safe working environments in the working sites will be established and physical hazards and risks will be prevented.
- The relevant plans and procedures of the relevant Turkish legislation and the Project Owner will be complied within the OHS measures and practices.
- Employees will be informed about the hazards that may cause from their work and thus a safer work environment will be created.
- Training will be given to employees according to the Regulation on the Procedures and Principles of Occupational Health and Safety Trainings. In this context, a training program will be prepared, training records will be kept and evaluation activities will be carried out after the trainings.
- Personal protective equipment will be provided to all employees and necessary training will be given for their use.
- Work areas will be equipped with warning signs (e.g. "Hazard", "Entry Prohibited", etc.) in accordance with the quality and potential risks of the work to be performed in that area.
- All necessary precautions will be taken in the Project Area to prevent possible fires from construction activities. Uncontrolled fires in and out of the field will be prevented.
- Smoking in areas where there is a risk of fire will be prohibited. All employees must have knowledge of what to do in the event of a fire.
- Project staff will have first aid trained personnel. In case of emergency where an intervention is required, personnel will be moved to the nearest health center by appropriate means.
- Procedures approved by the Project Owner and the requirements of the technical specifications of the supplier companies shall apply to the use and maintenance of the machines, equipment and tools to be used in the activities.
- Moving parts of machinery and equipment will be equipped with appropriate protective systems (e.g. metal shields etc.), minimizing the risk of injury or damage to the person using the machine or equipment.
- Personal factors that may create and control risks during activities (e.g. long hair, jewelry and accessory use, clothing etc.) will be removed from the site by the regulations brought by the field management. Project staff will be informed about the relevant regulations within the scope of the training program.
- Drivers and operators will be trained to comply with traffic rules and to control the vehicles and equipment they use against risks and hazards originating from vehicle traffic. Required traffic signs will be placed in the Project Site and its surroundings. Machine operators and other employees will be informed and alerted about the relevant signs.
- The wastes to be formed within the scope of the construction phase of the Project will be managed under the Waste Management Regulation and the negative impacts on public health will be minimized.

- Areas where excavation work is to be carried out will not be accessible other than the authorized personnel. The loading and unloading activities shall be carried out together with the persons to oversee the personnel to carry out the activity.
- Persons and/or organizations with the necessary permits will be assigned to ensure the security of the Project Area (e.g. private security companies/officials). These persons and/or organizations shall regularly monitor the facility and its surroundings. The special security applications and officials' authorities within the scope of the project shall comply with the provisions of the Regulation on the Implementation of the Law on Private Security Services and the Law on Private Security Services.
- In addition to safety personnel, monitoring of the Project Site for security purposes will be provided by a closed circuit camera system which will be installed at appropriate distances on the site boundary (e.g. 30-40 meters) to provide daytime and nighttime monitoring of the whole area.
- Before construction activities begin, working site will be fenced and the access of the visitors, local people and animals to the area will be controlled.
- Entry of staff and third parties into the working site will be carried out in a controlled manner from the doors at which authorized security personnel will work.

Mitigation measures that will be taken during the operation phase are listed below:

- The whole area will be fenced; the access of local people and wildlife will be controlled. The entry of personnel and third parties into the facility will be carried out in a controlled manner
- Private security officers will be hired in order to provide the security of the working area. The special security applications within the scope of the project and the competent authorities shall be in compliance with the provisions of the Law on Private Security Services and the Implementation of the Law on Private Security Services
- The workers will be trained in accordance with Regulations on the Procedures and Principles of Occupational Health and Safety Trainings of Employees.
- Personal Protective Equipment will be provided for the workers according to the nature of work to be performed. The necessary trainings will be carried out for their use.
- Smoking will be prohibited where the risks of fire is high. All the workers will be informed about the action plan in a case of fire
- All equipment will be operated in proper working order.
- Procedures approved by the Project Owner in the maintenance and repair activities and the requirements of the technical specifications of the supplier companies will be complied with.
- The necessary health and safety signs and traffic signs will be placed around the project site. Employees will be informed and alerted about the subject matter markings.
- Trainings will be given to employees and operational and maintenance personnel within the scope of the Regulation on Procedures and Principles of Occupational Health and Safety Trainings and measurement and evaluation activities will be carried out after the trainings.
- Entrance of operation and maintenance personnel and third parties will be carried out in a controlled manner from the doors of the security personnel.
- Equipment that meets international standards in terms of electrical performance and safety will be used at the plant.

- After the plant is completed, necessary electrical tests will be carried out to check that the electrical connections of the panels and other related equipment are made properly before the plant is taken into operation.
- By maintaining a minimum distance of 3 meters between the solar panels, conditions will be provided so that in the case of fire, the intervention can be carried out easily. The plant will be planned in such a way that the widths of the road will be sufficient.
- The vegetation under the panels will not be allowed to grow uncontrollably.
- An Emergency Response Plan will be prepared before the plant is taken into operation. The plan will describe the measures to be taken against fire risk. The number and quality of the fire intervention equipment to be determined within the scope of the plan will be available at the site. Security personnel will be trained on fire intervention.
- The amount of water to be needed in a possible fire intervention will be ensured so that the equipment required for its use (e.g. pump) is always accessible.

13.4. Workers Engaged by Third Parties and the Supply Chain

Project Owner will ensure that subcontractors are reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the labour conditions provided by the Project Owner.

Project Owner will establish policies and procedures for managing and monitoring the performance of subcontractors such that human rights policy and labour rights of all workers are exercised properly.

Project Owner will ensure that workers of subcontractors have access to the overall grievance mechanism to be established for the Project.

Project Owner will monitor its primary supply chain for safety issues related to supply chain workers, and where necessary Project Owner will introduce procedures and mitigation measures to ensure that suppliers are taking steps to prevent or to correct life-threatening situations.

13.5. Summary of Impacts

Table 13.1. Summary of Impact Assessment on Labor and Working Conditions (including Occupational Health and Safety)

Definition of Potential Impact	Affected Component	Project Phase	Impact Significance	Measures to be Taken	Significance of Residual Impacts
Working conditions	Labour Force	Construction and Operation	Low	• Workers will be provided with documented information that is clear and understandable, regarding their rights under national labor law; including collective agreements, their rights related to hours of work, wages, overtime, compensation, and benefits as of start up of working relationship and when any material changes occur. • Migrant workers will be treated in equivalent terms and conditions as non-migrant workers carrying out similar work. • Accommodation will be provided in a manner consistent with the principles of non-discrimination and equal opportunity. Workers' accommodation arrangements will not restrict their freedom of movement or of association. • Workers will not be discouraged from electing worker representatives, forming or joining workers' organizations of their choosing, or from bargaining collectively, and will not be discriminated or retaliated when they participate, or seek to participate, in such organizations and collective bargaining. • Principles of non-discrimination and equal opportunity will be applied such that employment decisions (i.e. recruitment and hiring, compensation, wages and benefits, working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices) will be given on the basis of personal characteristics unrelated to job requirements. Wages, work hours and other benefits shall be as per the national Labour Law. • A grievance mechanism will be established for workers to raise workplace concerns. Workers will be informed of the grievance mechanism at the time of recruitment and provided easy access to the mechanism.	Low
Protecting the Work Force	Labour Force	Construction and Operation	Low	• Employment of child labour and forced labour will be prevented.	Low

Definition of Potential Impact	Affected Component	Project Phase	Impact Significance	Measures to be Taken	Significance of Residual Impacts
Occupational health and safety	Labour Force	Construction	Low	• All Project staff and the Project Owner will be ensured to comply with the environmental policy and health and safety policies. • In order to minimize the risks and hazards that may arise from natural or human error situations (e.g. natural disasters, accidents, equipment malfunctions etc.) on human health and safety, safe working environments in the working sites will be established and physical hazards and risks will be prevented. • The relevant plans and procedures of the relevant Turkish legislation and the Project Owner will be complied within the OHS measures and practices. • Employees will be informed about the hazards that may cause from their work and thus a safer work environment will be created. • Training will be given to employees according to the Regulation on the Procedures and Principles of Occupational Health and Safety Trainings. In this context, a training program will be prepared, training records will be kept and evaluation activities will be carried out after the trainings. • Personal protective equipment will be provided to all employees and necessary training will be given for their use. • Work areas will be equipped with warning signs (e.g. "Hazard", "Entry Prohibited", etc.) in accordance with the quality and potential risks of the work to be performed in that area. • All necessary precautions will be taken in the Project Area to prevent possible fires from construction activities. Uncontrolled fires in and out of the field will be prevented. • Smoking in areas where there is a risk of fire will be prohibited. All employees must have knowledge of what to do in the event of a fire. • Project staff will have first aid trained personnel. In case of emergency where an intervention is required, personnel will be moved to the nearest health center by appropriate means. • Procedures approved by the Project Owner and the requirements of the technical specifications of the supplier companies shall apply to the use and maintenance of the machines, equipment and tools to be used in the activities. • Moving parts of machinery and equipment will be equipped with appropriate protective systems (e.g. metal shields etc.), minimizing the risk of injury or damage to the person using the machine or equipment. • Personal factors that may create and control risks during activities (e.g. long hair, jewelry and accessory use, clothing etc.) will be removed from the site by the regulations brought by the field management. Project staff will be informed about the relevant regulations within the scope of the training program. • Drivers and operators will be trained to comply with traffic rules and to control the vehicles and equipment they use against risks and hazards originating from vehicle traffic. Required traffic signs will be placed in the Project Site and its surroundings. Machine operators and other employees will be informed and alerted about the relevant signs. • The wastes to be formed within the scope of the construction phase of the Project will be managed under the Waste Management Regulation and the negative impacts on public health will be	Low

Definition of Potential Impact	Affected Component	Project Phase	Impact Significance	Measures to be Taken	Significance of Residual Impacts
				minimized. • Areas where excavation work is to be carried out will not be accessible other than the authorized personnel. The loading and unloading activities shall be carried out together with the persons to oversee the personnel to carry out the activity. • Persons and/or organizations with the necessary permits will be assigned to ensure the security of the Project Area (e.g. private security companies/officials). These persons and/or organizations shall regularly monitor the facility and its surroundings. The special security applications and officials' authorities within the scope of the project shall comply with the provisions of the Regulation on the Implementation of the Law on Private Security Services and the Law on Private Security Services. • In addition to safety personnel, monitoring of the Project Site for security purposes will be provided by a closed circuit camera system which will be installed at appropriate distances on the site boundary (e.g. 30-40 meters) to provide daytime and nighttime monitoring of the whole area. • Before construction activities begin, working site will be fenced and the access of the visitors, local people and animals to the area will be controlled. • Entry of staff and third parties into the working site will be carried out in a controlled manner from the doors at which authorized security personnel will work.	
Workers Engaged by Third Parties and the Supply Chain	Labour Force	Construction and Operation	Low	• Subcontractors will be selected among reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the labour conditions provided by the Project Owner. • Policies and procedures will be established for managing and monitoring the performance of subcontractors such that human rights policy and labour rights of all workers are exercised properly. • Workers of subcontractors will be ensured to have access to the overall grievance mechanism to be established for the Project. • Primary supply chain will be monitored for safety issues related to supply chain workers, and where necessary procedures and mitigation measures will be introduced to ensure that suppliers are taking steps to prevent or to correct life-threatening situations.	Low
Occupational health and safety	Labour Force	Operation	Low	• The whole area will be fenced; the access of local people and wildlife will be controlled. The entry of personnel and third parties into the facility will be carried out in a controlled manner • Private security officers will be hired in order to provide the security of the working area. The special security applications within the scope of the project and the competent authorities shall be in compliance with the provisions of the Law on Private Security Services and the Implementation of the Law on Private Security Services • The workers will be trained in accordance with Regulations on the Procedures and Principles of Occupational Health and Safety Trainings of Employees. • Personal Protective Equipment will be provided for the workers according to the nature of work to be performed. The necessary trainings will be carried out for their use. • Smoking will be prohibited where the risks of fire is high. All the workers will be informed about the action plan in a case of fire	Low

Definition of Potential Impact	Affected Component	Project Phase	Impact Significance	Measures to be Taken	Significance of Residual Impacts
				• All equipment will be operated in proper working order. • Procedures approved by the Project Owner in the maintenance and repair activities and the requirements of the technical specifications of the supplier companies will be complied with. • The necessary health and safety signs and traffic signs will be placed around the project site. Employees will be informed and alerted about the subject matter markings. • Trainings will be given to employees and operational and maintenance personnel within the scope of the Regulation on Procedures and Principles of Occupational Health and Safety Trainings and measurement and evaluation activities will be carried out after the trainings. • Entrance of operation and maintenance personnel and third parties will be carried out in a controlled manner from the doors of the security personnel. • Equipment that meets international standards in terms of electrical performance and safety will be used at the plant. • After the plant is completed, necessary electrical tests will be carried out to check that the electrical connections of the panels and other related equipment are made properly before the plant is taken into operation. • By maintaining a minimum distance of 3 meters between the solar panels, conditions will be provided so that in the case of fire, the intervention can be carried out easily. The plant will be planned in such a way that the widths of the road will be sufficient. • The vegetation under the panels will not be allowed to grow uncontrollably. • An Emergency Response Plan will be prepared before the plant is taken into operation. The plan will describe the measures to be taken against fire risk. The number and quality of the fire intervention equipment to be determined within the scope of the plan will be available at the site. Security personnel will be trained on fire intervention. • The amount of water to be needed in a possible fire intervention will be ensured so that the equipment required for its use is always accessible.	

CHAPTER 14

TRAFFIC AND TRANSPORT

14. TRAFFIC AND TRANSPORT

14.1. Existing Road Traffic Structure

The Apa GES Project Area is located at a point of high accessibility by road from about 65 km (by road) south- southwest of Konya Province. It is planned to provide access to the Project Area on the existing roads and no new road construction is foreseen within the scope of the Project. The map of Turkey showing the main transportation routes connecting the Project Area with Konya Province and other important centers in the country is presented in Figure 14.1.

The main transportation from Konya to the Project Area is provided via D705 Konya-Hadim Road that is separated to the right from D715 Ankara-Konya State Road at Icericumra location. This road deviates to the right towards the Apa neighborhood at Dineksaray neighborhood and reaches the Apa neighborhood with an approximately 6 km of asphalt village road. Access to the Project Area from Karaman direction is possible via junction from D715 Karaman-Konya road to the left at Gokhuyuk neighborhood which is then connected to D705 Konya-Hadim Road.

Road segments providing transportation between Konya and Karaman provincial centers and Apa neighborhood and their lengths are presented in Table 14.1. There are also alternative ways to access the Apa neighborhood from the surrounding neighborhoods. Map of the General Directorate of Highways (KGM) showing the existing transportation infrastructure in the region, where the Project Area is located, is presented in Figure 14.2, and Figure 14.3 shows the routes connecting the Project Area to Ankara-Konya and Karaman-Konya roads.

Table.14.1. Distances of the Project Area to Highways

Direction of Transportation	Road Section	Road Section No	Highway Description	Approximate Road Section Length (km)
Konya	Konya Center	330-13	D330 Ankara-Konya Road	12.0
	Konya Center-Icericumra Junction	715-04	D715 Ankara-Konya Road	30.0
	Icericumra-Dineksaray Junction	705-01	D705 Konya-Hadim Road	17.0
	Dineksaray Junction-Apa Neighborhood		Dineksaray-Apa Neighborhood Road	6.0
	Konya Center-Apa Neighborhood			**65.0**
Karaman	Karaman Center-Gokhuyuk Junction	715-05	D715 Karaman-Konya Road	63.0
	Gokhuyuk Junction-Konya Hadim Road		Gokhuyuk-Balcikhisar-Doganli Road	12.0
	Konya Hadim Road- Dineksaray Junction	705-01	D705 Konya-Hadim Road	4.0
	Dineksaray Junction-Apa Neighborhood		Dineksaray-Apa Neighborhood Road	6.0
	Karaman Center -Apa Neighborhood			**85.0**

14.2. Road Traffic Load

Existing traffic loads, according to Traffic and Transportation Information for 2015 published by KGM, on the roads numbered 715-04 (Segment 0) and 705-01 (Segment 1 and Segment 2) from Konya direction to the Project Area and control section numbered 715-05 from Karaman direction to the Project Area are summarized in Table 14.2.

Figure.14.1. Map Showing the Main Roads Connecting the Project Area with the Important Centers in the Turkey

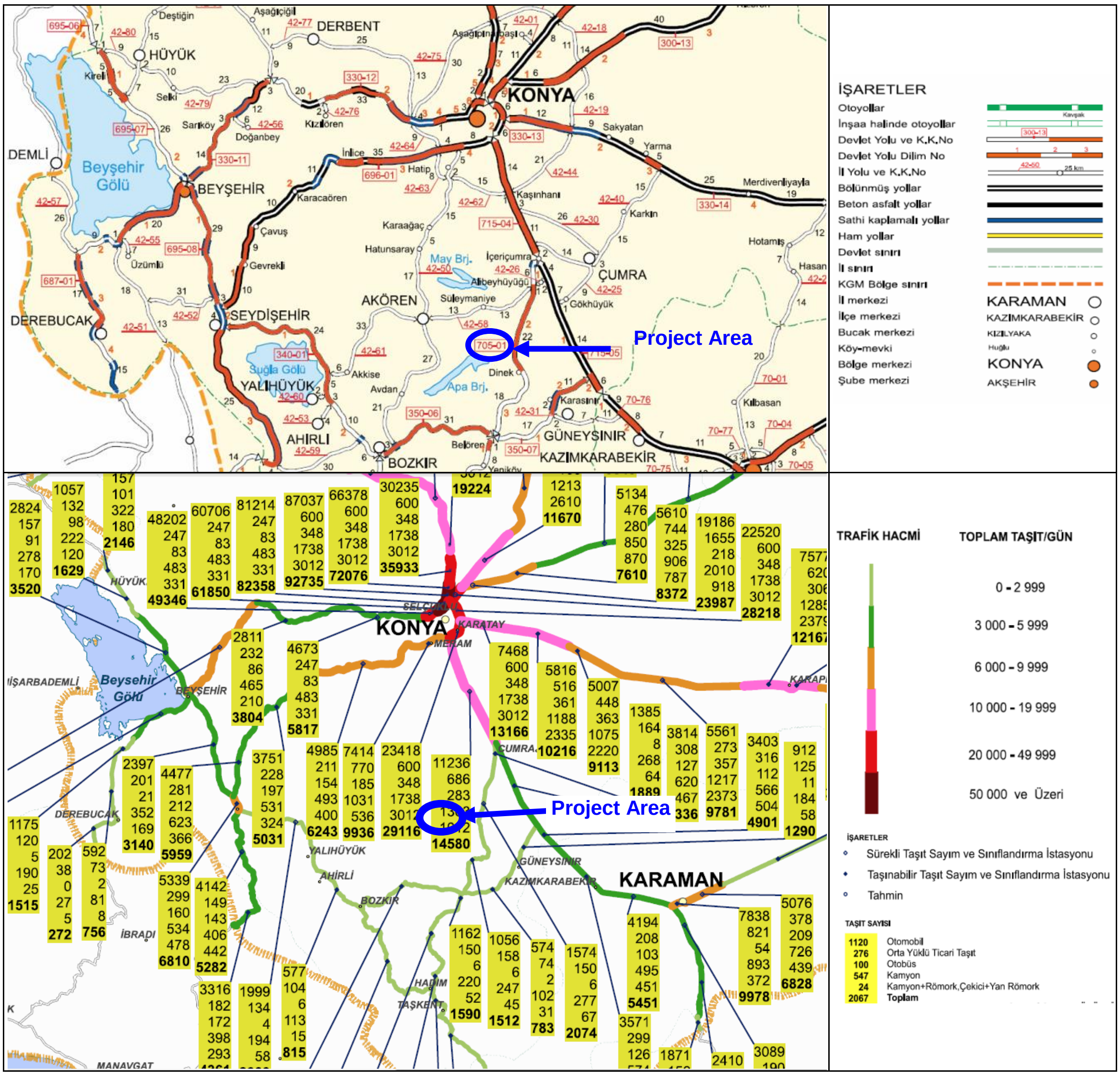


Figure.14.2. 3rd Regional Directorate of Highways (Konya) Traffic Segment Map
(Source: KGM, June 2016)

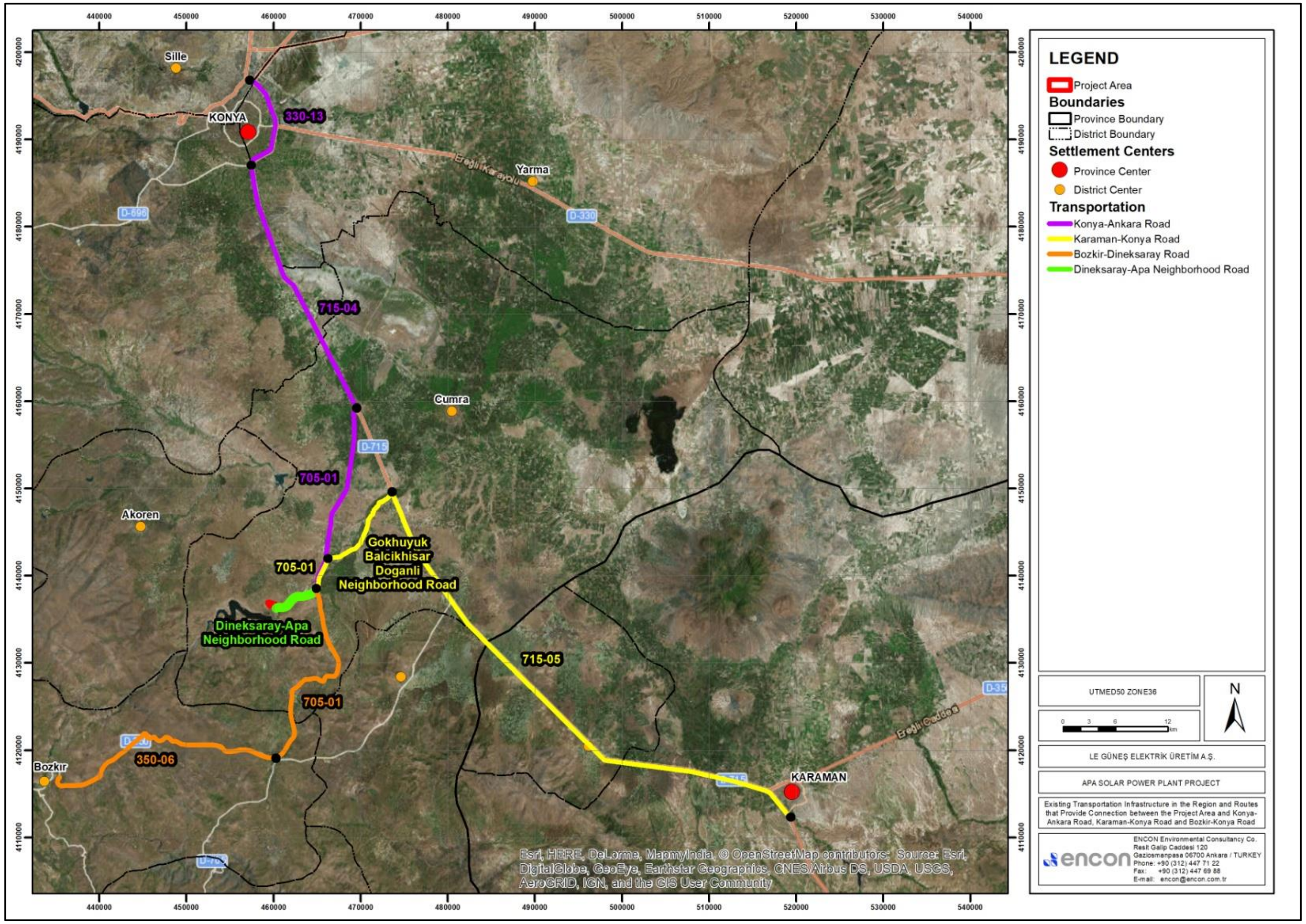


Figure.14.3. Existing Transportation Infrastructure in the Region and Routes that Provide Connection between the Project Area and Konya-Ankara Road, Karaman-Konya Road and Bozkir-Konya Road

Table.14.2. Existing Traffic Loads on the Roads to be used from Konya and Karaman Directions (Annual Daily Average)

Direction of Transportation	Road Section No	Segment No	Segment Length (km)	Total Annual Daily Average Vehicle Number	Car	Medium Loaded Commercial Vehicle	Bus	Heavy Vehicle		
								Truck	Trailer Truck, Tow Truck and Semi-Trailer	Heavy Vehicle (%)
Konya	715-04	0	31	14,580	11,236	686	283	1,363	1,012	16
	705-01	1	6	1,889	1,385	164	8	268	64	18
	705-01	2	22	2,074	1,574	150	6	277	67	17
Karaman	715-05	1	25	5,336	3,814	308	127	620	467	20
	705-01	2	22	2,074	1,574	150	6	277	67	17

Source: KGM, 2016.

During the land preparation and construction phase of the Project, there will be a temporary increase in the traffic load on the roads to be used in the transportation of the necessary materials and equipment (for the establishment of the power plant) by heavy vehicles (e.g. trucks) and due to this increase there would be possibility of indirect impacts (e.g. air emissions, noise, landscaping, accident risk, etc.). These impacts will disappear after the completion of the transportation process. Panels, inverters and cables (solar, LV/MV cables, DC cables) to be used in the construction of the power plant could be supplied from abroad; construction materials, concrete and other necessary materials/components (e.g. grounding conductors, corrugated pipes, cable trays, wire fences, camera poles, construction equipments, etc.) could be supplied locally by trucks and trailers. The materials and equipments to be supplied from abroad are planned to be dispatched from Mersin (from Karaman direction) and/or Antalya (from Konya Province, Bozkir District direction) ports. On the other hand, domestic materials and equipments are planned to be supplied from suppliers located in Central Anatolia, Marmara and Aegean regions (from Konya direction). Trucks/trailers belonging to logistic companies serving in accordance with the Highways Traffic Law, Road Transport Law and the regulations issued in compliance with these laws will be used for the transportation of materials and equipments on domestic roads. Foreseen round numbers and dispatching duration for the delivery of construction materials and equipments are summarized in Table 14.3.

Table.14.3. Foreseen Round Numbers and Dispatching Duration for the Delivery of Construction Materials and Equipments

Dispatching Location	Type of Material and Equipment to be Dispatched	Required Vehicle (Truck/Trailer) Round Number (One Direction) for Transportation Between Dispatching Location and Project Area	Total Dispatching Duration (Month)
Antalya and/or Mersin Ports	Photovoltaic panels	70	3
	Inverters	15	
	Cables (solar, LV/MV, DC)	9	
Foreign Material/Equipment (from Karaman and/or Bozkır direction)		**94**	**3**
Central Anatolia, Marmara, Aegean (from Konya direction)	Construction	30	3
	Transformers	3	
	Concrete material	15	
	Other material/equipment	5	
Domestic Material/Equipment (from Konya direction)		**53**	**3**

When the round number and dispatching duration presented in Table 14.3 are taken into account, the additional traffic load that will be generated in the existing roads for 2 months required for the transportation from Karaman (Mersin Port) and/or Bozkir (Antalya Port) directions for the materials/equipment dispatching from abroad and the transportation from Konya direction for the materials/equipment dispatching from domestic locations is summarized in Table 14.4. In this calculation, it is assumed that each vehicle will travel 2 times on the same road as round trip. Scenarios of transporting materials/equipment dispatching from abroad from Mersin or Antalya ports were alternatively evaluated. At this point, both alternatives have been examined separately, assuming that all of the materials will be dispatched from a single port in the worst case approach. If the materials and equipments are dispatched at both ports, the increase in the traffic loads will be lower than the calculation of given in the table since vehicle traffic will distribute on the connection routes between these ports and the facility.

Table 14.4. Impact of Project on Existing Traffic Loads

Supply Point	Dispatch Point	Road Section to be Used	Existing Traffic Load on the Road Section to be Used (Vehicle/Day)		Average Daily Round Number due to the Project	Additional Heavy Vehicle Load in the Road Section to be Used due the Project (%)
			Total Vehicle Number	Number of Heavy Vehicle		
Abroad (Alternative 1)	Mersin Port (Karaman direction)	715-05	5,336	487	2	0.4
		705-01 (1)	1,889	332	2	0.6
		705-01 (2)	2,074	344	2	0.6
Abroad (Alternative 2)	Antalya Port (Bozkır direction)	350-06 (0)	1,339	260	2	0.7
		705-01 (3)	1,512	292	2	0.7
Domestic	Central Anatolia, Marmara, Ege (Konya direction)	715-04	14,580	2,375	1	0.04
		705-01 (1)	1,889	332	1	0.3
		705-01 (2)	2,074	344	1	0.3

According to the information presented in Table 14.4, when the existing traffic loads on each road section to be used due to the transportation of construction materials and equipment to be performed within the Project are taken into consideration, the increase of heavy vehicle load due to the Project will be less than 1%. Even though on the 4 km part of the road, after the intersection of roads coming from Konya and Karaman directions on road section no 705-01 and segment no 2, the total vehicle load (3 rounds per day) coming from both directions will be observed, the daily heavy vehicle load increase will be less than 1%. However, as the anticipated impact will occur on a wider scale beyond the Project Area of Influence, the magnitude of impact is defined as "wide". Therefore, the significance of the project-based traffic impact on the main road sections to be used is assessed as “medium”. Additionally, the impact will occur only for a temporary period of 3 months and will disappear at the end of dispatching of materials and equipment to the Project Area (see Table 14.5).

On the other hand, the existing traffic load on the approximately 6 km section of the road providing transportation to the Apa neighborhood that is separated from D705 Konya-Hadim road at Dineksaray neighborhood is lower compared to the main roads. Therefore, this road will have a higher sensitivity (medium or high) and accordingly the significance of the traffic increase impact on this road section might be higher (“high” or “medium”, depending on existing traffic load).

As there will not be a significant traffic load during the operation phase of the Project, any impact on the traffic infrastructure is not expected.

Table 14.5. Assessment of Impacts on Existing Traffic Loads

Impact Issue	Road Section to be Used	Magnitude of Impact	Severity of Impact			Significance of Impact
			High (3)	Medium (2)	Low (1)	
Traffic load	715-05 715-04 705-01 (1) 705-01 (2)	Wide (A)	Roads where project-based traffic will increase the road's existing heavy vehicle load by more than 25%	Roads where project-based traffic will increase the road's existing heavy vehicle load by 10-25%	Roads where project-based traffic will increase the road's existing heavy vehicle load by less than 10%	Medium (A1)

14.3. Mitigation Measures

If the improvement of the asphalt road between Dineksaray and Apa neighborhoods is required during the land preparation phase of the Project in order to mitigate the possible impacts, the road would be improved by the Project Owner and the structure of the road will be ensured to be in a good condition during the Project. It will be ensured to take all the necessary precautions (e.g. installation/use of warning signs) in the entry and exit of this road and in terms of traffic safety along the road by cooperating with the relevant authority/administration. In case this road is damaged due to the activities originating from the Project during the service life of the Project, the necessary maintenance and improvement works will be done by the Project Owner.

On the other hand, trucks, trailers and other vehicles to be used to transport system equipments and materials will be provided to comply with speed limits before and during the construction phase of the Project. During all transportation operations to be carried out by the Project Owner (including logistics companies), it will be ensured to comply with Highways Traffic Law, Road Transport Law and the regulations issued in compliance with these laws.

14.4. Summary of Assessment and Residual Impacts

Table 14.6 provides a summary of impact assessment on existing traffic loads. Significance of the identified impacts before and after the implementation of mitigation measures are also given in this table.

Table 14.6. Summary of Impact Assessment on Existing Traffic Loads

Affected Ecosystem Component	Project Phase	Definition of Potential Impact	Type of Impact	Impact Significance Before Mitigation	Measures to be Taken	Significance of Residual Impacts
Local Communities Traffic Infrastructure	Land preparation and construction	Traffic load	Adverse	Medium	• The asphalt road between Dineksaray and Apa neighborhoods would be improved by the Project Owner, if required and the structure of the road will be ensured to be in a good condition during the Project. In case this road is damaged due to the activities originating from the Project during the service life of the Project, the necessary maintenance and improvement works will be done by the Project Owner. • All necessary precautions will be taken regarding traffic safety in cooperation with relevant authority/administration. • During all transportation operations to be carried out by the Project Owner (including logistics companies), it will be ensured to comply with Highways Traffic Law, Road Transport Law and the regulations issued in compliance with these laws.	Low

CHAPTER 15

STAKEHOLDER ENGAGEMENT

15. STAKEHOLDER ENGAGEMENT

Apa GES Project Area is located in Cumra District of Konya Province. The closest settlement to the Project Area is the Apa neighborhood on the south-southeast of the site. The distance to the Project Area of the nearest building belonging to the neighborhood is about 40 meters. Apasaraycik neighborhood, about 5 km west of the site, and Dineksaray neighborhood, about 5 km northeast of the site, are other settlements in the vicinity of the Project Area.

The parcel numbered 165/2 and qualified as pasture land (allocation purpose has been changed by the Governership of Konya on 26.10.2017 and a new title deed has been arranged as parcel number of 165/45 and qualified as Solar Power Plant Site), where the Project Area is located, is registered to the Apa neighborhood. The land to be used within the scope of the planned GES Project is located in this settlement and the nearest residential area to the power plant is also therein. Since this is the case, people/communities residing in the Apa neighborhood are considered to be the primarily project affected people, if the necessary measures are not taken, and are likely to benefit primarily from the opportunities brought by the Project. It is also possible that the Apasaraycik and Dineksaray neighborhoods are interacting with the Project, as well as the Apa neighborhood, even at a more limited level.

Turkish EIA Regulation defines Citizens of the Republic of Turkey, foreigners residing in Turkey and one or more legal persons within the framework of national legislation or associations, organizations or groups of such legal entities as "public". The Regulation sets forth the requirements in various stages of the EIA process that is described within the scope of the legislation with the aim of informing the local people and other stakeholders about the process and reflecting their opinions in EIA studies effectively. In this context, for the projects subject to the EIA process, a Public Participation Meeting should be organized in a central place that is at a close location to the most probable project affected people/settlement (for their easy access and participation) and identified by the Governorship in order to inform the public about the investment/project and to obtain their opinions and suggestions about the project, before the determination of the scope and special format of the EIA Report to be prepared. The date of this meeting is determined by the MoEU but its time and location is determined by the relevant Governorship. Institutions/organizations having certificate of competency from the MoEU (for the preparation of the EIA Report) and Project Owner participate to this meeting.

According to the EIA Regulation, the process for the projects subject to the full EIA process, starts with the submittal of an EIA Application File to the MoEU prepared in line with the format provided in Annex-3 of the EIA Regulation by the institutions/organizations having certificate of competency from the MoEU. In the event that the EIA Application File is found appropriate after the evaluation of the Ministry, a Scoping and Review and Evaluation Committee ("Committee") is established consisting of the related governmental agencies and institutes, representatives of the Ministry, Project Owner and the institution/organization having certificate of competency from the MoEU (the EIA Consultant) by considering the information provided in the EIA Application File. The Ministry may invite universities, representatives of the relevant research organizations, experts, professional chambers, unions, associations and non-governmental organizations to participate in the Committee depending on the scope, type and location of the project, if deemed necessary. The task of the Committee has been defined to be the determination of the scope of the Special Format to be provided for the Project and to review and evaluate the EIA Report to be prepared.

The EIA application to the MoEU for the Apa GES Project was made on 16.05.2016. A committee consisting of the following institutions has been established by considering the information provided in the application file after the examination of the application within the framework of the EIA Regulation. The Ministry informed the members of the Committee regarding the date of Public Participation Meeting and the deadline for their submission of scoping opinions with an official letter dated 23.05.2016 (together with the EIA Application File).

- **Ministry of Environment and Urbanization (Ankara)**
    - General Directorate of Environmental Impact Assessment, Permit and Inspection
- **Ministry of Forestry and Water Affairs (Ankara)**
    - General Directorate of State Hydraulic Works (DSI)
    - Turkish State Meteorological Service
    - General Directorate of Nature Conservation and National Parks
- **Ministry of Energy and Natural Resources (Ankara)**
    - General Directorate of Mining Affairs
- **Ministry of Culture and Tourism**
    - Konya Regional Council for the Protection of Cultural Assets
- **Konya Governorship**
    - Provincial Directorate of Environment and Urbanization
    - Provincial Directorate of Food, Agriculture and Livestock
    - Provincial Disaster and Emergency Directorate
- **Konya Metropolitan Municipality**

According to the EIA Regulation, institutions/organizations having certificate of competency from the MoEU issue an announcement regarding the date, time, place and scope of the meeting to at least one national newspaper and one local newspaper (issued at the region where the Project is planned to be realized) at least 10 calendar days before the public participation meeting. National and local newspaper announcements issued within the scope of the Apa GES Project in accordance with the EIA Regulation are presented in Figure 15.1 and Figure 15.2.

Public Participation Meeting has been performed within the scope of Apa GES Project on 16.06.2016 at 2:00 pm at a tea house in the Apa neighborhood with the participation of representatives of MoEU, Konya Provincial Directorate of Environment and Urbanization, Konya Provincial Directorate of Food, Agriculture and Livestock, Project Owner and ENCON Environmental Consultancy Co. (the EIA Consultant that prepared the EIA Report) and the residents of the Apa neighborhood. The meeting started with the information provided to the public by the Konya Provincial Directorate of Environment and Urbanization regarding the Project, requirements of the EIA Regulation, the purpose and function of the Public Participation Meeting and the EIA process. Afterwards, the local community and the other participants have been informed about the Project and environmental and social impact assessment process related to the Project with the presentation made by the representatives of ENCON Environmental Consultancy Co. Subsequently, opinions, questions and suggestions of the public and other participants about the Project were taken and the minutes of the meeting was kept. Some photographs taken during the Public Participation Meeting are presented in Figure 15.3, Figure 15.4 and Figure 15.5.

20 Ver Posta'ya gitsin!

2 Haziran 2016 Perşembe

POSTA SERİ İLAN

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DUYURU

LE Güneş Elektrik Üretim A.Ş. tarafından Konya ili, Çumra ilçesi, Apa mahallesi, Bağlar Mevkii'nde "Apa Güneş Enerjisi Santrali Projesi"nin yapılması planlanmaktadır. Söz konusu Proje için Çevresel Etki Değerlendirmesi (ÇED) Yönetmeliği'nin 9. maddesi gereğince aşağıda belirtilen tarih ve saatte faaliyetle ilgili Halkı bilgilendirmek, görüş ve önerilerini almak için "Halkın Katılımı Toplantısı" yapılacaktır.

Halkımıza saygı ile duyurulur.

Toplantının Yeri	: Apa Mahallesi Çay Ocağı
Toplantı Yerinin Adresi	: Apa Mahallesi Petrol Ofisi Yanı
Toplantı Tarihi	: 16 Haziran 2016
Toplantı Saati	: 14:00

Proje Sahibi	: **LE Güneş Elektrik Üretim A.Ş.**
Tel	: 0 (312) 446 88 00
Faks	: 0 (312) 446 88 10

ÇED Raporunu Hazırlayan Kuruluş: **ENCON Çevre Danışmanlık Ltd. Şti.**

Tel	: (0312) 447 71 22
Faks	: (0312) 447 69 88

TOPRAK MAHSULLERİ OFİSİ GENEL MÜDÜRLÜĞÜNDEN DUYURU

"Suriye'deki olaylardan zarar gören sivil halka hibe edilmek üzere Kuruluşumuzdan talep edilecek ekmeklik buğdaya karşılık gelecek miktarda 7.500 (± %20 TMO opsiyonunda) ton çuvallı ekmeklik buğday unu temini ihalesi"

Kapalı Zarfla Teklif Alma Yöntemi ile **08.06.2016 günü, saat 14:00'de**, TMO Genel Müdürlüğünde yapılacaktır.

Teklifler kapalı zarf içinde sunulacak olup, zarflar isteklilerin önünde açıldıktan sonra, ihaleye temsilci göndermeyen ya da gönderdiği halde pazarlık için teklifi vermeyen firmaların kapalı zarfla verilen ilk teklifleri dikkate alınacaktır.

Bu ihaleye verilecek teklifler **13.06.2016 günü saat 18:00'e** kadar geçerli olacaktır.

İhale ile ilgili şartname, aşağıda açık adresi bulunan TMO Genel Müdürlüğü Ticaret Dairesi Başkanlığından veya TMO Taşra Şube Müdürlüklerinden bedelsiz olarak alınabileceği gibi www.tmo.gov.tr internet adresinden de temin edilebilecektir.

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Figure 15.1. National Newspaper Announcement issued for the Public Participation Meeting

02 Haziran 2016 Perşembe ÇUMRA POSTASI Sayfa -4-

BEYŞEHİR BELEDİYESİ SİNEKLE MÜCADELE FİLOSUNU GÜÇLENDİRDİ

Konya'nın Beyşehir İlçe Belediyesi, takviye edilen yeni araç ve sivrisinek makineleri ile sinekle mücadele filosunu güçlendirdi.

Beyşehir ilçesinde, yaz döneminin gelmesi ile birlikte sinekle mücadele çalışmaları yoğunluk kazandı. Beyşehir Belediye Başkanı Murat Özaltun, havaların ısınmasıyla beraber halkın yoğun şikayetine yol açan sinekle mücadelede bu yıl bahar mevsiminden itibaren adeta seferberlik ilan ettiklerini söyledi. Beyşehir'in yaz dönemi ile birlikte ziyaretçi yoğunluğunun artmaya başladığını belirten Özaltun, gerek ilçede yaşayan vatandaşların gerekse ilçe dışından gelen misafirlerin sivrisinek ve uçkunlardan zarar görmemesi ve mağdur olmaması için Belediye olarak her türlü imkanı seferber ettiklerini söyledi.

Beyşehir Belediyesi Park ve Bahçeler Müdürlüğü'nün havaların ısınmasıyla artan sinek popülasyonuna karşı daha etkili olabilmek için ilaçlama çalışmalarına bugünlerde daha da hız verdiğini anlatan Özaltun, ilaçlama faaliyeti yürüten ekip ve ekipman sayısını da artırdıklarını söyledi. Beyşehir Belediyesi olarak mevcut ekipman ve ilaçlama makinelerine ilave olarak 15-20 metre yükseğe ilaç atabilecek boyutta bir makine alımı yaptıklarını da vurgulayan Özaltun, "Özellikle, hava karardıktan sonra yollardaki trafik lambalarında çok sayıda sivrisinek ve uçkunun aydınlanmanın olduğu bölgelerde kümelendiğini görürüz. İşte, burada kümelenen sineklere karşı da artık bu makine sayesinde daha etkili bir çalışma sağlayabileceğiz."dedi. Özaltun, ilaçlama faaliyetleri yürüten ekiplerin dönemlerinde ilgili birimlerle de koordine ederek profesyonel bir çalışmaya imza attığını, gerçekleştirilen takım çalışmasının ise bu hususta elde edilen başarıda da önemli paya sahip olduğunu dile getirdi.

Başkan Özaltun, yürütülen çalışmalarla şu bilgileri verdi:

"Belediye olarak ekibimizi profesyonelleştirirken, araç ekipman noktasında da araçlarımızı yeniliyoruz, modernize ediyoruz. Türkiye'nin en büyük tatlı su gölüne kıyısı olan Beyşehir'in çok geniş bir coğrafyadan oluşmasından dolayı araç ve ekipman sayımızı da sürekli artırıyoruz. Bu sene, Konya'nın ilçelerinde olmayan iki yeni sivrisinek ilaçlama makinesi satın alma yoluna gittik. Dolayısıyla bu yıl daha da güçlenen yeni sinekle mücadele araç filomuz ve yeni ilaçlama makinelerimizle birlikte, inşallah hemşehrilerimizi sivrisinek konusunda mağdur etmemeyi düşünüyoruz. Çalışmalarımızı ilçe merkezimizin yanı sıra, 55 dış mahallemizde de gerçekleştiriyoruz. Amacımız, sinek ve uçkunların verdiği rahatsızlıktan vatandaşlarımızı korumaktır, yürütülen bu çalışmalara rağmen sinekle ilgili herhangi bir rahatsızlığı olan vatandaşlarımızın da AK Masa ya da ilgili birimlerimiz aracılığıyla Belediyemizi bilgilendirmesi halinde, ilaçlama ekiplerimizi o bölgelere yönlendirmemiz ve kanalize etmemiz daha kolay ve hızlı olabilecektir."

Özaltun, bu yıl özellikle sivrisinekle mücadelede elde edilen başarıda Beyşehir Gölü kıyısında belediye tarafından yürütülen sazlık kesim çalışmalarının da önemli bir etkisi olduğunu da vurgulayarak, "Tabi Beyşehir Gölü'nün kıyılarındaki sivrisinek üreme yerleri haline gelen sazlıkların bu yıl kesiminin yapılarak temizlenmesi de sinekle mücadelede işimizi kolaylaştıran bir faktör oldu. Önceki dönemlerde, teknelerle bu sazlık alanların arasına girerek de ilaçlamalar yapıyorduk. Ama bu yıl sazlıkların kesilmesi ile ekiplerimiz göl üzerinde böyle herhangi bir ilaçlama faaliyeti yapmayacak. Bu da sevindirici bir gelişme oldu" diye konuştu. İHA

"HAYATIN RİTMİNİ YAKALA"ADLI EĞLENCE PROGRAMI DÜZENLENDİ

Amacımız özel eğitim gereksinimi olan bireylerin öğrenim görme ve öğrenme haklarından yararlanmaları için maddi ve manevi varlıklarını geliştirmeleri için uygun bir ortam sağlamak. Bunun içinde eğitimin evrensel ilkelerini hedefleyerek zengin içerikli programlar hazırlıyoruz. Özel öğrenme güçlüğü programını Çumra da sadece kurumumuzda uygulanmaktadır.

Bunların yanında bizim için aile ile işbirliği çok önemli. Ailelerin desteği olmadan istediğimiz gelişim ve ilerlemeyi sağlamamız mümkün değil. Bu yüzden ailelerimizi bu eğitimin bir parçası yapmak için çalışıyoruz. Amacımız öğrencilerimizi topluma kazandırmak, toplum içinde onları bağımsız hale getirmek.

Bu yola çıkarken insana ve insanın eğitimine değer vermeyi , sevmeyi ilke olarak benimsedik. İnşallah bundan sonrada bu çizgi üzerinde Bilir Özel Eğitim ve Rehabilitasyon Merkezi olarak eğitim-öğretim faaliyetlerimize devam edeceğiz " dedi.

Program tüm öğrenci ve öğretmenlerin "Bütün Dünya Buna İnansa" şarkısına eşlik ederek son buldu. **M.SARIKULAK**

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DUYURU

LE Güneş Elektrik Üretim A.Ş. tarafından Konya ili, Çumra ilçesi, Apa mahallesi, Bağlar Mevkii'nde "Apa Güneş Enerjisi Santrali Projesi"nin yapılması planlanmaktadır. Söz konusu Proje için Çevresel Etki Değerlendirmesi (ÇED) Yönetmeliği'nin 9. maddesi gereğince aşağıda belirtilen tarih ve saatte faaliyetle ilgili Halkı bilgilendirmek, görüş ve önerilerini almak için "Halkın Katılımı Toplantısı" yapılacaktır.

Halkımıza saygı ile duyurulur.

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Toplantı Saati	: 14:00
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Tel	: 0 (312) 446 88 00
Faks	: 0 (312) 446 88 10

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Figure 15.2. Local Newspaper Announcement issued for the Public Participation Meeting

Figure 15.3. Photographs from the Opening of the Meeting

Figure 15.4. Photographs from the Presentation made in the Meeting

Figure 15.5. Photographs from Public's Opinion, Question and Suggestions Session

The main issues mentioned in the Public Participation Meeting, the explanations made for these issues in the meeting and the relevant chapters where these issues are assessed/discussed in this ESIA Report are summarized in Table 15.1. The questions and the opinions of the locals were generally seen to concentrate on the impacts of the Project on pasture lands and other environmental impacts and the potential benefits of the Project to the local community. The Project Owner and the representatives of the institutions of the Committee members participated to the meeting responded to the questions of locals on these issues as much as possible during the meeting. These issues have also been assessed in the relevant chapters of this ESIA Report (see Table 15.1).

Committee members issued their opinions in writing regarding the Project to the Ministry before and after the Public Participation Meeting. The Ministry has drawn up the Special EIA Report Format based on both the views and proposals of the Committee members and the views and proposals of the public and other stakeholder issued during the Public Participation Meeting and during the disclosure period of the EIA Application File.

This ESIA Report has been prepared by considering the views and opinions of the Committee members, local community and other stakeholders as well. In order to successfully manage the potential environmental and social impacts of the Project and to ensure that the Project is carried out in an acceptable framework by all project stakeholders, it has been aimed to provide successful participation of all project stakeholders (being the locals as a priority) during the preparation of the ESIA Report and to reflect their opinion in accordance with the ESIA process by considering these starting from the planning stage of the Project.

According to the Turkish EIA Regulation, the competent EIA Consultant prepares the EIA Report in line with the special format and submits the draft report to the Ministry for review and evaluation. The Ministry sets a date for the Review and Evaluation Meeting and sends a copy of the Draft EIA Report and information on the date of Review and Evaluation Meeting to the Committee members. The start of the review process and that the Draft EIA Report is disclosed to public view is announced by the Ministry and its relevant Provincial Directorate(s) using appropriate communication tools (e.g. announcements, notice boards, internet, etc.). From the announcement date to the report finalization through the Review and Evaluation Meeting(s), public (and other stakeholders) can review the Draft EIA Report and submit their views and comments to the Ministry or its Provincial Directorate. These comments are taken into consideration by the Committee members and the competent EIA Consultant addresses them in the EIA Report. Questions or comments of the Committee members are answered and/or discussed in the meeting and the comments of the Committee members are obtained for finalizing the EIA report. Then, the Report is finalized based on the comments of the Committee members and the Final Draft EIA report is submitted to the Ministry for the final public disclosure. Accordingly, the Final Draft EIA Report is disclosed by the Ministry and its related Provincial Directorates for 10 calendar days through announcement boards and internet. Any comment received from public in this context is considered by the Ministry in the decision-making process. Depending on the comments received from public, Ministry may request fulfillment of the deficiencies, execution of additional studies or regathering of the Committee. Finally, the Ministry requires the Consultant to submit the Final EIA report with a statement indicating that the report and its annexes are under the commitment of the project owner. Taking the Committee’s evaluations and the public views, Ministry gives its “EIA Positive” or “EIA Negative” decision regarding the project. The decision of the Ministry is communicated to public using appropriate means.

Table.15.1. Main Issues Mentioned in the Public Participation Meeting, Explanations Made for These Issues and Relevant Chapters where These Issues are Assessed in the ESIA Report

Title	Subject	Explanations and Mentioned Issues/Questions/ Concerns	Explanations Made in the Meeting	Assessments Made in this ESIA Report on the Relevant Issue
Headman of Apa Neighborhood	Layout	• Distance of the panels to the residential areas	• It has been stated that the design of the layout of the project works in progress and the EIA Report will cover all the information related to the concern.	Chapter 3. Project Description
	Environmental Impacts	• The probable heating of the panels and the heat impact resulting from this situation	• It has been stated that heating of the panels and creating an impact on the surroundings is not a concern.	Chapter 13. Labor and Working Conditions
Local People	Social Impacts	• The potential risk of the investment for the settlement that engages with beekeeping and animal husbandry	• It has been stated that the impacts resulting from the Project will be detailed in the EIA Report.	Chapter 12. Socio-economic Environment
Local People	Cumulative Impacts	• Existing restriction of access to surrounding areas of the settlement (e.g. no access to pasture lands/lands due to lack of bridges) due to past projects/developments (e.g. channels of DSI, land acquisition for residential projects, unlicensed solar energy projects) and impacts resulting due to these projects	• It has been stated that the impacts resulting from the Project will be detailed in the EIA Report.	Chapter 16. Cumulative Impact Assessment
	Positive Impacts and Benefits of the Project	• Benefits of the Project to local people and opportunities to be provided (employment opportunities, etc.)	• It has been stated that the priority will be given to local people as much as possible for the foreseen employment of 25 people in the construction phase and about 7 people in the operation phase; in addition to these, operation services such as maintenance, repair, etc. are planned to be provided from the local as well.	Chapter 12. Socio-economic Environment
Local People	Cumulative/Social Impacts	• Reduction of social living space as a result of land acquisition/purchases made for other purposes	• It has been stated that the impacts resulting from the Project will be detailed in the EIA Report.	Chapter 16. Cumulative Impact Assessment
Konya Provincial Directorate of Food, Agriculture and Livestock	Land Use (pasture land)	• Pasture land allocation change process will be executed by the Ministry in accordance with the relevant legislation for the use of the land • If the allocation change process is completed, the land will be transferred/hired to the investor by the state	• It has been stated that the necessary processes will be followed and required permits will be taken in compliance with the relevant legislations.	Chapter 12. Socio-economic Environment
Local People	Social Impacts	• If the project is carried out, the livestock and farming activities in the neighborhood will no longer be possible; and the business areas will be reduced	• It has been stated that the impacts resulting from the Project will be detailed in the EIA Report.	Chapter 12. Socio-economic Environment
Local People	Social Impacts	• The pasture land to be used for the Project is a site where the settlement has a direct access; if this land is taken/used for the Project, there will be no area available for livestock activities	• It has been stated that the impacts resulting from the Project will be detailed in the EIA Report.	Chapter 12. Socio-economic Environment

After submitting the EIA Report prepared for Apa GES Project to the MoEU for review and evaluation, the above described Turkish EIA process had been followed. The Review and Evaluation Meeting conducted on March 17, 2017 and the Report accepted as Final Draft EIA Report. Final Draft EIA Report disclosed by the Ministry and its related Provincial Directorate for 10 calendar days. No comments or opinions received during disclosure period and Final EIA Report was submitted to the MoEU. EIA Positive Decision for the Project was received on April 18, 2017 from the MoEU and this decision was also communicated to public using appropriate means such as internet, etc.

The Project Owner aims to execute the Project in continuous communication with the locals and other Project stakeholders in a participant approach. In line with this, sharing of updated information with stakeholders in a timely and reliable manner, establishment of relevant mechanisms for the direct conveying of stakeholders' opinion, questions, grievances and suggestions regarding the Project to the Project Owner, building platforms that will enable the Project Owner to closely follow up the developments and the environmental, social, economic and cultural sensitivities in the neighborhood and executing of all these activities in full continuity throughout the service life of the Project will be the cornerstones/basis of the stakeholder engagement plan throughout the project life cycle.

CHAPTER 16

CUMULATIVE IMPACT ASSESSMENT

CHAPTER 16. CUMULATIVE IMPACT ASSESSMENT

Cumulative impact assessment (CIA) has been performed for possible added impacts of Apa Solar Power Plant (GES) Project and projects within the impact area of the Project. CIA has been mainly based on expert opinion.

CIA study follows the main principles of the Good Practice Handbook of the International Finance Corporation (IFC) on the Cumulative Impact Assessment (CIA) and Management Guidance, which is one of the latest and most comprehensive documents available to CIA practitioners and compiles the fundamental approaches of key reference documents on the assessment of cumulative impacts. Accordingly, the main steps of the study will comprise the following:

Step 1: Scoping Phase I – VECs, Spatial and Temporal Boundaries
Step 2: Scoping Phase II – Other Activities and Environmental Drivers
Step 3: Establish Information on Baseline Status of VECs
Step 4: Assess Cumulative Impacts on VECs
Step 5: Assess Significance of Predicted Cumulative Impacts
Step 6: Management of Cumulative Impacts – Design and Implementation

Step 1: Scoping Phase I

In line with the good practice handbook, the CIA study is based on the Valued Ecosystem Components (VECs) that would be environmentally or socially important in assessing the risks of the Project. Accordingly, since the CIA should be looked at “from the VECs point of view”, in which the combined (i.e., cumulative) effects of various actions on each VEC are assessed, as the first step of the assessment, VECs for which cumulative impacts are to be assessed and managed, have been identified.

It should be noted that only the VECs affected by the APA GES Project are considered in the assessment. In other words, any VEC that would be affected by other developments, but not by the APA GES Project are not taken into account in the assessment. Table 16.1 summarizes the VECs considered in the assessment together with the associated area of influence.

For the initial identification of VECs, the following key environmental, health and safety issues mentioned by the Project EIA Report and former sections of this ESIA Report have been considered:

- Land-take
- Terrestrial biodiversity
- Noise
- Glare

Temporal extent of the assessment covers the impacts of past, present and reasonably foreseeable future developments that would correspond to the economic life of the Project to the maximum extent practical.

Table 16.1. Summary of VECs and Areas of Influence

VECs	Potential Impacts from the Project	Area of Influence
Land take	• Top soil removal • Loss of pasture land	Footprint of the Project and immediate surrounding.
Erosion potential	• Decreased top soil with high value	Footprint of the Project and immediate surrounding.
Noise	• Noise from transportation vehicles • Noise from engines of construction equipment	Temporary impacts, limited to construction stage
Glare	• Visual impacts that may obstruct visibility	No residences/businesses in the impact area of glare effect.

Step 2: Scoping Phase II

Once the CIA extent is determined, other activities and environmental drivers within this geographical boundary that would affect the condition of the VECs selected for the CIA are determined based on a desk-top review of the readily available sources. The projects that might have a potential to contribute to possible cumulative impacts are provided in Table 16.2 below.

Table 16.2. Projects to contribute Possible Cumulative Effects

Projects to contribute to possible cumulative effects	Project Name	Installed Power	Estimated Maximum Area Use *
Source Project	Apa GES	13.1 MW	26 ha
Other Licensed GES Projects	Alibey GES, Alibeyhuyugu GES	23.0 MW	46 ha
Other Unlicensed GES Projects	-	44.0 MW	88 ha
Total		**80.1 MW**	**160 ha**

** It is assumed that 2 hectares of area is used per megawatt.*

None of the licensed GES projects are in operation currently. The Cumra district boundary, the location of the Alibeyhuyugu Transformer Station and the licensed GES projects planned to be connected to this station are shown in Figure 16.1.

At this step, potential impacts on the VECs identified in Step I are evaluated to decide whether they need to be included in the cumulative assessment or not. The summary of this assessment is provided in Table 16.3 below.

Table 16.3. Project Scoping Phase II

VECs	Area of Influence	Impact significance of Project	Estimated impact significance of other facilities and activities	Scoped in / Scoped out
Land take	Footprint of the Project and close environs	Moderate	Moderate	Scoped in
Erosion potential	Footprint of the Project and close environs	Low	Not known	Scoped out
Noise	Apa neighbourhood	Low	Not known	Scoped out
Glare	Apa neighbourhood	Negligible	Negligible	Scoped out

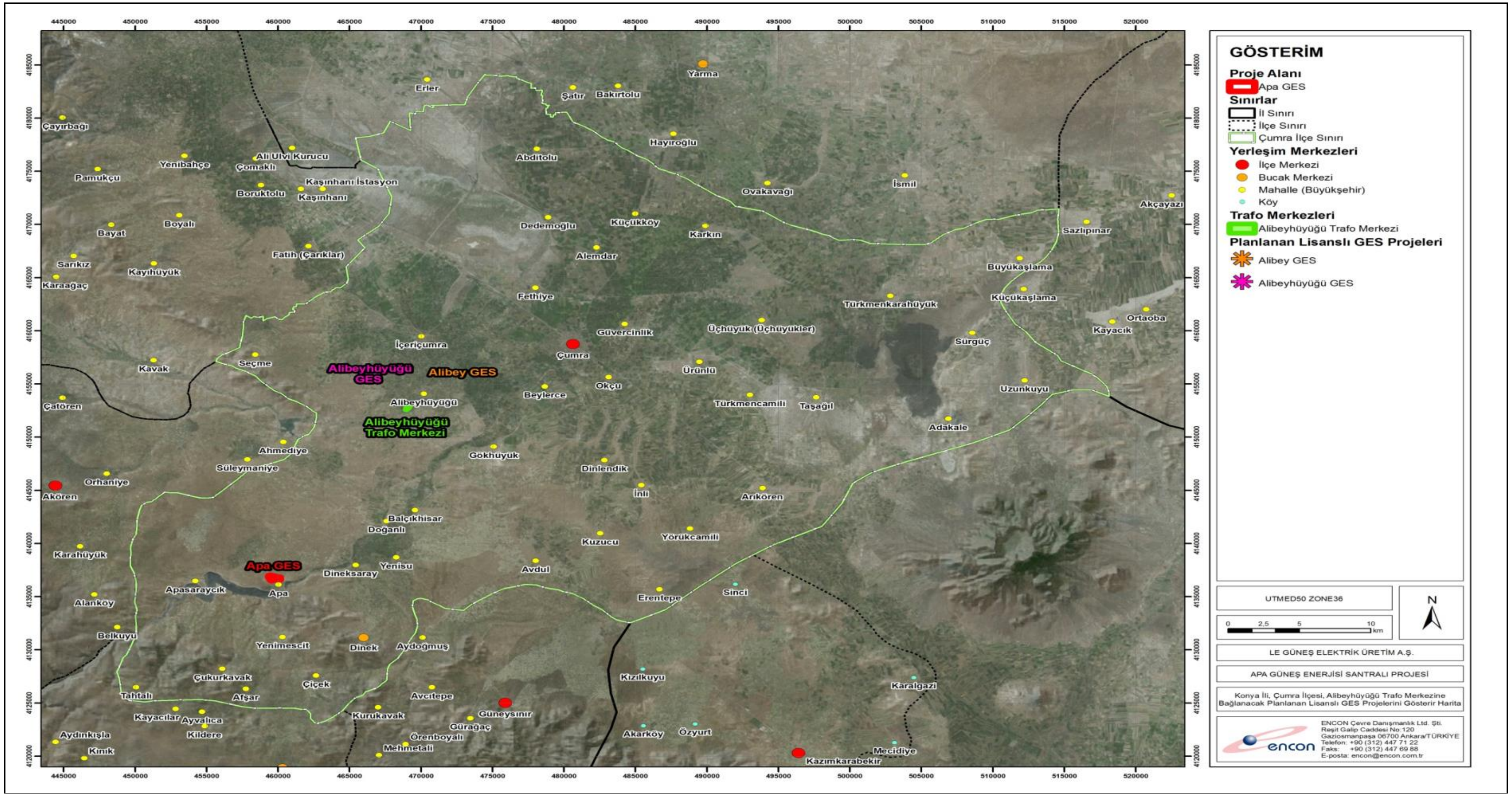

Figure 16.1. Licensed GES Projects planned which will be connected to the Alibeyhuyugu Transformer Station at Cumra District in Konya Province
(Estimated locations of other licensed GES projects are shown at settlement level)

VECs identified for the Project are of concern mainly only for the construction phase. Impacts during the operation phase are estimated to have low significance, thereby scoped out totally.

Erosion and noise impacts of the Project can be managed by individual efforts on project-basis, as they would not impose cumulative impacts to be managed by joint efforts.

Glare is a negligible concern as there are no sensitive receptors (i.e. military radar, highway, etc.) in the impact area.

Loss of pasture lands can be considered as the only VEC prone to cumulative impacts.

Step 3: Establish Information on Baseline Status of VECs

For the characterization of the existing conditions of the selected VECs, the main reference is the EIA Report, which includes comprehensive description of the baseline conditions regarding land use in the area of land take, as well as background noise, water quality, waste disposal records, etc. The baseline status of concern for the assessment is basically associated with land take and this is summarized in Table 16.4 below.

Table 16.4. Baseline Status of VECs

VECs	Baseline status and ESIA mitigation measures
Land take	Land to be occupied by the Project is pasture land. Pasture Land Rehabilitation Project has been prepared in order to bring the site to its former quality and capacity at the end of the investment; and has been approved by the Provincial Directorate of Ministry of Food, Agriculture and Livestock. The rehabilitation of the Project Area at the end of the operation phase (bringing the site to its former quality and capacity at the end of the investment) will be ensured in accordance with the approved Pasture Land Rehabilitation Project and the provisions of Pasture Law and Pasture Regulation.

Step 4: Assess Cumulative Impacts on VECs

Cumulative impacts on the VECs are analyzed by estimating the future state of the VECs under the aggregated effect of past, present and reasonably foreseeable activities/developments. The assessment is based on a qualitative approach rather than the magnitude of the impact.

The land preparation and construction stage effects of the GES projects are limited to the footprint area and can be completed within a relatively short period of time compared to other energy generation projects. In the long term operating periods of such plants, there are no environmental effects such as air emissions, process wastewater generation, hazardous waste generation. In addition, in the operation phase employment levels which are usually limited to security personnel are often low. There would not be any impact of the Project regarding restriction of access to surrounding areas of the settlement (e.g. access to pasture lands) since the location of the Project area would not hinder any crossing of the locals to their other lands. In addition, the use of the land take area is pasture and therefore, there would not be any loss or restriction of social living space.

As a result, the main issue is regarding land take and this area is mainly pasture land. However, in terms of cumulative impacts of the above mentioned activities on the overall pasturelands in Cumra, the land take of all the projects given in Table 16.2 is about 0.5% of the total pastureland in the district.

Step 5: Assess Significance of Predicted Cumulative Impacts

Significance of predicted cumulative impacts are estimated in terms of the vulnerability and/or risk to the sustainability of the VECs assessed, which are directly related with the existing sensitivity/vulnerability conditions of the VECs and the applicable thresholds that are the limits beyond which changes resulting from cumulative impacts become of concern. For practical purposes, if the cumulative impacts of all combined developments on a VEC do not exceed a limit or threshold, the impact is considered insignificant. In this regard, the land take area was assessed considering the loss of this land. As mentioned before, the land use of this area is pasture. The loss of the pasture land in the extended project area of influence for CIA, which can be considered as the Cumra District, is rather low (0.5% of the pasture lands). Therefore, the cumulative impacts are assessed to be low.

Step 6: Management of Cumulative Impacts

At the final step of the CIA, management strategies are suggested for any cumulative impacts that are anticipated to be significant. However, it should be noted that since cumulative impacts typically result from the actions of multiple stakeholders, the responsibility for their management will be collective, which would not be ensured solely by the efforts of the Project owner. Hence, the CIA is concluded with both project level mitigation measures as well as possible joint actions and coordinated efforts for managing cumulative impacts. In this regard, although the cumulative impacts due to Apa GES Project are found to be insignificant, project specific management approach regarding loss of pasturelands is provided in Table 16.5.

Table 16.5. Management Approaches for Cumulative Impacts

VECs	Impacts	Management approach
Land take	Decreased land for livestock grazing	• In case that local people have decreased access to pasture land for grazing of livestock, investors should provide access to new pasture lands, or should compensate for the limitations imposed on farmers.

CHAPTER 17

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

17. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

17.1. Purpose and Scope

Mitigation measures for adverse environmental and social impacts of Apa Solar Power Plant (GES) Project (Project), implementation of monitoring studies, stakeholder engagement, emergency response and explanation of institutional requirements are the main subjects of this Environmental and Social Management Plan (ESMP). Mitigation and monitoring activities are covered for all phases of the Project; “Land Preparation and Construction”, “Operation” and “Closure”.

Information on environmental and social responsibilities of LE Gunes Elektrik Uretim A.S. (Project Owner or Company) and their subcontractors, a list of procedures for environmental and social management of the Project that Project Owner is committed to, all outlined to prevent or minimize potential adverse impacts on the environment due to the Project activities and the monitoring activities, which are for understanding the effectiveness of the management plans are provided with the help of this ESMP.

The following chapters outline specifications of the Project as well as its location, and provide a list of specific management/mitigation measures for all phases of the Project, monitoring plan, stakeholder engagement framework, and emergency response plan. Procedures/plans provided within this ESMP are open for update, whenever there is a need to improve the performance of the Project and further mitigate any potential impacts.

17.2. Responsible Organizations and Institutions for the Implementation of the ESMP

LE Gunes Elektrik Uretim A.S. (Project Owner) will be the key organization for the implementation of ESMP of the Project. Different parties like contractors, sub-contractors, Provincial Directorate of Environment and Urbanization, etc. will be responsible for some of the issues specified in this ESMP during different phases of the Project. However, the coordination of the ESMP will still be under responsibility of the Project Owner.

It is recommended that the tender dossiers for the construction should include environmental obligations the constructor(s) has to fulfill. These consist of:

- ESMP specifications,
- Environmental, social and health and safety related obligations, which additionally may arise as part of any necessary permit (from e.g. Ministry of Environment and Urbanization, Ministry of Health, etc.) and
- Other environmental and social considerations, which may arise in the meantime.

17.3. Brief Project Description

17.3.1. Scope of the Project

Apa Solar Power Plant Project is planned to be constructed on an area of 26.17 hectares, that is located in Baglar vicinity within the boundaries of Apa neighborhood of Cumra District in Konya Province (Project Area or EIA Area), by the Project Owner. The Project Area is approximately 55 kilometers (air distance) south of Konya city center and

30 kilometers (air distance) southwest of Cumra district center. The Project Area is shown in Figure 17.1. Within the scope of the activity, it is aimed to produce electricity by using photovoltaic technology. The installed power capacity of the power plant has been planned as 13.1 MWe.

License application to the EMRA for the Apa GES Project was made on June 13, 2013 and a preliminary license has been granted to the Project Owner for the Project for 30 months starting from April 21, 2016 in order to obtain necessary approvals, permits, licenses and as such to initiate the investment. Apa GES is expected to have a 25 year service life, considering the current technology.

The energy demand situation in Turkey is parallel to the worldwide. Turkey is the country with the fastest increase in energy demand among the OECD countries over the last 10 years. Since 2002, Turkey is also the second country after China in increasing energy demand in the world (*Ministry of Foreign Affairs, 2016*). This continuously increasing energy demand and insufficient levels of domestic resource utilization increase the external energy dependency.

International public opinion highlights the importance of using more sustainable systems (e.g. systems based on renewable energy sources) in energy production in the near feature. Scientific and technological researches and developments are running on the use of renewable energy resources. On the other hand, necessary policies are enacted in various parts of the world in this respect. For example, by 2020, the European Union will have had developed policies and plans to maintain 20% of its energy needs from renewable sources. When considering all available alternative energy sources, the sun is the most important source of renewable energy, providing a non-consumable and non-decremental energy for the world.

Work on utilizing solar energy has gained momentum, especially since the 1970s, solar energy systems have shown great progress in terms of technological progress and cost efficiency over time, and solar energy has accepted itself as a clean energy source for environment (*World Energy Council Turkish National Commitee, June 2009*). As a result, the sun has become an important alternative source for energy production both in the world and in Turkey. Thanks to researches on electricity generation from solar energy, in recent years a great increase in the use of photovoltaic power systems has been observed in the world. The photovoltaic installed power capacity in the world has increased six fold since 2009.

While the developments in photovoltaic power generation in the world continues, the total installed power capacity of solar power plants in Turkey reached to 290 MW with more than 400 unlicensed solar power plants. This corresponds to only 0.4% of the total installed capacity *(TEIAS, January 2016)*. A total of 585.9 MW installed power capacity has been allocated to licensed GES projects planned by the investors in various provinces with GES competitions held by TEIAS besides unlicensed solar power plants. The investment processes of the mentioned licensed power plants, including the Apa GES Project, continue at different stages and the licensed power plants have the potential to contribute to the existing power generation in the country.

When current situation on solar energy plants and developments in worldwide, Europe and Turkey is evaluated together, the need for solar energy investments in our country, which has more solar potential than most European countries, with a sunshine duration exceeding 2,600 hours per year, clearly emerges.

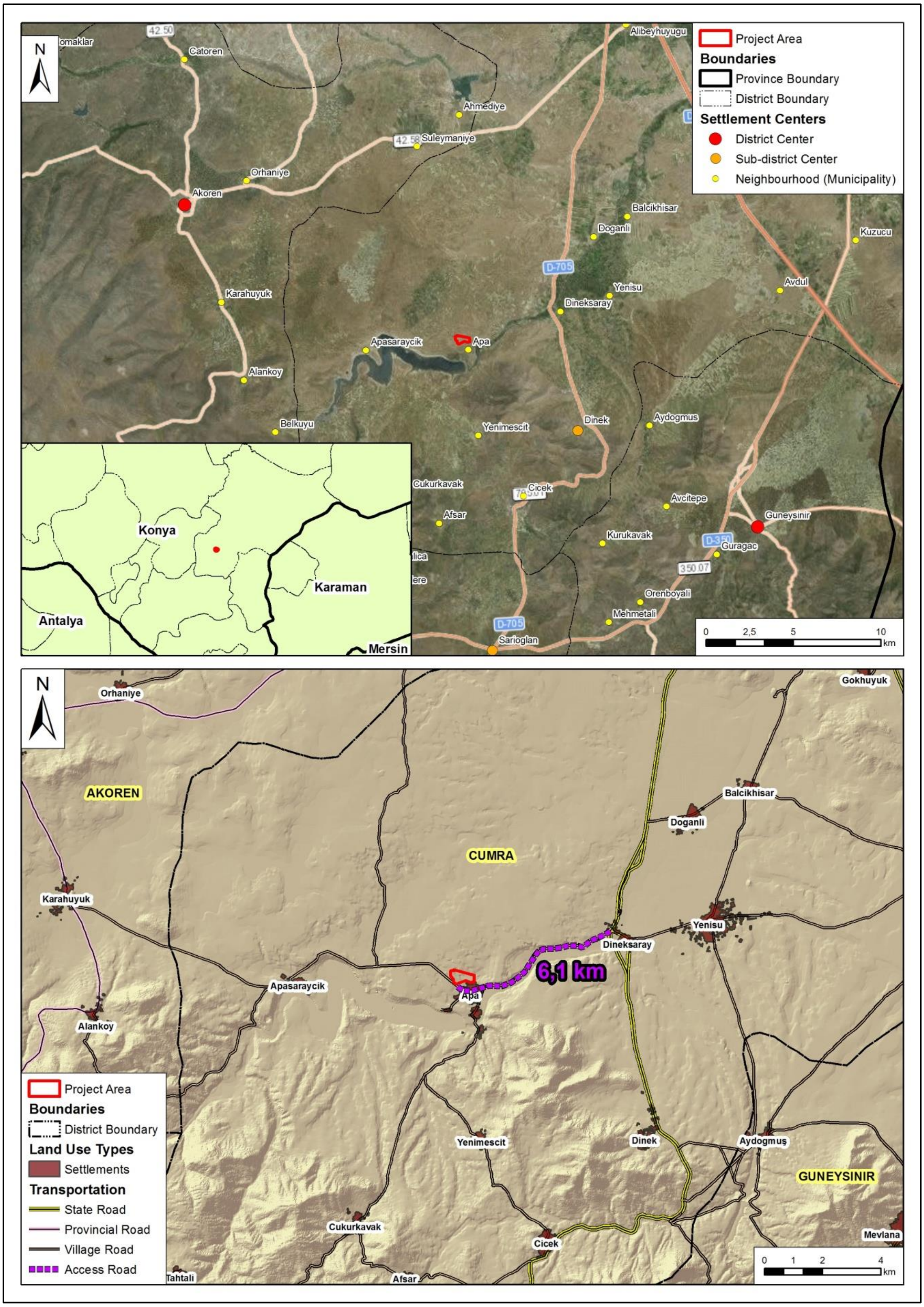

Figure 17.1.Site Location Map of the Project Area

With the planned Apa GES Project, the electric energy equivalent to the demand of approximately 10,250 dwellings will be produced. Therefore, the Project will contribute to supply the increased energy demand of our country without being dependent on external resources.

Solar power plants are classified according to their installed power capacity in the lists given in Annex-1 (Projects subject to full EIA) and Annex-2 (Projects subject to Screening-Elimination Criteria) of Turkish Environmental Impact Assessment (EIA) Regulation. According to the regulation, solar power plants having capacity of 10 MWe or above are listed in Annex-1 and the ones having capacity between 1 MWe and 10 MWe are listed in Annex-2. Since APA GES Project is planned to have a capacity of 13.1 MW, it is subject to EIA according to the Turkish EIA Regulation. In this context, the EIA study for the Project was conducted by ENCON Cevre Danismanlik Ltd. Sti. and EIA Positive Decision was received on April 18, 2017 from the Turkish Ministry of Environment and Urbanization (MoEU).

17.3.2. Project Location and Area of Influence

The Apa GES Project Area is located in APA neighborhood, about 55 km south of Konya city center and 30 km southwest of Cumra district center, within the boundaries of Konya Metropolitan Municipality. The closest settlement to the Project Area and potentially affected settlement within the scope of the Project is Apa neighborhood in the south-southeast of the site (The population of Apa neighborhood is 732, together with Yenimescit village (*TurkStat, 2015*) and according to information obtained from the Headman, the number of households in the neighborhood is 280). The nearest building belonging to the settlement is at a distance of 40 meters to the Project Area, and the nearest panel is at a distance of 130 meters. Apasaraycik neighborhood (5 km west of the site), Dineksaray neighborhood (5 km northeast of the site) and Yenimescit settlement of Apa neighborhood (5 km south of the site) are other settlements around the Project Area.

The nearest dam to the Project Area is the Apa Dam at the south-southwest, which is in operation and used for irrigation purpose. The dam axis is around 1 km to the Project Area and the reservoir is around 900 meters. Carsamba Creek, where Apa Dam constructed on, passes around 400 meters away from the Project Area. Project Area is not located in any protected area. The nearest protected area is Fosil Ardic Nature Monument that is at around 5.2 km east of the site. Alibeyhuyugu Transformer Station, which will provide connection of the Project to the grid, is around 18 km north of the site.

The main transportation from Konya to the Project Area is provided via D705 Konya-Hadim Road that is separated to the right from D715 Ankara-Konya State Road at Icericumra location. This road deviates to the right towards the Apa neighborhood at Dineksaray neighborhood and reaches the Apa neighborhood with an approximately 6 km of asphalt village road. Access to the Project Area from Karaman direction is possible via junction from D715 Karaman-Konya road to the left at Gokhuyuk neighborhood which is then connected to D705 Konya-Hadim Road. Konya Airport and Konya 3rd Jet Military Air Base are around 65 km north of the site. Mersin International Port is around 200 km, Antalya Port is around 180 km and Iskenderun International Port (operated by Limak Group as LimakPort) is around 330 km to the site.

The Project Area and the residential areas, transportation networks and power grids that are located in immediate vicinity have been demonstrated in Figure 17.2 on 1/25.000 scaled topographic map.

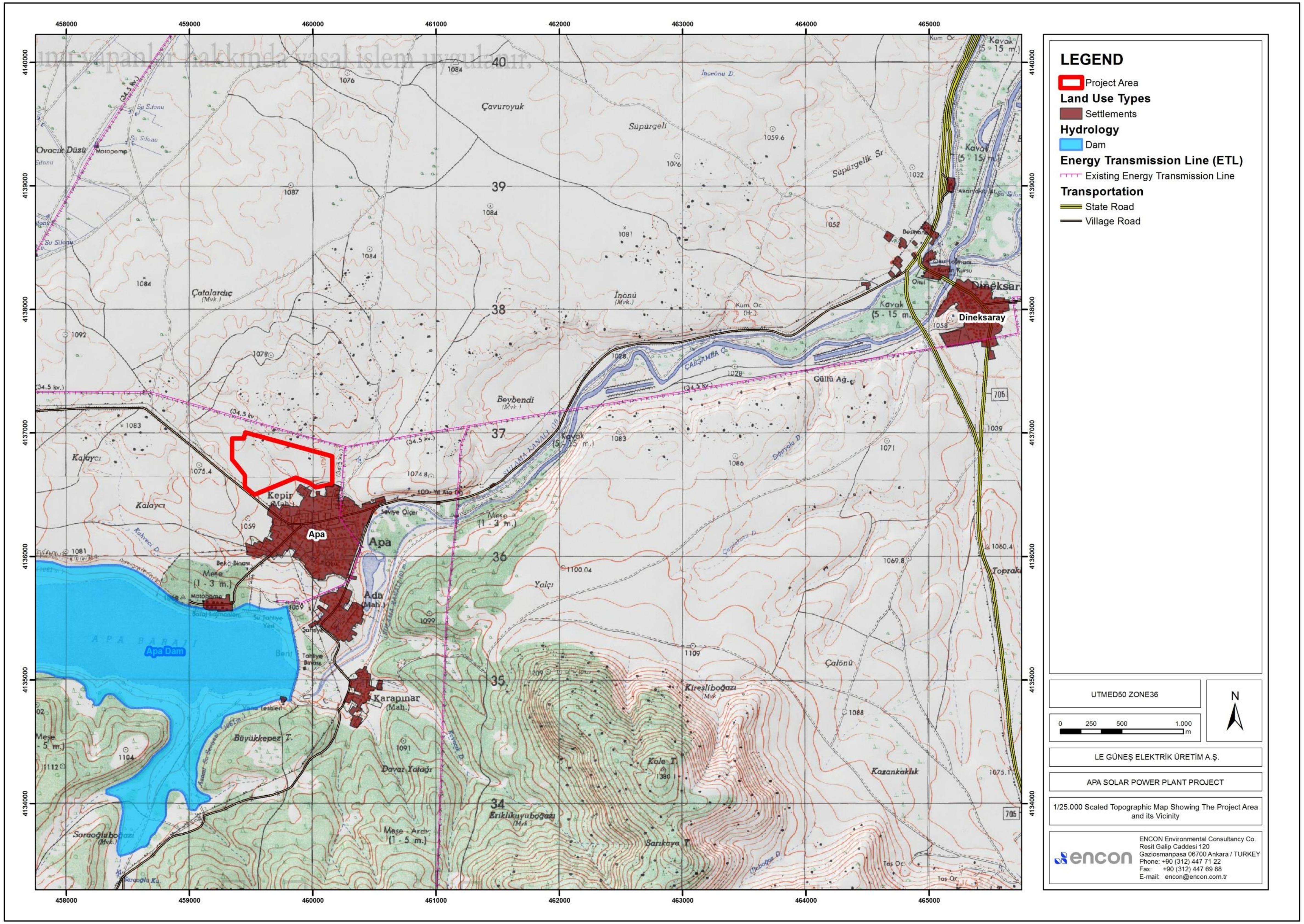

Figure 17.2. 1/25.000 Scaled Topographic Map Showing The Project Area and its Vicinity

The Project Area is located in the area that is planned as meadow-pasture within the scope of 1/100,000 scaled Environment Plan of Konya-Karaman Planning Area approved on 16.09.2013 by the MoEU and amended on 16.07.2014. The Project Area is also located in the area that is planned as rural development area, meadow-grassland and pasture within the scope of 1/100,000 scaled Environment Plan of Konya Province approved by the decision of Konya Metropolitan Municipality Council dated 12.12.2014 and numbered 953. The Project Owner has been applied to Konya Metropolitan Municipality, Directorate of Urban Development and Urban Planning on 07.02.2017 with a proposal of a 1/100,000 scaled Environmental Plan Alteration to request registration of the relevant part of the premises, where the Project Area located, in the name of the treasury by changing the allocation purpose and arrangement of the current title deed for the Project Area. Konya Metropolitan Municipality has requested the official opinion of the MoEU, General Directorate of Spatial Planning on the alteration of Environmental Plan. The official opinion of the MoEU states that it is allowed to conduct the business of renewable energy plant without any alteration on Environmental Plan by the positive opinion of relevant authorities and institutions. The process is still continuing in Konya Metropolitan Municipality. The Project Area lies partly in the region having 1,000 scaled Implementation Development Plan and partly out of planned area, as stated by the Cumra Municipality, Directorate of Real Estate and Expropriation. Currently, preliminary studies for the revision of development plan for the Project continues and application shall be made after the completion of the mentioned studies.

The Project Area is located on premises which is a former poor quality pasture. For the use of the part of the premises within the scope of the Project, the necessary permission (allocation purpose change) was taken within the frame of the Pasture Law by the consent of Konya Province Pasture Commission and approval of Konya Governorship and the registration and title deed transactions were completed in the name of the state treasury. New title deed has been arranged for the area with the characterization of Solar Power Plant Area on 31.01.2017 (having a parcel no of 165/45).

The impacts on land use characteristics, soil environment and biological environment during the construction of the plant will be limited to the Project Area. There will be no air emissions that could affect outside the facility. The use of process water or chemical/hazardous substances will not be the subject of electricity energy production activity at the plant. Likewise, there will be no flue gas emissions or other units that may be an emission source during electricity production. For these reasons, no impact outside the facility border is anticipated during the operation phase. However, when considering the socio-economic issues and visual characteristics of the Project and the possible noise that might occur during temporary construction activities, it has been found appropriate to include the Apa neighborhood into the area of influence. Within this scope, the reservoir belonging to the Apa Dam is considered as a natural border and thus it has been concluded an area of influence having 1 km radius will be sufficient for assessing the possible impacts. The area of influence determined in this context is shown in Figure 17.3.

On the other hand, the provision of premises required for the 31.5 kV medium voltage power transmission line, to be used for the connection to the Alibeyhuyugu Transformer Station located approximately 18 kilometers north of Apa GES, will be carried out by the relevant authorized institutions in accordance with the Electricity Market Law No. 6446 . In this respect, the area needed for the establishment of transmission towers and the area where the easement right will be given along the electric power transmission line will be within the scope of another project that would be developed under the responsibility of the related electricity distribution company.

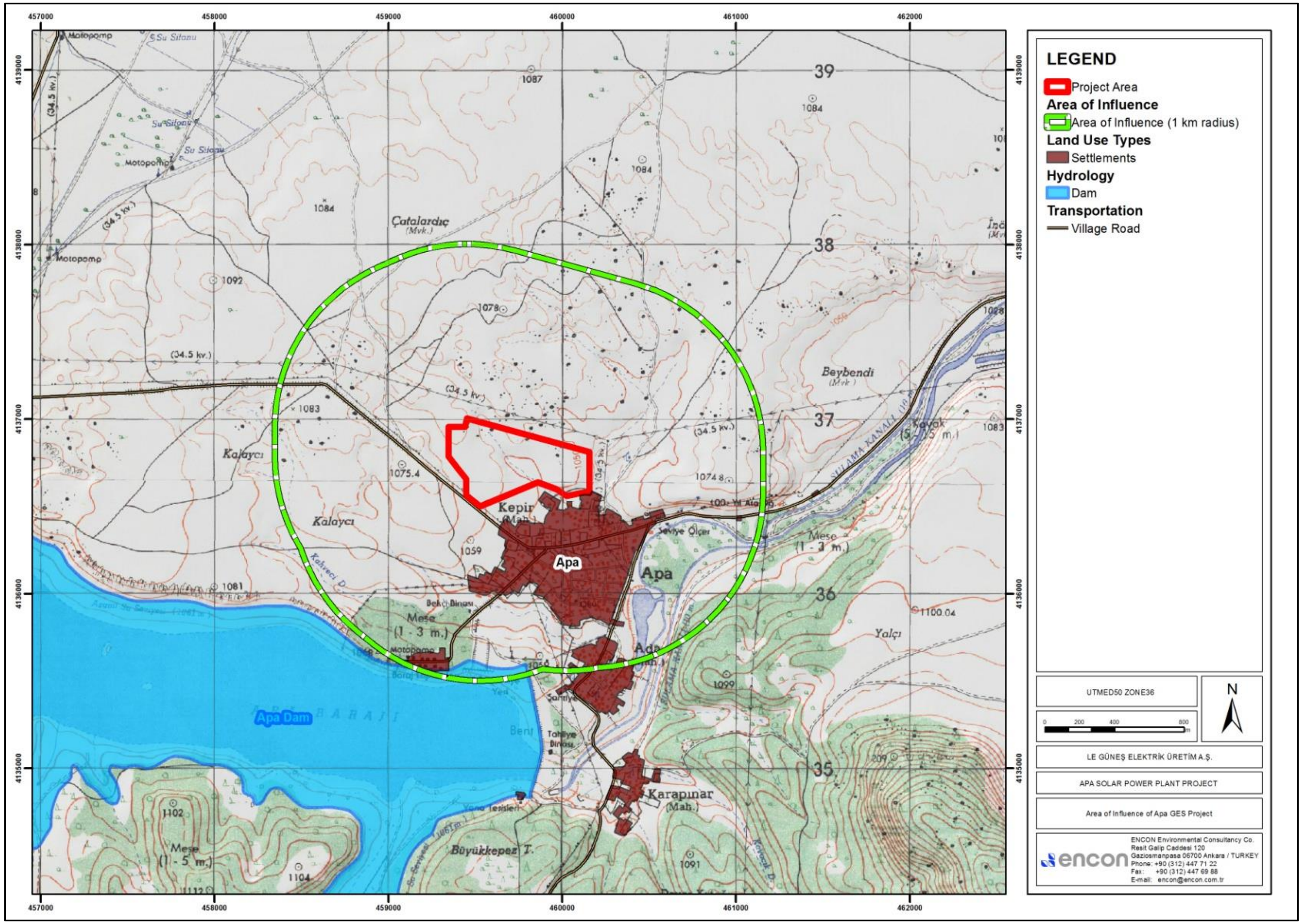

Figure 17.3. Area of Influence of Apa GES Project

17.3.3. Project Units and Properties

The feasibility studies for the Apa GES Project were completed in 2015 and the basic project characteristics were determined. In accordance with the design made in this context, it is aimed to build and operate a solar power plant with 13.1 MWe installed capacity by using photovoltaic systems. The maximum electricity (annual) to be generated with a solar power plant planned with this installed capacity is anticipated as 26,200,000 kWh/year. An operational life time of 25 years is foreseen for Apa GES Project considering the current technology.

The project components/units belonging to the Apa GES Project will include the temporary structures/units to be used in the land preparation and construction phase and the units/equipment that will provide electricity production at the power plant and its connection to the grid.

The temporary structures to be used in the land preparation and construction phase of the project will mainly consist of camp site, stock yards (where construction and installation materials and system equipment will be temporary stored before installation), topsoil storage area and waste storage areas. Workers/staff will not accommodate on site during land preparation and construction phase. However, infrastructure facilities for basic needs of the workers/staff (such as electricity, water, toilet, rest room, dining hall, etc.) will be provided within the camp site.

Main and auxiliary units of the solar power plant are listed below:

- Photovoltaic solar panels
- Construction/mounting legs (panel support systems)
- Inverters
- Direct current (DC) cabling system
- Alternative current (AC) cabling system
- Transformer station
- Distribution center
- Administrative building (including office, control room and warehouse)
- Control/monitoring systems (electronic circuits, camera systems, etc.)
- Security cabins
- Toilet cabinet/sealed septic tank
- Temporary waste storage area
- Roads in Project Area
- Drainage channels

The feasibility studies for the Apa GES Project are based on panels with 270 W. In this context, characteristic information about the facilities to be established within the Project is presented in Table 17.1 according to the basic design made for polycrystalline technology, which is considered as the primary alternative under the existing technological conditions. However, based on the geological and geotechnical studies to be carried out on the site, the final design and characteristics of the panels and support system (for example number of legs, dimensions, heights, etc.) will be determined on the basis of a consequence of completed projects and engineering studies considering the latest panel technologies and the latest state of technological developments in the photovoltaic sector. In this context, the number and characteristics of the equipment to be used in Apa GES Project will be the most effective in terms of efficiency and cost of production of the targeted electric energy with an installed power of 13.1 MWe, in accordance with the progress continuously recorded in photovoltaic technology.

Table 17.1. Characteristic Information about the Facilities to be Established in the Project based on Polycrystalline Technology

Panel Characteristics	Unit	Polycrystalline Panel	
		Central Inverter	Serial Inverter
Total installed capacity (DC)	MWp	14.96	14.96
Total installed capacity (AC)	MWe	13.1	13.1
Panel power	Watt	270	270
Total number of panels	number	55,408	55,408
Number of panel per MWe	number	3,704	3,704
Number of inverter	number	13	262
Inverter power	kW	1,000	50
Number of transformers	number	7	13
Transformer Power	kW	3,000	1,250
Annual electricity generation	kWh	26,200,000	26,200,000
Total footprint area of panels	m^2	92,532	92,532
Footprint area of panels per MWe	m^2	6,185	6,185
Footprint area of each panel	m^2	1.67	1.67
Total number of mounts	number	17,952	17,952
Estimated mount size (width x length)	cm	6 x 10	6 x 10
Length of the shorter mount	m	1.8	1.8
Length of longer mount	m	3.3	3.3
Total footprint area of the mount	m^2	564	564
Height of the shorter mount from the ground	cm	100	100
Height of the longer mount from the ground	cm	250	250
Panel inclination	°	20	20

It is planned that the panels will be placed with an inclination of 20 degrees in accordance with the current design for polycrystalline technology based on good practice. Panels will be placed on the short and long mounts that provide support in the front and the back. Depending on the ground structure/slope, 3 to 6 meters distance will be kept between the panels.

The inverter type selection will be made as a result of the ongoing alternative evaluation studies. Accordingly, central or serial inverters could be used in the system with the purpose of converting direct current (DC) generated by photovoltaic cells to alternating current (AC).

The solar panels will be installed on the outdoor area on the fixed inclined mounting legs whereas the administrative building, the central inverter station, the transformer building, the distribution center and security cabins will be closed structures. The cables will be placed in the cable channel to be prepared on site.

Solar panels will be assembled on legs using solar panel support systems, which mean that the footprint area of the mounts will be much less than the footprint area of the panels resulting in very limited land coverage.

17.4. Management Plan

Construction and operation periods of Apa GES Project may cause environmental and social impacts. A number of impacts are unavoidable, some can be minimized and some losses can be replaced. Thus, mitigation measures may take different forms. The mitigation activities/measures required to avoid or reduce the adverse environmental and social impacts of the Project are presented in this section.

Within the scope of this ESMP, mitigation measures and actions are identified for land preparation and construction, operation, and closure phases of the Project in compliance with the relevant Turkish legislation, as well as the international requirements. In Table 17.2 presented in this section, ESMPs for land preparation and construction, operation, and closure phases of the Project are summarized together with the environmental and social factors, significance of the impact, impact management/mitigation measures, and residual impact.

Table 17.2. Impact Management Table

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
Land Preparation and Construction Phase				
Land Use and Ownership /Socio-economy	Reduction of pasture lands Socio-economic impacts due to the likely impact on livestock activities	Medium	Pasture Land Rehabilitation Project prepared in order to bring the site to its former quality and capacity at the end of the investment has already been approved by the Provincial Directorate of Food, Agriculture and Livestock. The rehabilitation of the Project Area at the end of the operation phase (bringing the site to its former quality and capacity at the end of the investment) will be ensured in accordance with the approved Pasture Land Rehabilitation Project and the provisions of Pasture Law and Pasture Regulation. Additionally, the provisions of the contract signed between the Project Owner and the related authority will be complied with.	Low
			At the beginning of the operation phase of the Project, the Project Owner will establish a grievance mechanism appropriate to the scale of the Project and ensure the functionality of this mechanism throughout the service life of the Project. By this way, the local people will be able to forward their possible project-based complaints to the Project Owner.	
Soil Environment	Agricultural Suitability Grazing Suitability Topsoil Loss	Low	In order to avoid permanent impacts of construction activities on topsoil, before construction works started, productive topsoil layer will be stripped to the appropriate depth.	Low
			Topsoil stripped from the Project Area will be temporarily stored in the Topsoil Storage Area, located at the east of the Project Area, in piles not exceeding 2.5 meters in height, separated from other materials (ex. subsoil, construction materials, etc.).	
			Irrigation will be applied on stored topsoil in case of high weather temperatures and no seasonal rainfall during topsoil storage period.	
			Cable channels will be closed simultaneously following cable laying into the excavated channels. Within this scope, the channels will first be filled with subsoil and then covered with topsoil to restore the soil environment.	
			In order to minimize the impacts on soil environment, the amount of soil that could be subject to compaction and contamination/pollution will be minimized by ensuring the use of only the designated work sites and routes for the construction machinery and equipment and field personnel.	
			The fuel required for the construction equipment and vehicles to be used within the site during construction phase will be supplied primarily from the nearest station; if deemed necessary, fuels that may possibly be stored at site will be stored in the areas where necessary impermeability precautions are taken.	
			The relevant provisions of the Regulation on the Control of Excavation Soil, Construction and Demolition Wastes will be complied with during stripping, storage and reuse of topsoil.	
			Provisions of the Regulation on the Control of Soil Pollution and Sites Contaminated by Point Sources will be complied within the scope of the Project.	
			Wastes and wastewater to be generated during the land preparation and construction phases of the Project will be stored and disposed in a controlled manner in accordance with the relevant regulations and in line with the management practices described in this report. Thus, it will not be possible for the wastes and wastewater to be generated in the Project Area interact with the soil environment and cause any impacts.	
	Erosion Potential	Medium	By establishing a suitable drainage system in the field, the potential impact on soil environment and surrounding water resources will be minimized. In this context, drainage channels will be constructed in accordance with the topographical conditions of the site.	Low
			Following completion of construction and installation works, topsoil will be reused at the area where the panels will be installed and at other areas within the facility reserved for landscaping in order to provide restoration of these areas.	

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
Waste Management	Waste Generation	Low	Wastes to be generated within the scope of the Project will be managed in accordance with the waste management hierarchy.	Low
			Wastes will only be temporarily stored on site and final disposal will be carried out outside the facility.	
			Waste recycling, transport and disposal will be carried out by means of licensed companies and/or related municipalities.	
			Incineration or burying of wastes by any means at site and/or dumping of wastes to nearby roads or water resources will absolutely not be in question.	
			All kinds of implementations that may threaten personnel or public health will be avoided in all activities involving collection, temporary storage, transport and disposal of wastes throughout the Project.	
			Wastes to be temporarily stored on site will be delivered to licensed transport vehicles appropriate to the type of waste for disposal. Information related to the operations in this context will be recorded and the records will be kept in the administrative building.	
			Limited amount of hazardous or special wastes likely to be generated (e.g. waste electronic devices/parts, cables, filters and protective clothes, rags, packages contaminated with chemical substances such as paint/solvent or oils) within the scope of the Project will be stored in special departments in the Temporary Storage Area allocated for this purpose, in containers, separated from the non- hazardous wastes. This area will have an impermeable base/ground and will be protected from the surface flows and rain. Additionally, necessary drainage for the area will be provided.	
			Hazardous or non-hazardous inscription, waste code, stored waste amount and storage date will be indicated/labeled on wastes temporary stored by classifying according to their properties. The reaction of wastes with each other will be prevented by the measures taken in the Temporary Storage Area.	
Water Resources	Water Requirement Wastewater Generation	Low	Limited amount of domestic wastewater generated at site will be collected in the container of toilet cabins to be established or leak-proof septic tanks to be constructed in the Project Area during construction and operation phases and will be disposed within the scope of the protocol to be made with KOSKI.	Low
			Surface runoff waters will be controlled by the drainage channels to be constructed in the facility. Thus, flow from the Project Area to the Apa neighborhood, Carsamba Creek and Apa Dam directions will be prevented thereby will result in prevention of interaction with surface waters resources.	
Biological Environment	Continental flora types /fauna types (mammals)	Low	Before the land preparation phase, definite work areas, where the activities (eg vegetation clearing, vegetal soil stripping, leveling and construction) will be carried out and where permanent structures (units and roads) will be established, will be determined	Low
			The topsoil will be rubbed with appropriate methods from the designated areas before the construction activities (land preparation phase) and will be stored on the vegetal soil storage area reserved in the east of the site so that the soil will preserve its productivity. Topsoil will be spreaded over the working fields after the completion of the construction activities and the restoration of the plant cover will be provided.	
			The distance between the panels will be around 3 to 6 meters depending on the ground structure/ slope.	
			Land preparation and construction activities will be planned by taking into account the breeding season (April-May) and the necessary time and energy for individuals to escape to appropriate alternative areas outside the Project Area will be provided.	
			Collection of hedgehog (Erinaceus concolor), who has less mobility than others and transfer of these collected individuals to the territory where there will be no impact by constructional and operational activities will ensure the effects on the population of this species are eliminated.	

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
	Testudo graeca (tortoise)	Low	All field personnel will be informed about the need to transfer the individuals belonging to these species to the alternative areas.	
	Other types of reptiles			
	Vormela peragusna		Individuals of critical mammal species, whose abundance of populations have been identified before the site preparation and construction phases, will be transferred to similar suitable alternative areas with high ecological carrying capacity outside the Project Area, by catching traps before operations begin.	
	Spermophilus xanthophyrmnus			
	Mesocricetus brandti			
	Erinaceus concolor (Hedgehog)			
	Other types of mammals			
	Impact on bird species	Low		
	Terrestrial Habitat and Ecosystems	Low		
Air Quality	Dust Emissions	Low	Measures defined in Annex 1 of Industrial Air Pollution Control Regulation (IAPCR) such as installation/use of wind breakers at site; loading and unloading without throwing/scattering; and keeping the top soil at 10% humidity in the working areas will be applied.	Low
	Exhaust Emissions		Vehicles with regular exhaust inspection routines will be used.	
Noise	Increase in Noise Levels	Medium	The machinery and equipments to be used during the land preparation and construction activities will not be operated at the same point/location but homogeneously distributed in the site. This will enable noise level be at reasonable levels and not to exceed related limit values defined in RAMEN during the land preparation and construction phase of the Project.	Low
			It will be ensured that machinery and equipments are not operated together in the close section of the Project Area to the Apa neighborhood (south-southeast direction) so that the noise level at the Apa neighborhood does not exceed the regulatory limit values.	
			In order to minimize the noise that will be generated within the scope of the Project; the maintenance of the construction machinery and equipments will be carried out regularly and speed limitations will be defined and obeyed for construction vehicles.	
			The Project Owner will designate a liaison staff, in case of complaints related with noise that could be received from Apa neighborhood, for the evaluation of the complaints and where necessary, for the planning and implementation of corrective actions.	
			Prior to pile driving activities, local people will be informed about the activity and its duration through headman of Apa neighborhood.	
Traffic	Traffic Load	Medium	The asphalt road between Dineksaray and Apa neighborhoods would be improved by the Project Owner, if required and the structure of the road will be ensured to be in a good condition during the Project. In case this road is damaged due to the activities originating from the Project during the service life of the Project, the necessary maintenance and improvement works will be done by the Project Owner.	Low
			All necessary precautions will be taken regarding traffic safety in cooperation with relevant authority/administration.	

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
			During all transportation operations to be carried out by the Project Owner (including logistics companies), it will be ensured to comply with Highways Traffic Law, Road Transport Law and the regulations issued in compliance with these laws.	
Protected Areas	-	No impact	Related Civilian Authority or Museum Directorate will be informed latest in three days in case of finding any movable or immovable cultural asset by chance during construction works according to the Article 4 of Law on the Conservation of Cultural and Natural Properties. Construction works will also be stopped at that time.	No impact
Community Health and Safety		Low	All Project staff and the Project Owner will be ensured that complies with the environmental policy and health and safety policies.	Low
			In order to minimize the risks and hazards that may arise from natural or human error situations (e.g. natural disasters, accidents, equipment malfunctions etc.) on human health and safety, safe working environments in the working sites will be established and physical hazards and risks will be prevented.	
			The relevant plans and procedures of the relevant Turkish legislation and the Project Owner will be complied with in the occupational health and safety measures and practices within the scope of the project.	
			Employees will be informed about the hazards that may cause from their work and thus a safer work environment will be created.	
			Training will be given to employees according to the Regulation on the Procedures and Principles of Occupational Health and Safety Trainings. In this context, a training program will be prepared, training records will be kept and evaluation activities will be carried out after the trainings.	
			Personal protective equipment will be provided to all employees and necessary training will be given for their use.	
			Work areas will be equipped with warning signs (eg "Hazard", "Entry Prohibited", etc.) in accordance with the quality and potential risks of the work to be performed in that area.	
			All necessary precautions will be taken in the Project Area to prevent possible fires from construction activities. Uncontrolled fires in and out of the field will be prevented.	
			Smoking in areas where there is a risk of fire will be prohibited. All employees must have knowledge of what to do in the event of a fire.	
			Project staff will have first aid trained personnel. In case of emergency where an intervention is required, personnel will be moved to the nearest health center by appropriate means.	
			Procedures approved by the Project Owner and the requirements of the technical specifications of the supplier companies shall apply to the use and maintenance of the machines, equipment and tools to be used in the activities.	
			Moving parts of machinery and equipment will be equipped with appropriate protective systems (e.g. metal shields etc.), minimizing the risk of injury or damage to the person using the machine or equipment.	
			Personal factors that may create and control risks during activities (e.g. long hair, jewelery and accessory use, clothing etc.) will be removed from the site by the regulations brought by the field management. Project staff will be informed about the relevant regulations within the scope of the training program.	
			Drivers and operators will be trained to comply with traffic rules and to control the vehicles and equipment they use against risks and hazards originating from vehicle traffic. Required traffic signs will be placed in the Project Site and its surroundings. Machine operators and other employees will be informed and alerted about the relevant signs.	
			The wastes to be formed within the scope of the construction phase of the Project will be managed under the Waste Management Regulation and the negative impacts on public health will be minimized.	

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
			Areas where excavation work is to be carried out will not be accessible other than the authorized personnel. The loading and unloading activities shall be carried out together with the persons to oversee the personnel to carry out the activity.	
			Persons and/or organizations with the necessary permits will be assigned to ensure the security of the Project Area (e.g. private security companies/officials). These persons and/or organizations shall regularly monitor the facility and its surroundings. The special security applications and officials' authorities within the scope of the project shall comply with the provisions of the Regulation on the Implementation of the Law on Private Security Services and the Law on Private Security Services.	
			In addition to safety personnel, monitoring of the Project Site for security purposes will be provided by a closed circuit camera system which will be installed at appropriate distances on the site boundary (e.g. 30-40 meters) to provide daytime and nighttime monitoring of the whole area.	
			Before construction activities begin, working site will be fenced and the access of the visitors, local people and animals to the area will be controlled. Entry of staff and third parties into the working site will be carried out in a controlled manner from the doors at which authorized security personnel will work.	
Operation Phase				
Water Resources	Water Requirement Wastewater Generation	Low	Panel washing will be made 1-2 times a year by machines minimizing water usage. There will not be any chemical addition to wash waters.	Low
			Limited amount of drinking water requirement of the staff will be provided by bottled water supply and similarly limited amount of utility water requirement will be provided by water tankers. The drinking water and utility water supply will comply with the provisions of the Regulation Concerning Waters for Human Consumption.	
			Domestic wastewater generated as a result of drinking and utility water usage at the facility will be temporary collected/stored in toilet cabins or leak-proof septic tanks and disposed within the scope of the protocol to be made with KOSKI.	
			The washing process will be done with modern machines that minimize the use of water.	
			There will not be any chemical usage at the facility during operation phase.	
Noise	Increase in Noise Levels	Low	The Project Owner will take into account the sound power levels of the equipments given in the technical specifications/data sheet, in the selection of inverter, transformer and other electrical equipments. Moreover, relevant provisions and limit values of RAMEN will be complied with during the operation of the power plant.	Low
Waste Management	Waste Generation	Low	See mitigation measures for "Land Preparation and Construction Phase".	Low
			“Management Plan for Malfunctioned and End-of-life Modules" will be prepared before the commencement of the power plant by researching recovery alternatives for both the semi-conductive materials of module and the glass.	
Occupational Health and Safety		Low	The whole area will be fenced; the access of local people and wildlife will be controlled. The entry of personnel and third parties into the facility will be carried out in a controlled manner	Low
			Private security officers will be hired in order to provide the security of the working area. The special security applications within the scope of the project and the competent authorities shall be in compliance with the provisions of the Law on Private Security Services and the Implementation of the Law on Private Security Services	
			The workers will be trained in accordance with Regulations on the Procedures and Principles of Occupational Health and Safety Trainings of Employees.	
			Personal Protective Equipment will be provided for the workers according to the nature of work to be performed. The necessary trainings will be carried out for their use.	

Environmental and Social Factor		Significance of Impact	Impact Management/Mitigation Measures	Residual impact
			Smoking will be prohibited where the risks of fire is high. All the workers will be informed about the action plan in a case of fire	
			All equipment will be operated in proper working order.	
			Procedures approved by the Project Owner in the maintenance and repair activities and the requirements of the technical specifications of the supplier companies will be complied with.	
			The necessary health and safety signs and traffic signs will be placed around the project site. Employees will be informed and alerted about the subject matter markings.	
			Trainings will be given to employees and operational and maintenance personnel within the scope of the Regulation on Procedures and Principles of Occupational Health and Safety Trainings and measurement and evaluation activities will be carried out after the trainings.	
			Entrance of operation and maintenance personnel and third parties will be carried out in a controlled manner from the doors of the security personnel.	
			Equipment that meets international standards in terms of electrical performance and safety will be used at the plant.	
			After the plant is completed, necessary electrical tests will be carried out to check that the electrical connections of the panels and other related equipment are made properly before the plant is taken into operation.	
			By maintaining a minimum distance of 3 meters between the solar panels, conditions will be provided so that in the case of fire, the intervention can be carried out easil. The plant will be planned in such a way that the widths of the road will be sufficient.	
			The vegetation under the panels will not be allowed to grow uncontrollably.	
			An Emergency Response Plan will be prepared before the plant is taken into operation. The plan will describe the measures to be taken against fire risk. The number and quality of the fire intervention equipment to be determined within the scope of the plan will be available at the site. Security personnel will be trained on fire intervention.	
			The amount of water to be needed in a possible fire intervention will be ensured so that the equipment required for its use (eg pump) is always accessible..	
Closure Phase				
Land Use, Soil Environment	Land use change	Low	After the Project completed its operational life time, if there is no planning for use of the site for similar purposes (energy production, other industrial activities), the site will be returned to the state of the pre-project land use (pasture), with necessary restoration/rehabilitation works by Project Owner.	Low
			As a result of using a pressure pile driving machine for the installation of panel legs, the impacts on soil environment during the removal of these legs will be minimized.	
			The cables installed in the soil will be left in channels if it is suitable for the land use purposes after the closure. Thus, there will not be any excavation-filling works in this context.	

17.5. Monitoring Plan

In order to ensure continuity of implementation of effective management strategies which are submitted at previous section, monitoring is a very important tool. The main objective of the Monitoring Plan presented in this chapter is to provide a basis for the evaluation of the impacts of Apa GES Project.

In addition to these, monitoring activities will help to provide important information about changes in environmental and social conditions with the onset of Project activities and actual levels of impacts (impact levels are estimated prior to the start of the Project).

Information collected with the help of monitoring tool can be used to improve management plan during the land preparation and construction, operation, and closure phases of the Project. While impact assessment attempts to encompass all relevant potential impacts to identify their significance and include appropriate responses for these impacts, unanticipated impacts may still arise, which can be managed or mitigated before they become a problem using the information obtained through monitoring. So, monitoring will ensure the successful implementation of the mitigation/management plans and optimize environmental protection through good practice at all stages of the Project.

The monitoring activities to be performed during the land preparation and construction, operation, and closure phases of Apa GES Project are outlined in Table 17.3, together with the details on which parameter is to be monitored, where the parameter is to be monitored, how the parameter is to be monitored, frequency of the monitoring, why the parameter is monitored, source of financing and finally responsible parties.

The main responsibility in the implementation of the monitoring plan belongs to the Project Owner. The Project Owner will keep the records of monitoring activities by reporting the results of the monitoring plan. The monitoring reports prepared could be submitted to the MoEU and/or its relevant provincial directorate with a frequency determined by the Ministry, if requested.

Likewise management plan, monitoring plan is also open for update, whenever there is a need to improve the performance of the Project.

Table 17.3. Monitoring Plan

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
Land Preparation and Construction Phase							
Soil Environment	Leakages/spills such as oil, chemical, paint, fuel, etc. resulting from the Project activities	Working sites inside the Project Area	Visual investigation Recording (in case of spill/ leakage)	Continuous	Determination of possible contaminations in the soil environment	No need for additional budget	Project Owner
	Topsoil (location of the storage area, pile height, drainage of storage area, erosion situation, etc.)	Topsoil storage area	Visual investigation Recording/reporting	Weekly	Ensuring that the topsoil is stripped, transported and stored on the conditions that it does not lose its productivity	No need for additional budget	Project Owner
	Erosion	Inside the Project Area	Visual investigation Recording/reporting	Monthly	Observation and control of erosion formation within the Project Area	Project budget	- Project Owner - Authorized independent institution/ organization
Water Resources	- Amount of water supplied - Amount of water consumed - Resources of water supplied - Permits/agreements regarding water supply	Project Area	Visual investigation Recording/reporting	Monthly	Minimization of water consumption	No need for additional budget	Project Owner
	- Amount of domestic wastewater - Management of domestic wastewater (storage, disposal)	Watertight cesspool	Visual investigation Recording of disposal with sewage truck	Monthly	Management of domestic wastewater in compliance with legal legislation, and without causing any water and/or soil pollution	No need for additional budget	Project Owner
	SWQMR Annex-5 Table 2	- Çarsamba Creek (the closest point to the Project Area) - Apa Dam Reservoir	In-situ measurement Sampling and laboratory analysis	Quarterly (if the construction lasts in three months, it will be once in the peak period of construction activities)	- To check whether there is a project-based impact on surface water resources or not - To make quality classification according to SWQMR	Project budget	- Project Owner - Authorized independent institution/ organization

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
	Construction of interception and drainage channels	Project Area	Visual investigation	Once at the end of construction phase	Control of surface flow	No need for additional budget	Project Owner
Air Quality	- PM_{10} (dust) - Dust suppression applications	Apa Neighborhood	PM_{10} sampler Visual investigation	Quarterly (if the construction lasts in three months, it will be once in the peak period of construction activities)	- Compliance with RAMAQ and IAPCR - Provision of occupational and community health and safety	Project budget	- Project Owner - Authorized independent institution/ organization
Flora and Fauna	- *Spermophilus xanthophyrmnus* (Anadolu Yersincabi) (Anatolian Ground Squirrel) - *Mesocricetus brandti* (Turkish Hamster) (Turk Hamsteri)	Working sites inside the Project Area	Collection of individuals and transferring them to alternative habitats	Once before the start of land preparation activities	Protection of critical mammal species	Project budget	- Project Owner - Mammal Specialist
	- *Erinaceus concolor* (Porcupinne) (Kirpi) - *Testudo greaca* (Turtle) (Tosbaga)			Once before the start of land preparation activities; during activities if encountered	Protection of species that have limited mobility	No need for additional budget	Project Owner
	Distance between panels	Panel field	Control of the final layout	Before the construction	To ensure the continuity/sustainability of flora species	No need for additional budget	Project Owner
Noise	Environmental noise level	Closest residential in Apa neighborhood	Noise measurement device	- Quarterly (if the construction lasts in three months, it will be once in the peak period of construction activities) - In case of complaints	Compliance with the limits values defined in RAMEN	Project budget	- Project Owner - Authorized independent institution/ organization

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
Waste Management	- Activities and records related to waste types, quantities, separate collection of wastes, temporary storage, reuse, recycling and disposal - Waste Declaration Forms	- Waste storage areas - Working sites inside the Project Area	Visual investigation Recording/reporting	Monthly	Compliance with legislation regarding waste management	No need for additional budget	Project Owner
	Construction of temporary waste storage area	Temporary waste storage area	Visual investigation	Once at the end of construction phase	Compliance with legislation regarding waste management	No need for additional budget	Project Owner
Occupational Health and Safety	- Occupational health and safety practices - Personal Protective Equipment use - Warning signs - Training records - Machinery, equipment maintenance records, etc.	Working sites inside the Project Area	Visual investigation Recording	Continuous	Compliance with legislation regarding occupational health and safety	No need for additional budget	Project Owner
	Electromagnetic field level	- Working sites inside the Project Area - Administrative Office - The closest border of the facility to Apa neighborhood	Measurement with electromagnetic radiation measurement devices and recording	Once at the end of construction phase	- Provision of international exposure limit values - Provision of personnel and community health and safety	Project budget	Project Owner
Socio-Economy	- Number of employees - Local employment rates - Service purchase contracts	Project managers	Recording/reporting	Monthly	Maximize the employment-based social benefits of the Project	No need for additional budget	Project Owner
Cultural Assets	Chance finds	Working sites inside the Project Area	Visual investigation Recording	Continuous	Compliance with legislation regarding protection of cultural and natural assets	No need for additional budget	- Project Owner - Authorized administration

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
Emergency Cases	- Construction phase Emergency Preparedness and Response Plan - Availability of emergency response equipment, their locations and conditions	- Administrative Office - Project Area	Visual investigation Recording	- Once at the beginning of construction - Monthly	To intervene to a possible emergency case without causing any adverse impact on personnel and community health	Project budget	Project Owner
Operation Phase							
Soil	Reuse of topsoil and restoration of vegetation cover	Project Area	Visual investigation Recording	At the end of the first year of operation	Protection of topsoil	No need for additional budget	Project Owner
Water Resources	- Amount of water supplied - Amount of water consumed - Resources of water supplied - Permits/agreements regarding water supply	Project Area	Visual investigation Recording/reporting	Annually	To supply water demand of the Project without creating any pressure on water resources	No need for additional budget	Project Owner
	- Amount of domestic wastewater - Management of domestic wastewater (storage, disposal)	Watertight cesspool	Visual investigation Recording of disposal with sewage truck	Quarterly in the first year of operation Annually in subsequent years	Management of domestic wastewater in compliance with legal legislation, and without causing any water and/or soil pollution	No need for additional budget	Project Owner
	Construction of interception and drainage channels	Project Area	Visual investigation	At the end of the first year of operation	Control of surface flow	No need for additional budget	Project Owner
Waste Management	Condition of temporary waste storage area, properties and impermeability of departments, labeling applications, drainage of the area	Temporary waste storage area	Visual investigation	Monthly	Compliance with legislation regarding waste management	No need for additional budget	Project Owner

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
	- Activities and records related to waste types, quantities, separate collection of wastes, temporary storage, reuse, recycling and disposal - Waste Declaration Forms	- Temporary waste storage area - Working sites inside the Project Area	Visual investigation Recording/reporting				
Socio-Economy	Condition of livestock activities of local people and change in their socio-economic conditions	Apa neighborhood	Grievance mechanism	Continuous	Planning and implementation of corrective actions against possible socio-economic impacts resulting from the Project, if necessary	No need for additional budget	Project Owner
Occupational Health and Safety	- Occupational health and safety practices - Personal Protective Equipment use - Warning signs - Training records	Working sites inside the Project Area	Visual investigation Recording	Continuous	Compliance with legislation regarding occupational health and safety	No need for additional budget	Project Owner
Emergency Cases	- Operation phase Emergency Preparedness and Response Plan - Availability of emergency response equipment, their locations and conditions	- Administrative Office - Project Area	Visual investigation Recording	Once at the beginning of operation Annually in subsequent years	To intervene to a possible emergency case without causing any adverse impact on personnel and community health	Project budget	- Project Owner - Authorized institutions
Closure Phase							
Waste Management	- Disposal of closure phase wastes (e.g. solar panels, inverters, etc) - Waste disposal agreements	Working sites inside the Project Area	Visual investigation Recording/reporting	Quarterly	Compliance with legislation regarding waste management	No need for additional budget	Project Owner

Subject	***Which*** **parameter is to be monitored?**	***Where*** **the parameter is to be monitored?**	***How*** **the parameter is to be monitored/type of monitoring equipment?**	**When the parameter is to be monitored-frequency of measurement or continuous?**	***Why*** **the parameter is to be monitored?**	**Source of Financing**	**Institutional Responsibility**
Restoration	- Effectiveness of restoration activities - Harmony with the former land use (meadow) - Harmony with the surrounding areas	Project Area	Visual investigation Recording/reporting	Once at the end of restoration works	Reconstructing the ecological balance and the landscape character in the area	No need for additional budget	Project Owner

Abbreviations:

SWQMR : Surface Water Quality Management Regulation
RAMAQ : Regulation on Assessment and Management of Air Quality
IAPCR : Industrial Air Pollution Control Regulation
RAMEN : Regulation on the Assessment and Management of Environmental Noise

17.6. Stakeholder Engagement Framework

Stakeholder engagement activities are essential components of the appraisal, management and monitoring of environmental and social issues associated with the proposed Project. For this reason, the Project Owner considers stakeholder engagement activities to be a key part of good business practice and corporate responsibility, as well as a constructive feedback mechanism which allows the quality of the Project.

Objectives of stakeholder engagement activities to be carried out within the scope of Apa GES Project, type of activities that will be used during land preparation and construction, operation and, closure phases and possible compensation indemnity and Corrective Action Plan that will be implemented in the scope of the Project are described in following sections.

17.6.1. Introduction and Scope

Introduction (Overview of the Proposed Project)

Apa Solar Power Plant Project is planned to be constructed on an area of 26.17 hectares, that is located in Baglar vicinity within the boundaries of Apa neighborhood of Cumra District in Konya Province. The Project Area is approximately 55 kilometers south of Konya city center and 30 kilometers southwest of Cumra district center. The closest settlement to the Project Area and potentially affected settlement within the scope of the Project is Apa neighborhood in the south-southeast of the site. The nearest building belonging to the settlement is at a distance of 40 meters to the Project Area, and the nearest panel is at a distance of 130 meters. Apasaraycik neighborhood (5 km west of the site), Dineksaray neighborhood (5 km northeast of the site) and Yenimescit settlement of Apa neighborhood (5 km south of the site) are other settlements around the Project Area. The nearest dam to the Project Area is the Apa Dam at the south-southwest. The dam axis is around 1 km to the Project Area and the reservoir is around 900 meters. Carsamba Creek, where Apa Dam constructed on, passes around 400 meters away from the Project Area.

It is predicted that proposed Project will bring multiple benefits which can be summarized as follows:

- Contribute to increasing energy security through development of local energy resources and reducing Turkey’s dependency on energy sources;
- Enabling sustainable development through producing clean energy and reducing the consumption of alternative polluter resources; and
- Regional socio-economic development through enabling local employment and procurement opportunities during the land preparation and construction, and operation phases.

17.6.2. Objectives

The objectives of Stakeholder Consultation are as follows;

- Define the project affected people and other stakeholders such as NGOs, media, academics, government authorities;

- Provide an interactive system to give free, objective and prior information, seek feedbacks at local and national levels during the planning, construction, and operation of projects;
- Provide opportunities for stakeholders especially to community based organizations (CBOs) and NGOs to participate in project activities throughout the project cycle; and
- Define detailed action plans, monitoring and reporting procedures.

The communications with stakeholders will be custom tailored through careful selection of the communication methods. Most governmental communications will rely on written materials and meetings. Neighborhood meetings will be held for all disclosure activities, complemented by reports accessible to stakeholders. Specifically, the content of all communications will be guided by the following principles:

- Written and oral communications in a language understandable to all stakeholders;
- Easy accessibility to both written information and to the consultation process by relevant stakeholders;
- Use of oral or visual methods to explain information to the public; and
- Clear mechanisms to respond to people's concerns, suggestions and grievances.

Based on this Stakeholder Engagement Framework, the Project Owner will prepare a Stakeholder Engagement Plan as necessary.

17.6.3. Stakeholder Identification

As an important part of this Stakeholder Engagement Framework, following categories of stakeholders have been identified:

- Local Governmental Organization (e.g. Konya Metropolitan Municipality, Governorship of Konya, Cumra District Municipality);
- National Governmental Organizations (e.g. Ministry of Energy and Natural Resources, Ministry of Environment and Urbanization, Ministry of Forestry and Water Affairs, Ministry of Food, Agriculture and Livestock)
- Non-governmental Organizations (e.g. Konya Agricultural Credit Cooperative, Konya Chamber of Commerce, Konya TEMA Foundation)
- Local Communities/Residents (e.g. Apa neighborhood)
- Project Owner and Contractors Employees

17.6.4. Stakeholder Engagement Activities

Project related documents (e.g. ESIA, ESMP and Stakeholder Engagement Framework) will be shared with public when needed. When additional information required, disclosure activities will be carried out by the Project Owner's social point of contact. This will ensure that the public remains informed of the most recent Project developments and activities.

When notifying stakeholders on Project developments and including them in public discussions, where appropriate the following communication methods will be implemented:

- Consultation meetings and discussions to accompany any new developments or Project variations;

- Public notices will be provided to headman and displayed in the neighborhood office building, community health centers, local libraries etc. In addition, notices will also be posted in tea/coffee houses (e.g. Apa tea house).

Information on job vacancies will continue to be disclosed in accordance with the cultural patterns and customs (e.g. through headman or other opinion leaders).

Where future public stakeholder meetings are undertaken by the Project Owner (e.g. with the affected community, heads and representatives of local municipal administrations etc.), advance notice will be given of the purpose and venue location (e.g. by placing a notification in the local and regional printed media). Where appropriate, transportation will be offered by the Project Owner to facilitate participation of residents from locations remote to the meeting venue.

Grievance Mechanism

Grievance/demand mechanism is an essential component of the Project Owner's social management system since project-affected communities' demands; concerns and complaints can be received and resolved through this system in a transparent and timely manner. The main principles of the Project Owner's grievance/demand mechanism are as follows:

- Grievance/demand form is composed of 2 parts: Grievance/demand register form and Closure form.
- It is required that grievance/demands are registered to the system in the soonest possible time.
- Grievances/demands can be received during regular visits to affected communities or PAP's visits to the Project Owner's office or telephone calls.
- The grievance/demands received at one-to-one meetings and/or by the written petitions are also acceptable. However, all the aforementioned different forms of grievance/demand are recorded through same procedure to the system.
- After recording the grievance/demands, it is aimed to take the corrective actions which will be satisfactory for both parties, follow up the actions and close the grievance/demand via using Closure Form, and inform the complainants about the outcomes of the corrective actions. All grievances should be closed within 30 days. If closing the grievance in 30 days is not possible, the complainant(s) should be consulted by the end of this duration. Pending duration of grievance can be prolonged if the complaint gives consent.

Grievance and demands received from all relevant stakeholders (local community, local institution officers, workers etc.) will be recorded in the Project Owner's data entry system by the Social Point of Contact at site in an organized and standard content. Where it is not possible to enter the data electronically, hard copy of the form may be used for recording; entry into the electronic media shall be done later.

17.6.5. Possible Compensation Indemnity and Corrective Action Plan

Since the Project does not require land acquisition or resettlement activities, compensatory measures are not applicable.

17.7. Emergency Response Plan

This section provides the framework of Emergency Preparedness and Response Plan for Apa GES Project. An Emergency Response Plan will be prepared before the land preparation and construction, and operation phases of the Project based on this framework plan in accordance with international standards and tailored for the Project.

Emergency Response Plan will be updated and revised by considering the developments and activities within the scope of the Project, when necessary. Project Owner will cooperate with Apa neighborhood and local administrations (e.g. Konya Provincial Disaster and Emergency Directorate, Cumra Fire Authority) for the emergency preparedness and response. If the local authorities have a limited capacity or no capacity for the effective response for emergencies, the Project Owner will play an active role in the emergency preparedness and response regarding the Project.

17.7.1. Introduction

Apa Solar Power Plant Project is planned to be constructed on an area of 26.17 hectares having parcel number of 165/2, that is located in Baglar vicinity within the boundaries of Apa neighborhood of Cumra District in Konya Province. The Project Area is approximately 55 kilometers south of Konya city center and 30 kilometers southwest of Cumra district center. Within the scope of the activity, it is aimed to produce electricity by using photovoltaic technology in the power plant to be established in the Project Area.

In this emergency response plan, purpose and scope of the plan, actions to be taken before, during and after any emergency events and responsibilities are described.

17.7.2. Purpose and Scope

Purpose of the Emergency Response Plan

It is possible that emergencies may occur in the construction and operation phases of the Project that could jeopardize environmental safety, occupational and community health and safety. The main purpose of the Emergency Response Plan is; in order to manage in all aspects of emergencies that may arise within the scope of the Project; to define and determine all of the actions to be performed before an emergency (prevention and preparation), during an emergency (intervention) and after an emergency (damage assessment and improvement if possible) according to the determined responsibilities and creating a guide document in this direction. However, the emergency response plan may be updated if it is deemed necessary at any stage of the Project to protect/sustain its effectiveness.

Legislative Framework

Within the context of emergency management issues; accidents or disasters; minimum requirements are set out with relevant regulatory provisions including related provisions with occupational health and safety and environmental protection. Main legislative regulations that should be considered within the scope of the Project are listed below:

- Environmental Law
  (Law No: 2872, Official Gazette Number: 18131, Date: 11.08.1983)
- Labor Law

(Law No: 4857, Official Gazette Number: 25134, Date: 10.06.2003)
- Social Insurances and General Health Insurance Law
(Law No: 5510, Official Gazette Number: 26200, Date: 16.06.2006)
- Public Health Law
(Law No: 1593, Official Gazette Number: 1489, Date: 06.05.1930)
- Law on General Assistance to be Taken by Measures to be Taken for Disasters
(Law No: 7269, Official Gazette Number: 10213, Date: 25.05.1959)
- Forestry Law
(Law No: 6831, Official Gazette Number: 9402, Date: 08.09.1956)
- Special Provincial Administration Law
(Law No: 5302, Official Gazette Number: 25745, Date: 04.03.2005)
- Regulation on Occupational Health and Safety,
(Official Gazette Number: 25311, Date: 09.12.2003)
- Health and Safety Signs Regulation
(Official Gazette Number: 28762, Date: 11.09.2013)
- Regulation on Health and Safety Measures in the Use of Work Equipments
(Official Gazette Number: 28628, Date: 25.04.2013)
- First Aid Regulation
(Official Gazette Number: 29429, Date: 29.07.2015)
- Regulation on Methods and Essentials of Work Health and Safety Training for Workers
(Official Gazette Number: 28648, Date: 15.05.2013)
- Regulation on Personal Protective Equipment
(Official Gazette Number: 26361, Date: 29.11.2006)
- Regulation Concerning the Use of Personal Protection Equipments at Workplaces
(Official Gazette Number: 28695, Date: 02.07.2013)
- Regulation on the Protection of Buildings from Fire
(Official Gazette Number: 26735, Date: 19.12.2007)
- Regulation on Protection of Employees from Risks Related to Noise
(Official Gazette Number: 28721, Date 28.07.2013)

Emergency Levels

Emergency situations can be classified according to hazard levels. Emergencies under this plan are classified as Level 1, Level 2 and Level 3, as defined below.

<u>Level 1</u>

Level 1 emergencies are small, limited events that can be removed from the scene in a short period of time with resources in the workplace. These are the lowest level emergency situations in terms of emergency importance/priority. In determining such events, the following criteria are taken into account:

- Community health or safety is not threatened.
- There are no significant environmental impacts outside or within the area.
- Any injury can only be treated with first aid.
- Damage of goods is at a low value.

Medical injuries and fire incidents such as a single worker's injury and small fires, etc. are considered as Level 1 according to this emergency plan.

Level 2

Level 2 emergencies are uncontrolled but limited/localized events. These events are at a higher risk level than Level 1, where additional resources (crews and equipment) are needed in addition to the available resources where the event takes place. Some external resources may need to be used, but the team and equipment to be actuated/provided is not beyond the related responsible person’s authority and capacity he/she could provide.

Injuries that will not be completely treated with first aid and therefore a health center for the treatment is needed but do not pose a death risk, and fire incidents at level that cannot be completely extinguished with field equipment, etc. are considered as Level 2 according to this plan.

Level 3

Level 3 emergencies are events that are uncontrolled and involve serious hazards or cover a wide area or pose a serious threat to life, business or surrounding community, and require the use of external resources. Such incidents are events at the highest risk level that may disrupt the entire project/operation, which may cause damage to persons, surroundings, and movable and immovable properties, and may require the calling of joint aid agencies.

The injuries that can pose death risk to site workers and surrounding communities, large-scale slope failure, big fires and natural disaster that can cause interruption in the operation of the plant, etc. are considered as Level 3 according to this plan.

Duties and Responsibilities

The Apa GES Project is a small-scale project where an average of 25 personnel in the land preparation and construction phase, and only 6 security personnel in the operational phase (the facility will be operated with remote management plan) will be employed work. In this context, it is anticipated that one Emergency Response Plan (ERP) Coordinator and an Emergency Response Team of five persons will be sufficient for both phases of the Project. However, Plant Manager of the Project Owner, who will not be at the plant in the operation phase, has also duties and responsibilities within this scope. The basic responsibilities of these units are listed in the following subsections.

Plant Manager

- To ensure the development and implementation of the emergency action plan of the plant
- To provide adequate training within the responsibilities of the employees participated in the emergency action plan
- To ensure annual review and update of the emergency action plan

ERP Coordinator

The other responsibilities and duties of the ERP Coordinator, who will ensure the actions to be developed/taken against emergencies are carried out in accordance with the Emergency Response Plan, is as follows:

- To ensure that staff receive necessary trainings regarding emergency situations
- To ensure the jobshare within the Emergency Response Team and it is complied with
- To ensure that the contact information of the persons and institutions that need to be reached in any emergency case is kept in a place where everyone can reach it
- To perform emergency practices
- To prepare a status report after the end of emergency situation and to present this report to the site manager and the plant manager

Emergency Response Team

- To participate in trainings and practices related to emergencies
- To carry out the necessary actions within the scope of emergency response plan
- To inform ERP Coordinator when an emergency occurs
- To assist the ERP Coordinator in the preparation of the status report after the end of emergency situation

17.7.3. Preparedness to Emergency Situations

Planning and Coordination

Preparedness ensures that arrangements and resources are maintained in a state of readiness to be mobilized and directed for response to an emergency event. In this regard planning plays a key role together with coordination. For an effective emergency response, preparation of employees, related resources and activity programs is important.

Coordination is not only important during an emergency, but also vital throughout project implementation and management. In this regard, effective coordination before an emergency event would ensure a more efficient response. Furthermore, good coordination is also a measure of building thrust between parties and developing confidence against emergency situations.

As a part of planning and coordination, activities that will be coordinated and/or carried out for emergency preparedness by Plant Manager and ERP Coordinator, are described below:

- Emergency Response Plan will be reviewed regularly and updated if necessary. In this regard, Emergency Response Plan will be reviewed at least annually and updated if necessary to ensure that the risks are accurately reflected and respond to needs with a continuous improvement approach.
- Development and/or updating requirements of the Emergency Response Plan will be determined and necessary arrangements will be made by analyzing the effectiveness of Emergency Response Plan within the scope of the evaluation meeting and evaluations to be carried out after the end of an emergency situation. In the case of an unforeseen emergency, it will be included in the Emergency Response Plan and specific response plan related to that event will be developed.
- It will be ensured that, all employees and those involved in the Emergency Response Plan are informed about their duties in this scope and will be trained with the necessary knowledge and skills.

- Cooperation with other related organizations will be provided for emergency management and special response arrangements and this relationship will be kept alive by arranging joint programs.
- It will be ensured that, Emergency Response Team that is on the field will be sufficient in terms of fulfilling the needs and accessible and necessary/proper resources will be provided to the team.

Assembly areas/points for assembling of employees in emergency events will be determined and evacuation procedures will be established. While determining assembly areas and establishing evacuation procedures each working area will be evaluated separately. When the emergency alert is triggered, all employees will go the nearest assembly area/point. If the nearest assembly point is unavailable, employees will be directed to other assembly areas/points. General site map showing all assembly points/areas will be put up within the facility at appropriate locations. Participants in the recruitment training will also be informed about the locations of the assembly areas/points.

Training and Resources

Emergency trainings will start with recruitment training. Within this scope, as a part of recruitment training Emergency Response Plan and duties and responsibilities of newly hired personnel/worker will be explained.

In addition, training needs of personnel and other employees who are in charge of emergency management will be determined by Plant Manager and ERP Coordinator, and necessary internal and external trainings will be programmed so that, relevant employees will receive these trainings.

Emergency practices will be practices that take place at regular periods to make employees understand how to behave when encountered with an emergency event. It will be ensured that all employees will join in emergency practices.

Resource needs related to emergency will be determined by ERP Coordinator. The procurement of equipment and materials to be used in an emergency will be carried out by the Plant Manager in accordance with the purchasing procedure of the plant. Assignments related to human resources will be carried out with the confirmation of Plant Manager.

17.7.4. Emergency Management (Emergency Response/Action Plan)

Emergency response/intervention can be defined as a set of actions to minimize the impacts of an emergency situation and to remove or limit the threat on human life, the environment and the movable and immovable property. Emergency response basically involves the followings:

- Initial assessment and reporting of the emergency situation, event location/site and communication methods identified
- On-site management of the event/incident (event location management)
- Coordination of resources to support event location management (outsourcing coordination)
- Communication about the event with relevant stakeholders
- Termination of response/intervention actions when the event is over

Emergency Events and Response Procedures to Emergency Events

Four main emergency events have been identified, taking into account the construction and operation activities of the Project, the process used, the materials and the environmental conditions. These emergency events are listed below:

- Fire
- Electric Shock
- Other Medical Emergencies (e.g. injuries resulting from accidents)
- Natural Disasters (in the scope of Level 2 and 3 emergency cases)

Response methods to be performed according to the emergency levels explained in the above sections are explained below:

<u>Level 1 Emergency Response Procedures</u>

<u>Fire</u>

- Alarms will be given, employees will be alerted, ERP Coordinator and Plant Manager will be notified
- Resources (fuel, etc.) that can spread/blow up the fire will be removed from the vicinity of event location
- Fire will be responded by securing the site
- Response team will be withdrawn in case of a flareup or reignition
- Additional resources will be requested if necessary
- If the fire cannot be controlled by site/field resources, all personnel in the area will be taken to a safe area and instructions from the Plant Manager will be awaited

<u>Electric Shock</u>

- Before touching the injured, the current will be cut off with an insulating material
- First aid intervention will be done
- It will be checked whether there are fractures and similar physical injuries or not
- The injured person will be kept warm by covering that person up with a blanket
- ERP Coordinator and Plant Manager will be notified
- An ambulance will be called to the event location if necessary
- Instructions from the ERP Coordinator will be awaited
- Safety of all employees at the event location will be ensured

<u>Other Medical Emergencies</u>

- The site will be taken under control and the hazards will be removed in order to provide safety of the site
- First aid intervention will be done
- ERP Coordinator and Plant Manager will be notified
- An ambulance will be called to the event location if necessary
- Instructions from the ERP Coordinator will be awaited
- The event location will be preserved for investigations
- Safety of all employees at the event location will be ensured

Level 2 and Level 3 Emergency Response Procedures

Fire

- Event/incident history will be written and it will be checked whether the necessary information has been provided within the scope of the first response procedure and the nearest fire department will be notified about the event
- The site will be taken under control, the region will be emptied (people in the region will be taken to a safe place) and employees will be identified
- The event location will be secured, the entrances and exits to the region will be kept under control and energy sources will be deactivated if necessary
- Emergency Response Team will be activated, fire fighting and rescue activities will be managed until fire brigade arrives and these activities will be continued in coordination after the arrival of fire brigade
- Material Safety Data Sheets (MSDSs) will be checked to assess the hazards that may arise from materials that may remain in the fire
- If there is a injured person, that person will be carried to a safe environment, first aid intervention will be done and medical assistance will be requested
- Based on the number of injured persons and the size of the event, the nearest state hospital will be informed about the issue and it will be ensured that they are be prepared
- Tasks to be performed will be identified according to their priority during the event and additional human resources and equipment will be provided from external resources
- If there is a injured person, his/her relatives will be informed and continuous communication will be provided
- Communication will be made with related institutions and information about the event will be provided
- When the emergency situation is over, this situation will be announced to all concerned parties and the teams involved in the intervention will be sent
- The event location will be preserved until the necessary investigations are completed after the emergency and necessary investigations will be made
- After the emergency, the equipment/materials used in the response will be identified and the lacking equipment/materials will be supplied again as soon as possible
- Evaluation meeting will be held after the emergency situation

Electric Shock

- Event history will be written
- The site will be taken under control and the safety of the site will be ensured by controlling the hazards
- Before touching the injured, the current will be cut off with an insulating material
- First aid intervention will be done
- It will be checked whether there are fractures and similar physical injuries or not
- The injured person will be kept warm by covering that person up with a blanket
- If necessary, the nearest hospital will be called and informed (issues such as the type of the injury, event location, access road to the site, etc.) and ambulance will be requested
- The ambulance will be directed to the nearest safety location to the event location and continuous communication will be maintained with the ambulance

- File containing the personal medical information of the injured will be checked and the necessary information will be transferred to authorized health professional to assist in the appropriate medical intervention
- Information that can help with medical intervention regarding the injury event will be transferred to authorized health professional
- Relatives of the injured will be informed and continuous communication will be provided
- If the injured is under control in a healthcare facility, the situation and needs of the injured will be followed by providing continuous communication with the healthcare facility
- Communication will be made with related institutions and information about the event will be provided
- The event location will be preserved until the necessary investigations are completed after the emergency and necessary investigations will be made
- After the emergency, the first aid equipment/materials used in the response will be identified and the lacking equipment/materials will be supplied again as soon as possible
- Evaluation meeting will be held after the emergency situation

Other Medical Emergencies

- Event history will be written
- The site will be taken under control and the safety of the site will be ensured by controlling the hazards
- First aid intervention will be done
- If necessary, the nearest hospital will be called and informed (issues such as the type of the injury, event location, access road to the site, etc.) and ambulance will be requested
- The ambulance will be directed to the nearest safety location to the event location and continuous communication will be maintained with the ambulance
- File containing the personal medical information of the injured will be checked and the necessary information will be transferred to authorized health professional to assist in the appropriate medical intervention
- Information that can help with medical intervention regarding the injury event will be transferred to authorized health professional
- Relatives of the injured will be informed and continuous communication will be provided
- If the injured is under control in a healthcare facility, the situation and needs of the injured will be followed by providing continuous communication with the healthcare facility
- Communication will be made with related institutions and information about the event will be provided
- The event location will be preserved until the necessary investigations are completed after the emergency and necessary investigations will be made
- After the emergency, the first aid equipment/materials used in the response will be identified and the lacking equipment/materials will be supplied again as soon as possible
- Evaluation meeting will be held after the emergency situation

Natural Disasters

- Event history will be written
- If there is a injured person, that person will be carried to a safe environment, first aid intervention will be done and medical assistance will be requested
- Based on the number of injured persons and the size of the event, the nearest state hospital will be informed about the issue and it will be ensured that they are be prepared
- If there is a injured person, his/her relatives will be informed and continuous communication will be provided
- Employees will be taken to a safety region
- Communication with the related institutions will be carried out to determine the activities that can be done related to the subject and continuous communication with the related institutions will be provided
- Emergency Response Team will be activated according to the size of the natural disaster and related response activities will be initiated both inside and outside the facility
- The hazards that may occur within the facility due to natural disaster will be evaluated and necessary measures will be taken
- Tasks to be performed will be identified according to their priority and additional human resources and equipment needed will be tried to be provided from both internal and external resources
- When the emergency situation is over, this situation will be announced and the teams involved in the intervention will be sent
- If there are damaged areas within the facility after the emergency, this area will be preserved until the necessary investigations are completed and necessary investigations will be made
- After the emergency, the equipment/materials used in the response will be identified and the lacking equipment/materials will be supplied again as soon as possible
- Evaluation meeting will be held after the emergency situation

Post-Emergency Actions

Within the scope of the evaluation meeting to be held under the chairmanship of Plant Manager after Level 2 and Level 3 emergencies, below mentioned issues will be considered:

- The compliance of the actions carried out during emergency event and emergency response to the Emergency Response Plan will be discussed;
- The requirements for the development and/or updating of the Emergency Response Plan will be identified and necessary arrangements to be made in this regard will be ensured;
- In the case of encountering an unforeseen emergency, it will be ensured that this event is included in the Emergency Response Plan;
- Additional resource needs will be identified and provision of these will be ensured;
- If there are injured in the emergency event, the situation of both the injured and the families of the injured will be assessed, the necessary things to be done will be determined and implementation of these will be ensured.

The magnitude of the damage and the loss caused by the emergency will be determined by damage assessment studies, and if the operation is interrupted, improvement/remediation plan and practices will be carried out in order to accomplish the operation of the plant quickly and safely.

17.8. Schedule

License application to the EMRA for the Apa GES Project was made on June 13, 2013 and a preliminary license has been granted to the Project Owner for the Project for 30 months starting from April 21, 2016.

Environmental baseline and EIA studies were started in January 2016 and official EIA process was initiated by submitting the EIA Application File to the MoEU on May 16, 2016. A public participation meeting within the scope of EIA process conducted on June 16, 2016 at Apa neighborhood. EIA Positive Decision was received on April 18, 2017 from the MoEU.

Project Owner applied to Konya Governorship for the registration of the Project Area to the treasury by requesting allocation purpose change in order to establish Apa GES Project. As a result of the application, Konya Governorship decided that the allocation purpose change is acceptable in October 2016. All permitting procedures and engineering studies will be completed before the start of construction works.

The service life for photovoltaic solar power plants is usually around 25-30 years. Apa GES is also expected to have a 25 year service life, considering the current technology. However, service life might be extended, if required and related requirements are completed, with possible system modifications based on possible technological developments within the service life of the Project and the license period granted by EMRA for electricity production.

Main phases of the Project are; (i) Permitting and License, (ii) Design and Engineering, (iii) Manufacturing, Transportation, Construction and Assembly, (iv) Start-up, and (v) Operation/Production with License. The project schedule based on these phases is given in Table 17.4.

Table 17.4. Project Schedule

ISSUE	MONTHS																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. PERMITTING AND LICENSE PHASE																				
1.1. Preliminary License																				
1.2. Turkish EIA Process																				
1.3. Land Use Permits (allocation purpose change and registration to treasury, lease)																				
1.4. Geological and Geotechnical Studies																				
1.5. Implementation Development Plan and its Approval																				
1.6. Other Local Permits																				
1.7. Energy Transmission Line Feasibility, Routing and Design Studies																				
1.8. License																				
2. DESIGN AND ENGINEERING PHASE																				
2.1. Preparation of EPC Package and Contracts																				
2.2. Finance Meetings and Agreements																				
3. MANUFACTURING, TRANSPORTATION, CONSTRUCTION AND ASSEMBLY PHASE																				
3.1. Preparation of Camp Site (Electricity, Mobilization, Water Supply, Access Roads)																				
3.2. Excavation/Leveling Works, Concreting and Construction Works																				
3.3. Provision of Plant Equipment and Installation/Assembly																				
3.4. Manufacturing, Transport and Assembly of Transformer Station and Switchyard Equipment																				
3.5. Construction and Assembly of Main and Auxiliary Units																				
4**. START-UP PHASE**																				
4.1. Completion of the Plant, Performance Tests and Start-up																				
4.2. Temporary Acceptance and Commencement of Commercial Operation																				
5. OPERATION/PRODUCTION WITH LICENSE																				

APPENDIX 1

List of Flora and Fauna

Appendix 1. List of Flora and Fauna

Legend Used in Flora and Fauna Species Tables

IUCN (International Union for Conservation of Nature) Red List of Threatened Species)	
1994 (ver 2.3)	**2001 (ver 3.1)**
EX: Extinct	**EX:** Extinct
EW: Extinct in the wild	**EW:** Extinct in the wild
CR: Critically endangered	**CR:** Critically endangered
EN: Endangered	**EN:** Endangered
VU: Vulnerable	**VU:** Vulnerable
LR: Lower risk	**NT:** Near Threatened
cd: conservation dependent	**LC:** Least Concern
nt: near threatened	**DD:** Data deficient
lc: least concern	**NE:** Not evaluated
DD: Data deficient	
NE: Not evaluated	
BERN CONVENTION	
Annex I: Protected Flora Species	
Annex II: Strictly Protected Fauna Species	
Annex III: Protected Fauna Species	
CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)	
Appendix I: Species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.	
Appendix II: Species not necessarily threatened with extinction, but their trade must be controlled to avoid utilization incompatible with their survival.	
Appendix III: Species protected in at least one country, and their trading is under control by CITES.	
NATIONAL HUNTING STATUS (According to Central Hunting Commission, 2015-2016)	
App I: Includes game animals which are protected by the CHC	
App II: Includes game animals which are allowed to be hunted in seasons predefined by CHC	
NATIONAL THREAT CATEGORIES (for bird species) (Kiziroğlu,İ., 2009. The Pocket Book for Birds of Türkiye, ISBN: 975-7460-01-X, Ankamat Matbaası, Ankara, 564 s.)Matbaası, Ankara, 564 s.)	
Category A:	
A.1.2.: (CR) Critically endangered and breeding species in Turkey	
A.2. : (EN) Endangered and breeding species in Turkey	
A.3. : (VU) Vulnerable and breeding species in Turkey	
A.3.1.: (D) Declining, vulnerable and breeding species in Turkey	
A.4. : (NT) Near threatened. Breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey	
A.5.: (LC) Least Concern. Breeding species that are widespread in Turkey	
A.6.: (DD) Not Evaluated. Breeding species which have not been evaluated in Turkey	
A.7.: (NE) Critically endangered and non-breeding species in Turkey	
Category B:	
B.1.2. : (CR) Critically endangered and non-breeding species in Turkey	
B.2. : (EN) Endangered and non-breeding species in Turkey	
B.3. : (VU) Vulnerable and non-breeding species in Turkey	
B.3.1.: (D) Declining, vulnerable and non-breeding species in Turkey	
B.4. : (NT) Near threatened, non-breeding species do not face to risk now but are likely to qualify for threatened category in the near future in Turkey	
B.5.: (LC) Least Concern, non-breeding species that are widespread in Turkey	
B.6.: (DD) Data Deficient, non-breeding species on which there is deficient information in Turkey	
B.7. : (NE) Not Evaluated, non-breeding species which have not been evaluated in Turkey	
Status for Birds	
KZ : Winter Visitor, Species that spend winter months in the region	
G : Migrate, Species migrating from the region after the breeding in spring and summer	
Y : Native, Species observed for the year	
T : Transit Migrate: Species observed only in migration period and only for a short time in the region	
V : Vagrant: Rare, incidental (stray = traveler) species	
Turkish Red Data Book of Turkish Plants (TRDB;	**National Threaten Status (for fauna species)**

Legend Used in Flora and Fauna Species Tables

Appim et al., 2000) **Based on IUCN Red List Categories and Criteria (ver. 2.3)**	*Demirsoy, A. 2002. Genel Zoocoğrafya ve Türkiye Zoocoğrafyası, Meteksan Yayınları, Ankara, ISBN:975-7746-33-9*
EX: Extinct	**E:** Extinct
EW: Extinct in the wild	**Ex:** Extinct in the wild
CR: Critically endangered	**I:** Taxon status unknown
EN: Endangered	**K:** It is not known which category the relevant taxon situation will be due to lack of information.
VU: Vulnerable	**nt:** Common, abundant and endangered species
NT: Near Threatened	**O:** Non-endangered species
LC: Least Concern	**R:** Rare species
DD: Data deficient	**V:** Vulnerable species
NE: Not evaluated	
ENDEMISM (for flora species)	
R: Regional	
W: Widespread	
RELATIVE ABUNDANCE	
1: Very Rare	
2: Rare	
3: Moderate	
4: Abundant	
5: Very Abundant	
SOURCES	
O: Observation	
S: Survey	
L: Litrature	
H: Habitat suitability	
F: Feces	
N: Nest	

Table 1.1. List of Flora Species

No	Family	Species Name	Turkish Name	Phytogeographical Region	Endemism		T.S	BERN	CITES			Steppe Habitat	Relative Abundance					Source
					R	W		App 1	App1	App2	App3		1	2	3	4	5	
1	**RANUNCULACEAE**	*Ranunculus arvensis* L.	Dugun cicegi	Mediterranean								x	x					O
2		*Ceratocephalus falcatus* (L.) Pers.	–	Wide spread								x		x				O
3	**CRUCIFERAE**	*Descurainia sophia* (L.)	–	Wide spread								x		x				O
4		*Thlaspi perfolatum* L.	Kulakçıklı akça çiçeği	Wide spread								x	x					O
5		*Alyssum minutum* (L.)Rothm.var. *minutum*	–	Wide spread								x		x				O
6		*Capsella bursa-pastoris* (L.) Medik.	Cobancantasi	Wide spread								x		x				O
7		*Erysimum crassipes* Fisch. & Mey.	–	Wide spread								x	x					O
8	**RESEDACEAE**	*Reseda lutea* L. var. *lutea*	Mine çiçeği	Wide spread								x		x				O
9	**CISTACEAE**	*Helianthemum salicifolium* (L.) Miller	–	Wide spread								x		x				O
10	**CARYOPHYLLACEAE**	*Minuartia hamata* (Hausskn.) Mattf.	–	Wide spread								x	x					O
11		*Dianthus zonatus* Fenzl var. *zonatus*	Yabani karanfil	Wide spread								x		x				O
12		*Arenaria serpyllifolia* L.	–	Wide spread								x	x					O
13		*Velezia rigida* L.	–	Mediterranean								x		x				O
14	**ILLECEBRACEAE**	*Herniaria incana* Lam.	Kirik otu	Wide spread								x	x					O
15		*Scleranthus annuus* L. subsp. *annuus*	–	Wide spread								x	x					O
16		*Paronychia kurdica* Boiss. subsp. *kurdica* var. *kurdica*	–	Wide spread								x		x				O
17	**GUTTIFERAE**	*Hypericum triquetrifolium* Turra	Binbir delik otu	Wide spread								x		x				O
18	**GERANIACEAE**	*Erodium cicutarium* (L.) L. Herit subsp. *cicutarium*	Turna gagası	Wide spread								x	x					O
19	**CHENOPODIACEAE**	*Noaea mucronata* Boiss. & Bal. Subsp. *mucronata*	–	Wide spread								x		x				O
20	**POLYGONACEAE**	*Rumex acetosella* L.	Evelik	Wide spread								x	x					O
21	**LEGUMINOSAE**	*Astragalus podperae* Sirj	Geven	Iran-Turan		x	LC					x			x			O
22		*Astragalus acicularis* Bunge	Geven	Iran-Turan		x	LC					x			x			O
23		*Astragalus microcephalus* Willd.	Geven	Iran-Turan								x			x			O
24		*Astragalus mesogitanus* Boiss.	Geven	Iran-Turan		x	LC					x	x					O
25		*Lotus corniculatus* L. var. *tenuifolius* L.	Gazelboynuzu	Wide spread								x		x				O
26		*Trigonella monantha* C.A.Meyer subsp. *monantha*	–	Iran-Turan								x	x					O
27		*Onobrychis montana* DC. Subsp. *cadmea* (Boiss.) P.W. Ball	Korunga	Wide spread								x		x				O
28	**ROSACEAE**	*Potentilla recta* L.	Dik parmak otu	Wide spread								x	x					O
29		*Sanguisorba minor Scop. Subsp. muricata (Spach)Brig*	Çayırdüğmesi	Wide spread								x	x					O
30	**UMBELLIFERAE**	*Torilis leptophylla* (L.) Reichb.	–	Wide spread								x	x					O
31		*Eryngium campestre* L. var. *campestre*	Şekerdikeni	Wide spread								x	x					O
32		*Falcaria vulgaris* Bernh.	–	Wide spread								x		x				O
33	**DIPSACACEAE**	*Pterocephalus plumosus* L.	–	Wide spread								x	x					O
34		*Scabiosa argentea* L.	–	Wide spread								x		x				O
35		*Scabiosa rotata* Bieb.	–	Iran-Turan								x		x				O
36	**VALERIANACEA**	*Valerianella vesicaria* (L.) Moench	–	Wide spread								x		x				O
37	**COMPOSITAE**	*Senecio vernalis* Waldst. et Kit	–	Wide spread								x		x				O
38		*Inula heterolepis* Boiss.	–	Mediterranean								x		x				O
39		*Centaurea virgata* Lam.	Peygamber cicegi	Wide spread								x	x					O
40		*Centaurea solstitialis* L. subsp. *solstitialis*	Peygamber cicegi	Wide spread								x		x				O
41		*Centaurea triumfettii* All.	Peygamber cicegi	Wide spread								x		x				O
42		*Centaurea urvillei* DC. Subsp. *stepposa* Wagenitz	Peygamber cicegi	Iran-Turan								x		x				O
43		*Cousinia iconica* Hub.-Mor.	–	Iran-Turan	x		VU					x		x				O
44		*Carthamus persicus* Willd.	–	Iran-Turan								x		x				O
45		*Echinops viscosus* DC. Subsp. *bithynicus* (Boiss.) Rech.fil.	–	Iran-Turan								x		x				O
46		*Onopordum acanthium* L.	–	Wide spread								x		x				O
47		*Carlina oligocephala* Boiss. & Kotschy subsp. *oligocephala*	–	Wide spread								x		x				O
48		*Picnomon acarna* (L.) Cass.	–	Mediterranean								x		x				O
49		*Scariola viminea* (L.) F.W. Schmidt	–	Wide spread								x		x				O
50		*Anthemis tinctoria* L. var. *tinctoria*	Papatya	Wide spread								x		x				O
51		*Anthemis fimbriata* Boiss.	Papatya	Mediterranean	x		VU					x		x				O
52		*Anthemis cotula* L.	Papatya	Wide spread								x		x				O
53		*Cichorium intybus* L.	Hindiba	Wide spread								x	x					O
54		*Carduus nutans* L. sensu lato	Kenger	Wide spread								x		x				O
55		*Chondrilla juncea* L . var. *juncea*	–	Wide spread								x	x					O
56		*Lactuca serriola* L.	–	Wide spread								x	x					O
57		*Crepis sancta* (L.) Babcock	–	Wide spread								x	x					O

Table 1.1. List of Flora Species

No	Family	Species Name	Turkish Name	Phytogeographical Region	Endemism		T.S	BERN	CITES			Steppe Habitat	Relative Abundance					Source
					R	W		App 1	App1	App2	App3		1	2	3	4	5	
58	**BORAGINACEAE**	*Echium italicum* L.	Sığırdili	Mediterranean								x		x				O
59		*Lappula barbata* (Bieb.) Gürke	–	Iran-Turan								x		x				O
60		*Onosma tauricum* Pallas ex Willd. var. *brevifolium* DC.	–	Wide spread								x		x				O
61	**SCROPHULARIACEAE**	*Verbascum cheriranthifolium* Boiss. var. *cheiranthifolium*	Sığır kuyruğu	Wide spread								x	x					O
62		*Linaria pelisserina* (L.) Miller	–	Mediterranean								x		x				O
63	**CONVOLVULACEAE**	*Convolvulus arvensis* L.	Tarla sarmaşığı	Wide spread								x		x				O
64		*Convolvulus lineatus* L.	–	Wide spread								x		x				O
65	**GLOBULARIACEAE**	*Globlaria orientalis* L.	–	Iran-Turan								x		x				O
66	**LABIATAE**	*Lamium amplexicaule* L.	Ballibaba	Wide spread								x		x				O
67		*Ajuga chamaepitys* (L.) Schreber subsp. *chia* (Schreber) Arcangeli var. *chia*	–	Wide spread								x		x				O
68		*Marrubium parviflorum* Fisch. & Mey. Subsp.*parviflorum*	–	Iran-Turan								x		x				O
69		*Nepeta congesta* Fisch. & Mey. var. *congesta*	–	Wide spread		x	LC					x		x				O
70		*Satureja cuneifolia* Ten.	Sivriçay	Mediterranean								x		x				O
71		*Phlomis nissolii* L.	Çobançırası	Iran-Turan		x	LC					x		x				O
72		*Teucrium chamaedrys* L. subsp. *chamaedrys*	Acıyavşan	European-Siberian								x		x				O
73		*Teucrium polium* L.	Acıyavşan	Wide spread								x		x				O
74		*Thymus sipyleus* Boiss. susbp. *rosulans* (Borbas) Jalas	Kekik	Wide spread								x			x			O
75	**EUPHORBIACEAE**	*Euphorbia macroclada* Boiss.	Sütleğen	Wide spread								x			x			O
76		*Euphorbia aleppica* L.	Sütleğen	Wide spread								x		x				O
77		*Euphorbia szowitsii* Fisch. & Mey. Var. *szowitsii*	Sütleğen	Iran-Turan								x		x				O
78		*Andrachne telephioides* L.		Wide spread								x		x				O
79	**PLANTAGINACEAE**	*Plantago lanceolata* L.	Sinir otu	Wide spread								x		x				O
80	**RUBIACEAE**	*Cruciata traurica* (Pallas ex Willd.) Ehrend.	–	Iran-Turan								x		x				O
81		*Galium incanum* Sm. subsp. *elatius* (Boiss.) Ehrend.	–	Iran-Turan								x	x					O
82	**LILIACEAE**	*Asphodeline rigidifolia* (Boiss.) Baker	Çiriş	Iran-Turan		x	LC					x		x				O
83	**GRAMINEAE**	*Poa bulbosa* L.	–	Wide spread								x		x				O
84		*Aegilops markgrafii* (Greuter) Hammer	–	Mediterranean								x		x				O
85			–									x						O
86		*Cynodon dactylon* (L.) Pers. Var. dactylon	Ayrık	Wide spread								x		x				O
87		*Festuca valesiaca* Schleich. ex Gaudin	–	Iran-Turan								x			x			O
88		*Stipa holosericea* Trin.	Palak	Iran-Turan								x	x					O
89		*Bromus sterilis* L.	–	Wide spread								x	x					O
90		*Echinaria capitata* (L.) Desf.	–	Wide spread								x		x				O
91		*Bromus tomentellus* Boiss.	–	Iran-Turan								x			x			O
92		*Dactylis glomerata* L. subsp. *hispanica* (Roth) Nyman	Parmak otu	Mediterranean								x		x				O
93		*Hordeum bulbosum* L.	Arpa	Wide spread								x		x				O
94	**RANUNCULACEAE**	*Eremopyrum bonaepartis* (Sprengel) Nevski subsp. *bonaepartis*	–	Iran-Turan								x		x				O

Table 1.2. List of Amphibian and Reptile Species

Order	Family	Taxon No.	TAXON	Turkish Name	English Name	International Threatened Categories			National Threatened Categories		Source
						IUCN	BERN	CITES	CHC	Demirsoy	
Anura	Bufonidae	1	*Bufotes variabilis*	Değişken Desenli Gece Kurbağası	Variable Toad	LC	App 2	-	-	-	O, H
Testudınes	Tesdudinidae	2	*Testudo graeca*	Tosbağa	Spur-thighed Tortoise	VU	App 2	App 2	App 1	nt	O
Squamata	Lacertidae	3	*Ophisops elegans*	Tarla Kertenkelesi	Wester sanke-eyed lizard	LC	App 2	-	App 1	nt	O
Squamata	Scincidae	4	*Trachylepis aurata*	Tıknaz Kertenkele	Levant skink	LC	App 3	-	App 1	nt	O
Squamata	Typholophidae	5	*Typlops vermicularis*	Kör Yılan	Blind snake	LC	App 3	-	-		O
Squamata	Colubridae	6	*Dolichopis caspius*	Hazer Yılanı	Schmidt's whip snake	LC	App 2	-	App 1	nt	H, L
Squamata	Colubridae	7	*Eirenis modestus*	Uysal Yılan	Ring-headed dwarf snake	LC	App 3	-	App 1	nt	H, L
Squamata	Colubridae	8	*Elaphe sauromates*	Sarı Yılan	East Four-lined Ratsnake	LC	App 2		App 1	nt	H, L
Squamata	Colubridae	9	*Malpolon monspessulanus*	Çukurbaşlı Yılan	Montpellier Snake	LC	App 3	-	App 1	nt	O

Table 1.3. List of Mammal Species

Order	Family	Taxon No.	TAXON	Turkish Name	English Name	International Threatened Categories			National Threatened Categories		Source
						IUCN	BERN	CITES	CHC	Demirsoy	
Eulipotyphla	Erinaceidae	1	*Erinaceus concolor*	Kirpi	Southern White-breasted Hedgehog	LC	-	-	App 1	nt	O
Eulipotyphla	Soricidae	2	*Crocidura leucodon*	Çiftrenkli Böcekçil	Bicolored Shrew	LC	App 3	-	App 1	nt	H, L
Chiroptera	Rhinolophidae	3	*Rhinolophus ferrumequinum*	Büyük Nalburunlu Yarasa	Greater Horseshoe Bat	LC	App 2	-	App 1	nt	L
Chiroptera	Vespertilionidae	4	*Myotis mystacinus*	Bıyıklı Yarasa	Whiskered Myotis	LC	App 2	-	App 1	nt	L
Lagomorpha	Lepori dae	5	*Lepus europaeus*	Yaban Tavşanı	European Hare	LC	-	-	App 3	nt	O
Rodentia	Sciuridae	6	*Spermophilus xanthophyrmnus*	Anadolu Yersincabı	Asia Minor Ground Squirrel	NT	-	-	App 1	nt	O
Rodentia	Cricetidae	7	*Cricetulus migratorius*	Cüce Hamster	Gray Dwarf Hamster	LC	-	-	App 1	nt	L
Rodentia	Cricetidae	8	*Mesocricetus brandti*	Türk Hamsteri	Brandt's Hamster	NT	-	-	App 1	nt	O, N
Rodentia	Cricetidae	9	*Microtus guentheri*	Gunther Faresi	Günther's Vo	LC	-	-	App 1	nt	N
Rodentia	Cricetidae	10	*Meriones tristrami*	Türkiye Çöl Sıçanı	Tristram's Jird	LC	-	-	App 1	nt	N
Rodentia	Spalacidae	11	*Nannospalax nehringi*	Anadolu Körfaresi	Nehring's Blind Mole Rat	DD	-	-	App 1	nt	N
Rodentia	Muridae	12	*Apodemus flavicollis*	Sarı Boyunlu Ormanfaresi	Yellow-necked Field Mouse	LC	-	-	App 1	nt	L
Rodentia	Muridae	13	*Mus macedonicus*	Sarı Evfaresi	Macedonian Mouse	LC	-	-	-	-	L
Rodentia	Dipodidae	14	*Allactaga williamsi*	Araptavşanı	William's Jerboa	LC	-	-	App 1	nt	N
Carnivora	Canidae	15	*Canis lupus*	Kurt	Gray Wolf	LC	App 2	App 2	App 1	R (V)	S, L
Carnivora	Canidae	16	*Vulpes vulpes*	Kızıl Tilki	Red Fox	LC	-	App 3	App 3	nt	F
Carnivora	Mustelidae	17	*Mustela nivalis*	Gelincik	Least Weasel	LC	App 3	-	App 2	nt	L, H
Carnivora	Mustelidae	18	*Vormela peragusna*	Alaca Sansar	European Marbled Polecat	VU	App 2	-	App 1	V	L
Artiodactyla	Suidae	19	*Sus scrofa*	Yaban Domuzu	Wild Boar	LC	App 3	-	App 3	nt	H, F

Table 1.4. List of Bird Species

Order	Family	Taxon No.	Taxon	Turkish Name	English Name	International Threatened Categories			National Threatened Categories		SEASONAL AND PREİNCUBATİON STATUS	Source
						IUCN	BERN	CITES	CHC	RDB 2009		
Ciconiiformes	Ciconiidae	1	*Ciconia ciconia*	Leylek	White stork	LC	App 2	-	App 1	A.3.1	G-Y	L, S
Falconiformes	Accipitridae	2	*Milvus migrans*	Kara Çaylak	Black kite	LC	App 3	App 2	App 1	A.3	Y	L
Falconiformes	Accipitridae	3	*Circaetus gallicus*	Yılan Kartalı	Short-toed snake eagle	LC	App 3	App 2	App 1	A.4	Y	O
Falconiformes	Accipitridae	4	*Circus cyaneus*	Gökçe Delice	Northern harrier	LC	App	App 2	App 1	A.1.2	Y	L
Falconiformes	Accipitridae	5	*Accipiter nisus*	Atmaca	Sparrowhawk	LC	App 3	App 2	App 1	A.3	Y	O
Falconiformes	Accipitridae	6	*Buteo rufinus*	Kızıl Şahin	Long-legged buzzard	LC	App 3	App 2	App 1	A.2	Y	O
Falconiformes	Falconidae	7	*Falco tinnunculus*	Kerkenez	Common kestrel	LC	App 2	App 2	App -1	A.2	Y	O
Falconiformes	Falconidae	8	*Falco peregrinus*	Gökdoğan	Peregrine falcon	LC	App 2	App 1	App 1	A.1.2	Y	L
Galliformes	Phasianidae	9	*Alectoris chukar*	Kınalı Keklik	Chukar partridge	LC	App 3	-	App 3	A.2	Y	O
Columbiformes	Pteroclidae	10	*Pterocles orientalis*	Bağırtlak	Black-bellied sandgrouse	LC	App 2	-	App 2	A.3	Y	O
Columbiformes	Columbidae	11	*Columba livia*	Kaya Güvercini	Rock pigeon	LC	App 3	-	App 3	A.5	Y	O
Columbiformes	Columbidae	12	*Streptopelia decaocto*	Kumru	Collared dove	LC	App 3	-	App 2	A.5	Y	O
Columbiformes	Columbidae	13	*Streptopelia turtur*	Üveyik	Turtle dove	LC	App 3	-	App 3	A.3.1	G	O
Cuculiformes	Cuculidae	14	*Cuculus canorus*	Guguk	Cuckoo	LC	App 3	-	App 1	A.2	G	O
Strigiformes	Strigidae	15	*Athene noctua*	Kukumav	Little owl	LC	App 2	App 2	App 1	A.2	Y	O
Apodiformes	Apodidae	16	*Apus apus*	Ebabil	Swift	LC	App 3	-	App 1	A.3.1	G	O
Apodiformes	Meropidae	17	*Merops apiaster*	Arıkuşu	Bee-eater	LC	App 3	-	App 1	A.3.1	G	O
Apodiformes	Coraciidae	18	*Coracias garrulus*	Gökkuzgun	Roller	NT	App 2	-	App 1	A.2	G	O

Table 1.4. List of Bird Species

Order	Family	Taxon No.	Taxon	Turkish Name	English Name	International Threatened Categories			National Threatened Categories		SEASONAL AND PREİNCUBATİON STATUS	Source
						IUCN	BERN	CITES	CHC	RDB 2009		
Apodiformes	Upupidae	19	*Upupa epops*	İbibik	Hoope	LC	App 2	-	App 1	A.2	G	O
Passeriformes	Alaudidae	20	*Melanocorypha calandra*	Boğmaklı Toygar	Calandra lark	LC	App 2	-	App 1	A.5	Y	O
Passeriformes	Alaudidae	21	*Calandrella brachydactyla*	Bozkır Toygarı	Short-toed lark	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Alaudidae	22	*Calandrella rufescens*	Çorak Toygarı	Lesser short-toed lark	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Alaudidae	23	*Galerida cristata*	Tepeli Toygar	Crested lark	LC	App 3	-	App 2	A.3	Y	O
Passeriformes	Hirundinidae	24	*Hirundo (Ptyonoprogne) rupestris*	Kaya Kırlangıcı	Crag martin	LC	App 2	-	App 1	A.5	G	O
Passeriformes	Hirundinidae	25	*Hirundo rustica*	Kır Kırlangıcı	Barn swallow	LC	App 2	-	App 1	A.5	G	O
Passeriformes	Hirundinidae	26	*Delichon urbicum*	Ev Kırlangıcı	House martin	LC	App 2	-	App 1	A.3	G	O
Passeriformes	Motacillidae	27	*Anthus campestris*	Kır İncirkuşu	Twany pipit	LC	App 2	-	App 1	A.2	G	O
Passeriformes	Turdidae	28	*Phoenicurus ochruros*	Kara Kızılkuyruk	Black redstart	LC	App 2	-	App 1	A.2	Y	O
Passeriformes	Turdidae	29	*Saxicola rubetra*	Çayır Taşkuşu	Whinchat	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Turdidae	30	*Oenanthe isabellina*	Boz Kuyrukkakan	İsabelline wheather	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Turdidae	31	*Oenanthe oenanthe*	Kuyrukkakan	Wheather	LC	App 3	-	App 1	A.3	G	O
Passeriformes	Turdidae	32	*Oenanthe hispanica*	Kara Kulaklı Kuyrukkakan	Black-eared wheather	LC	App 2	-	App 1	A.2	G	O
Passeriformes	Sylvidae	33	*Hippolais pallida*	Ak Mukallit	Olivceous warbler	LC	Ek 2	-	App 1	A.3	G	O
Passeriformes	Muscicapidae	34	*Muscicapa striata*	Benekli Sinekkapan	Spotted flycatcher	LC	App 2	-	App 1	A.3	G	O

Table 1.4. List of Bird Species

Order	Family	Taxon No.	Taxon	Turkish Name	English Name	International Threatened Categories			National Threatened Categories		SEASONAL AND PREİNCUBATİON STATUS	Source
						IUCN	BERN	CITES	CHC	RDB 2009		
Passeriformes	Sittidae	35	*Sitta neumayer*	Kaya Sıvacısı	Rock nuthatch	LC	App 2	-	App 1	A.2	Y	O
Passeriformes	Laniidae	36	*Lanius collurio*	Kızıl Sırtlı Örümcekkuşu	Red-backed shrike	LC	App 3	-	App 1	A.2	G	O
Passeriformes	Laniidae	37	*Lanius minor*	Karaalınlı Örümcekkuşu	Lesser gray shrike	LC	App 3	-	App 1	A.3	G	O
Passeriformes	Laniidae	38	*Lanius nubicus*	Maskeli Örümcekkuşu	Masked shrike	LC	App 3	-	App 1	A.2	G	O
Passeriformes	Corvidae	39	*Pica pica*	Saksağan	Magpie	LC	-	-	App 3	A.5	Y	O
Passeriformes	Corvidae	40	*Corvus monedula*	Cüce Karga	Jackdaw	LC	-	-	App 3	A.5	Y	O
Passeriformes	Corvidae	41	*Corvus frugilegus*	Ekin kargası	Rook	LC	-	-	App 3	A.5	Y	O
Passeriformes	Corvidae	42	*Corvus corona*	Leş kargası	Carrion crow	LC	-	-	App 3	A.5	Y	O
Passeriformes	Sturnidae	43	*Sturnus vulgaris*	Sığırcık	Starling	LC	-	-	App 2	A.5	Y	O
Passeriformes	Passeridae	44	*Passer domesticus*	Serçe	house sparrow	LC	-	-	App 3	A.5	Y	O
Passeriformes	Fringillidae	45	*Fringilla coelebs*	İspinoz	caffinch	LC	App 3	-	App 2	A.4	Y	O
Passeriformes	Fringillidae	46	*Carduelis chloris*	Florya	greenfinch	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Fringillidae	47	*Carduelis carduelis*	Saka	goldfinch	LC	App 2	-	App 1	A.3.1	Y	O
Passeriformes	Fringillidae	48	*Carduelis cannabina*	Ketenkuşu	linnet	LC	App 2	-	App 1	A.3	Y	O
Passeriformes	Emberizidae	49	*Emberiza hortulana*	Kirazkuşu	ortolan bunting	LC	App 3	-	App 2	A.3	G	O
Passeriformes	Emberizidae	50	*Miliaria calandra*	Tarla Kirazkuşu	corn bunting	LC	App 3	-	App 2	A.4	Y	O

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